

DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

# , ECE 09.461 PROFESSIONALISM & CONSULTING IN ENGINEERING

### LECTURE 12

ETHICS IN ENGINEERING DESIGN & DECISION MAKING



Dr. Robi Polikar

ELECTRICAL & COMPUTER ENGINEERING



### THIS WEEK IN P&C:

### ETHICAL CONSIDERATIONS

- Not your typical ethics class
- Ethics vs. morals
  - Some (in)famous examples of engineering disasters
  - Code of ethics, ABET student outcomes
- Four corners approach
  - Capabilities
  - Consequences
  - Duties
  - Virtues
- But wait... what about / what if...?
  - Some exercises
- The headline test
- Putting it all together

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Some of the content in this lecture is based upon material in *Technology and Design Ethics*; Morten Rand-Hendricksen, Nov 2019. Available at <a href="https://www.linkedin.com/learning/technology-and-design-ethics/">https://www.linkedin.com/learning/technology-and-design-ethics</a>





- - Fairness & justness
  - Moral obligations
  - Benefits to society

- There is a difference between morals and ethics, however:
  - Morals: personal understanding of what is right / wrong, typically based on culture, religion, politics and own life experience
  - Ethics: societal agreement / understanding of what is right / wrong

### ETHICS VS. MORALS

- Morals and ethics can be at conflict with each other:
  - During your consultant work for a company, you are provided with some data that can help an underserved community in a significant way.
    - You signed an NDA with this company, but if you were to release the data, there is no way the company can possibly trace that to you, and the information can help hundreds of underserved people in your community.



- Morally, you feel perfectly and completely justified in releasing the data.
- Is it ethical to do so?
  - Why / why not?





#### • ... are rare!

- In most cases and examples that are presented as ethical dilemmas, the situation is either absurdly hypothetical or the right thing to do is often (but not always\*) obvious
  - There is often an obviously right decision
  - ...but that decision is ignored due to other, typically financial, factors
- An ethically right decision even when it is obvious after the fact - is not necessarily easy to make, due to competing circumstances:
  - Clouded judgment
  - Miscalculations on risk
  - Conflicts of interest
  - Greed
  - Fear of loss (of money, position, prestige, etc.)

\* We will see some true ethical dilemmas later in this class







### Some (IN)Famous Examples of Engineering Disasters

#### • Titanic (1912)

 Not only the watertight compartments were not properly designed, but there were not enough lifeboats for everyone. There was enough space for 1200 people, whereas there were 2200+ people on board.

#### • Ford Pinto (1971-1976)

A faulty fuel tank design that could cause a rupture → some engineers pointed out the flaw that would cost \$11 to fix (per vehicle), but the company did not follow the recommendations. 30 ~180 people have died as a result.

#### • Kansas City Hyatt Regency Hotel Walkway (1981)

Two walkways suspended in the air were supposed to be held together by a single set of rods connected to the ceiling. During construction, the different sets of rods were used and connected to each other, causing the rods to carry twice the weight. The design change was not properly evaluated/approved. The walkways crashed, killing 114 and wounding 200+.

#### • New Orleans' Levees (2005 – Katrina)

 The Army Corps of Engineers did not follow its own design guidelines, designed the levees to withstand only low-speed hurricanes, and did not consider the natural gradual sinking of the levees, leading to insufficient height. The collapse of the levees killed 1800+ people, causing over \$100 billion in damage.

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### Some (IN)Famous Examples of Engineering Disasters

#### Space Shuttle Challenge Disaster – NASA 1986

The O-rings used in fuel tanks were improperly designed for colder ambient temperatures – and failed in the cold temperatures, leading to the explosion. The issue was known to some engineers, who advised against launching at colder temperatures, but reportedly, NASA went ahead with the launch so as not to miss the launch window. Seven crew members died.

#### Space Shuttle Columbia Disaster – NASA 2003

Debris from the fuel tank during liftoff struck the left wing of the shuttle. NASA informed the crew that there
was no significant damage and it was safe to return. 16 days later, when the shuttle returned to earth, Columbia
disintegrated during reentry. Seven crew members died.

#### Baltimore Key Bridge Collapse (2024)

Container ship MV Dali struck one of the six piers of Baltimore's F.S. Key Bridge, causing it to collapse instantly, killing six crew members on the bridge, and shut down Baltimore harbor for 11 weeks, causing over \$2B damage. The bridge, which had previously been hit by another ship (in 1980), had not been upgraded to the current standards to withstand ship collisions (a not-so-uncommon occurrence), while the ship had electromechanical issues before departure, which were not fully addressed, causing it to lose power (and hence propulsion control).

### What is the common problem in all of these – and countless other – disasters?

Computer engineering

 Many organizations involved in various areas of engineering have issued their own ethical standards

- AIChE Code of Ethics
- ASME Code of Ethics
- ASCE Code of Ethics
- BMES Code of Ethics, Conduct & Policies
- ASEE Code of Ethics for Engineering Educators
- IEEE Code of Ethics

 Looking at them, you will see common threads on insuring health, safety, honest decision making, avoiding conflicts of interest, treating others with respect, etc.

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ETHICAL STANDARDS

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### IEEE CODE OF ETHICS

#### IEEE Code of Ethics

We, the members of the IEEE, in recognition of the importance of our technologies in affecting the quality of life throughout the world, and in accepting a personal obligation to our profession, its members, and the communities we serve, do hereby commit ourselves to the highest ethical and professional conduct and agree:

- To uphold the highest standards of integrity, responsible behavior, and ethical conduct in professional activities.
- to hold paramount, the safety, health, and welfare of the public, to strive to comply with ethical design and sustainable development practices, to protect the privacy of others, and to disclose promptly factors that might endanger the public or the environment;
- to improve the understanding by individuals and society of the capabilities and societal implications of conventional and emerging technologies, including intelligent systems;
- to avoid real or perceived conflicts of interest whenever possible, and to disclose them to affected parties when they do exist;
- to avoid unlawful conduct in professional activities, and to reject bribery in all its forms;
- to seek, accept, and offer honest criticism of technical work, to acknowledge and correct errors, to be honest, and realistic in stating claims or estimates based on available data, and to credit properly the contributions of others;
- to maintain and improve our technical competence and to undertake technological tasks for others only if qualified by training or experience, or after full disclosure of pertinent limitations;

- II. To treat all persons fairly and with respect, to avoid harassment or discrimination, and to avoid injuring others.
- to treat all persons fairly and with respect, and to not engage in discrimination based on characteristics such as race, religion, gender, disability, age, national origin, sexual orientation, gender identity, or gender expression;
- to not engage in harassment of any kind, including sexual harassment or bullying behavior;
- to avoid injuring others, their property, reputation, or employment by false or malicious actions, rumors, or any other verbal or physical abuses;
- III. To strive to ensure this code is upheld by colleagues and coworkers.
- to support colleagues and coworkers in following this code of ethics, to strive to ensure the code is upheld, and to not retaliate against individuals reporting a violation.

Adopted by the IEEE Board of Directors June 2020

www.ieee.org

Advancing Technology

for Humanity

#### https://www.ieee.org/content/dam/ieee-org/ieee/web/org/about/corporate/ieee-code-of-ethics.pdf



### **ABET STUDENT OUTCOMES**

An engineering program – to be accredited - must document the attainment of the following student outcomes that prepare graduates to enter the professional practice of engineering.

- 1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- 2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
- 3. an ability to communicate effectively with a range of audiences.
- 4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
- 5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
- 6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- 7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

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### FOUR CORNERS APPROACH

- Ethics is about making the right decision, whether there is a dilemma or not!
- We will use the four corners approach to guide our decision-making process.
  - Each corner represents a key consideration to help in ethical decision-making
    - Map to four theories of moral philosophy:
      - Capability approach
      - Consequentialism
      - Duty ethics
      - Virtue ethics

CAPABILITIES	CONSEQUENCES

VIRTUES

### DUTIES





- Every new design introduces / modifies capabilities
  - Granting new capabilities something new that did not previously exist
  - Enabling capabilities providing access to a capability
  - Limiting capabilities
  - Removing capabilities
- Using this product / solution, the user now can / cannot \_\_\_\_\_
  - Discuss, e.g.: e-bicycle, smart-bulb, parental controls, non-fungible tokens, etc.
- The design and the new / modified capabilities must be relevant / useful to the end user → utility ethics, utilitarianism
  - <sup>•</sup> Giving a smart bulb to someone who has no internet access (or power) is not very useful
- Capabilities create a ripple effect beyond the primary end-user, each perhaps with a decreasing but non-zero impact.

• Evaluate the new / modified capabilities for each stakeholder from two primary perspectives:

... BUT IS IT GOO

- Equity does every member of this stakeholder have equal access to these capabilities
- Does it serve a common good for this stakeholder
- Then, ask yourself: what is the worst that can happen when this stakeholder has this capability.
  - Look at all reasonable scenarios
    - ...but not cases with zero or infinitesimally small chances of happening, e.g., no aliens, dinosaurs, etc.
    - E.g. you develop a new [drone / smart bulb / social media platform / Gen AI tool ...]
       → i) who are the stakeholders, and ii) what is the worst they can do with that tool?
- Add all primary and downstream capabilities to your Capabilities corner, and prepare to consider the reasonable scenarios for the...

CONSEQUENCES

- What is the impact or utility of this new / modified capability on each of the stakeholders
   Consequences
  - The client / company for which you provided services / designed something
  - The primary end-user of that design / service
  - All other potential stakeholders / users impacted by your design / service, including <u>those</u> <u>who will not or cannot</u> use your service / design.
- The most ethical design/ decision is the one that provides the most utility (happiness, relief of pain / suffering, improvement in quality of life, etc.) to most people.
  - The utility should be considered not just in the immediate term but also long term.
  - Determining / imagining long-term consequences, particularly negative ones, may be difficult
    - Intentional or unintentional misuse, negative consequences
    - For example: think about the unintended consequences of social media

- Consider, in particular, those who are "left out" by your decision / service, and the impact of your decision on those stakeholders.
  - These are typically people who cannot use / benefit from your design / service for some reason or another (typically access, cost, etc.)
- You may find out that your design will benefit some stakeholders (primary stakeholders), and perhaps harm others.
  - Ask yourself if and how you may be able to protect the rights and dignity of all people who may interact with or be impacted (even if indirectly – say by not using it), from your design / service / decision.

WHO IS LEFT OUT?





#### • Fill this table and add to the Consequences corner.

Capability	Consequence	Stakeholder	Utility Value
			Positive Utility: +1
			Neutral Utility: 0
			Negative Utility: -1

- With every design / service decision, you are not just providing a solution to your immediate stakeholder / client; you are also setting a path – an example – for others to follow.
  - Those "others" include your customers, clients, colleagues, and even competitors.
- When this path / example leads to good things, you become a pioneer, innovator, trend setter, transformer, change maker, etc.
  - How do you know if this path leads to good things?
    - Ask yourself: Is this the decision I would want others to take if they were in this specific situation?



DUTY ETHICS

- Does your decision set a good precedence for other people to follow?
  - Does your decision uphold <u>your duty of care</u> for other people?
    - Consequentialism → Consequences of what you have created
    - Duty ethics → <u>Your</u> reason for your design / decision
  - If other people (colleagues, clients, competitors) were to replicate what you have done, is that still in the best interest of most people? (Competitor test)
    - Mind you, once your solution / decision / design is replicated, both its advantages and disadvantages may amplify → Does that change your decision?
  - Given the answer to the above question, would you still take the same path / design / decision?
    - Can your solution / design / decision be considered a best practice?
    - If your solution / design / decision sets a precedence with your name attached to it would you still make the same decision?





3. Can my design / decision possibly harm anyone? If so, what is the harm, how does my design / decision cause the harm, and who does it harm? (consider – physical safety, security, data safety, privacy, psychological impact, etc.)

Duty of care: This is a legal obligation requiring adherence to a standard of reasonable care while performing any acts that © All Rights Reserved, Robi Polikar, 2021 - 2025



### ...BUT WAIT .... (PART I)

#### • Q: What about:

- ... other people who do unethical things?
- ... who do not care about whether they cause harm?
- ... or intentionally want to cause harm?
- ... aren't there companies/individuals who not only break ethical rules but also legal laws to get an advantage or get what they want?... And get away with them?

#### • A: Bad actors / apples do not matter – they are irrelevant!

- Just because someone is doing the wrong thing and gets away with it does not make it right. It is still wrong!
- Being ethical is a conscious decision to do the right thing because of our commitment to our society, to ourselves – even if there are others who get away with being unethical.

### True Ethical Dilemmas

....BUT WAIT .... (PART II)

- Q: What if...
  - ... I am forced to do the unethical thing because of peer pressure
  - ... or simply because I am ordered to do so by my boss / superior?
  - ... doing the right thing causes harm to <u>me / my family / loved ones</u>?
- A. Asking someone to put themselves in a difficult, precarious or dangerous situation over an ethical situation would be unreasonable and, in turn, be unethical – in many circumstances.
  - E.g., if you will lose a job you depend on to care for your dependents.
  - In most consulting jobs, this is unlikely to be the case.
- But, there are some cases where simply refusing to do the wrong thing and if necessary walking away from that job – is not only the right thing to do, but is also the only thing you should do, if otherwise significant, real and irreparable harm will come to one or more

#### people.

## SOLUTION TO THE DILEMMA

- In most cases, the bad decisions of bad apples / bad people are not because they just want to cause harm, but rather there is bias, ignorance, unawareness, greed, etc. in play.
- Your opportunity: educate them. Tell them that:
  - The path they are following is likely to cause harm not just to other people, but to our / your / their customers, eventually to the company and to themselves;
  - ...and that there are / may be other solutions, that will provide better outcomes (albeit, perhaps in the long run).
  - .. and that you may be able to propose some such solutions.
- A not-so-unlikely scenario for a real dilemma (an in-class exercise):
  - You are offered a job at a company whose business practices you despise because while legal the company profits off the misfortune of the most vulnerable population of society, or engages in a line of business that you find very much against your morals.
  - However, you have been out of a job for several months, racking up (say, medical or mortgage) debt, and your family depends on you.

 We have talked about Capabilities, Consequences, Duty Ethics – all of which are somewhat external concerns.

VIRTUES & VALUES

- We now ask inward pointing question(s):
  - " What are our virtues, beliefs and values?
  - Virtue ethics: the goodness of a decision is determined by the impact of that decision on the decision maker him/herself.
    - This is where ethics and morality overlap considerably.

• Ask yourself: Is this the design / decision my ideal self would make?

VIRTUE ETHICS

- Virtue ethics help us become the person / company we want to become.
  - Companies / organizations do this through their mission, vision, code of conduct statements.
- For tech-design, consider Shannon Vallor's Technomoral Virtues
  - HonestyCare
  - Self-controlCivility
  - HumilityFlexibility
  - JusticePerspective
  - Courage
     Magnanimity (generosity)
  - Empathy
     And their integration to technomoral wisdom
- What are your virtues? Identify your virtues, and then ask:
  - What decision would be appropriate for someone with [those virtues].
  - Is this the decision a person with [those virtues] would make?
  - Is this the decision a person *I want to become* would make?

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## Do the Right Thing....



https://abc.xyz/investor/other/code-of-conduct/

### YOUR VIRTUES

- Once you identify your virtues, decide what those mean to you.
  - <sup>o</sup> If you picked **honest**, **just** and **caring**, ask yourself what these mean to you.
  - By doing this, you are setting an ethical bar a threshold for yourself → every design / decision you make, you will be judging yourself against that threshold.
- Ask yourself: With this design / decision:
  - Is this a design / decision an [honest] person would make?
  - Is this a design / decision a [just] person would make?
  - Is this a design / decision a [caring] person would make?

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## THE HEADLINE TEST

\$3.00

- A simple test to determine whether you are holding yourself to these standards:
  - How do you feel about reading the news about your design / decision on a major national / international news headline?
  - Will people reading this headline think you are honest, just and caring ?

The Glassboro Times

VOL. CLXX ... No. 58,908

\_ GLASSBORO, MONDAY, NOVEMBER 21, 2024

### ...AND HERE IT IS!

The Consultant / Designer / Engineer Jane Doe releases her latest design / decision: C RowanUniversity DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

## PUTTING IT ALL TOGETHER

#### • These are not exercises

- ... that you do only one
- ... that must be completed all at once all the time
- ... that need to be completed in a specific order

### • Use them holistically to

- accomplish your goals,
- evaluate your designs and decisions
- find hidden issues, flaws, concerns, problems with your design / decision
- answer your ethical questions or dilemmas
- find better solutions, develop better designs, make better decisions

Assignment

- Use the four corners approach in evaluating your design / service in the context of global, economic, environmental, and societal factors; and how you address them or how they can be addressed.
  - Identify (by asking and answering the questions mentioned in this lecture) the capabilities, consequences, duties and virtues associated with your design / service / decisions.
- This is Part 3 of your Engineering Design & Impact Statement, and will probably need a separate page to answer thoroughly and properly.
  - Each part of Engineering Design and Impact Statement will be graded separately, and will form part of your grade.





- The final grading will be as follows:
- Project Approval and Evaluation Form: 15 %
- Project 60%
  - Grade given by client:30%
  - Engineering Design & Impact Statement: 30%
    - Part I: 10 %
    - Part II: 10 %
    - Part III: 10%
  - Final Exam covering the most critical aspects of lecture content: 15%
  - Professionalism & attendance: 10%



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# , ECE 09.461 PROFESSIONALISM & CONSULTING IN ENGINEERING

**LECTURE 13-14** Financial Literacy



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- Quite likely the most important lecture you will ever have
- Your first paycheck
- Financial literacy: what is it, and why is it important?
- Planning for financial well-being:
  - How much do you make?
  - How much do you need? How much can you spend? What is left?
- Setting priorities
- About retirement
  - Saving for retirement how much do you need? How will you save that much?
  - Retirement calculators /playing with numbers
- Where and how to invest
  - Investment instruments
  - Risk vs. reward
  - Best and worst investment instruments
- Some final thoughts and life advice

## THIS WEEK IN P&C: FINANCIAL LITERACY

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### FINANCIAL LITERACY



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#### Financial Literacy

[fə-ˈnɑn(t)-shəl ˈli-t(ə-)rə-sē]

The ability to understand and effectively use various financial skills, including personal financial management, budgeting, and investing.

Investopedia



#### **Did you know?**

## April is financial literacy month

- Remember: financial literacy is the ability to understand and effectively use financial knowledge and skills, including personal <u>financial management</u>, <u>budgeting</u> and <u>investing</u>
- Financial management: understand how much you <u>need</u> to earn and spend, how much you <u>can</u> spend, and how to plan for financial emergencies as well as for retirement.
- Budgeting: understand your cash flow, how much you are <u>actually</u> earning and spending, and how much you <u>need to save</u>.
- Investing: A critical component to be able to save for life's big events: marriage, having kids, buying a house, caring for elders, caring for yourself during retirement, etc.

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### FINANCIAL LITERACY: IN DETAIL





INVESTMENT

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#### **RISK MANAGEMENT**

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EMERGENCY ACCUMULATION

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**OPPORTUNITIES** SAVINGS PLAN POLICY **CASH FLOW** 



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**CASH FLOW** 





EDUCATION CASH MANAGEMENT

COLLEGE





STRATEGY

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### HOW MUCH DO YOU MAKE?

NO REALLY!

- Numbers on your bank account may be smaller than they appear on your paycheck!
- What is taken from your paycheck before your net pay is deposited?
  - Federal income tax Most of you will probably be in the 22-24% tax bracket
  - Social security tax 6.2% from you, 6.2% from your employer (up to \$176K)
  - Medicare tax 1.45% of your wages
  - NJ income tax Most of you will probably be in the 6.37% tax bracket
  - NJ unemployment/disability / workforce development/family leave taxes (0.05 - 0.1%)
  - Health insurance premiums (varies greatly)
  - Retirement / 401K plans


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## TAKE HOME PAY????

### For most people, about

#### ... and even less if you have student loans, child support, alimony, etc. withdrawn from your paycheck

## How About You Dr. P.?

### In 2024, of my total gross income → about was withheld for:

- of taxable income for federal taxes (why is this below 24%?)
- social security tax (why is this below 6.2%?)
- health insurance (with my wife)
  - Medicare and Medicare additional tax
- NJ income and other taxes
- Retirement savings
  - 403b / 401a / 457
- Net take-home pay:



### What are your other Fixed expenses?

And from the remaining 40 – 60% of your pay, you need budget for other fixed expenses, such as :

- Housing Rent, mortgage payment, mortgage insurance, real estate taxes
- Utilities Electric, Gas, Water, Internet, Cell phone
- Insurance renter's, homeowner's, auto, etc.
- Food and household expenses
- Gas for car
- Later in life: childcare, school, etc.
- AND if you have them:
  - Student loans
  - Car loans
  - Credit card debt
  - Alimony / child support

How much do these cost?

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# COST OF LIVING IN NEW JERSEY



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https://www.unbiased.com/discover/banking/what-is-the-cost-of-living-in-new-jersey



### WHAT IS LEFT?

#### Let's play with numbers a bit:

- Assume a starting salary of \$80K
  - State and Federal taxes, health insurance, etc.: \$25K
  - Housing and household fixed expenses (rent/mortgage/food/utilities/gas, etc.): \$40K- \$50K
  - Retirement savings: \$5K (not enough!)
- All gone already. And here, we did not even consider any of:
  - Student loans
  - Car loans
  - Credit card debt
  - Entertainment / travel
  - Childcare / school
  - Wait, most people make less than \$80K How is this possible?
- ...And what happens if there is an emergency?





- This is where financial literacy comes into play.
- There are ways to:
  - Decrease your taxes (legally!)  $\rightarrow$  Did you notice Dr. P.'s effective tax rate?
    - Take advantage of various tax deductions: retirement contributions, child credit, charitable contributions, certain medical expenses, business expenses (for your consulting business), etc.
  - Decrease your health insurance/car insurance costs
  - Decrease your housing costs (maybe you don't need a very large house!)
  - Increase your income
    - Spousal income
      - Two-income is the single most effective way to increase your income, and help reach financial independence... ... so long as you stay together!
    - Consulting income
      - Equally effective way, without requiring a spouse
    - Bonuses
- If you do these, then you will have money for other things ...
- ...but all of that requires some financial literacy.





- How should we plan/spend our money?
- Set priorities
  - Do you have student loans?
  - Credit card debt?
  - Car loan debt?
- Do you have an emergency / rainy day fund?
  - Would you be able to cover a \$10K unexpected expense? Perhaps car repair, or worse, a medical emergency?
  - Are you one financial emergency away from a financial collapse?





### 1. Emergency fund

- Set aside some amount from <u>every paycheck</u>
- **Q**: How much and how long?
- A: Until you have enough to cover you for 6 months (12 is better)  $\rightarrow$  This is the typical amount of economic recovery needed after a major recession and/or the amount of time you need to find a new job in a down economy
- Be most aggressive until you reach a 3-month cushion—preferably within 24 months. Then, get to a 6-month cushion, preferably within 3-4 years, and slowly build up the rest.
- \$80K salary → 3-month cushion: \$20K → Set aside \$800/month for the first two years





#### 2. Pay down your debt – starting with the highest interest

- □ Credit cards 20 ~30% ← Get rid of these immediately !!!
- □ Student loans 6~10% ← Pay as quickly as you can!

#### Why?

- Because paying down a 20% interest debt is equivalent to having an investment with a 20% return!
- There aren't very many investments with that kind of ROI out there!



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 Dr. P, you just showed that we have no money left, and you are asking about retirement? How? Why?

PRIORITIES

• Isn't this something I will consider later when I make more money?



 Assume that you have been working for 40 years, and you are ready to retire.

\*

- Before you retire, you make \$\_\_\_\_
- When you retire, that amount drops to:\$\_\_\_\_\_

#### \* We will talk about social security later

### HOW WILL YOU LIVE?

• If you have not put in enough amount while you are working, you will not have enough to live on during retirement.

#### • How much do you need?

- Most people need about 80% of their pre-retirement income to be able to maintain their current standard of living
- For most career engineers, their annual income (in today's dollars) before retirement is about \$200K
- The highest social security pays is about \$3K/month → \$36K/year (but there is no guarantee that it will still be there in 40 years!)
- If you have no retirement savings, you simply will not be able to retire

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ncoe

- ...and this is the unfortunate reality of Americans today:
  - $^\circ~\sim 48\%$  of working Americans do not have access to a retirement plan
  - $^\circ~\sim\!23\%$  of US adults over the age of 65 are still employed fulltime

ncoe

- ~80% of households with older adults are either financially struggling or at risk of becoming economically insecure
- According to Yahoo Finance, 45% of American households are expected to run out of money in retirement if they stop working at age 65.

27 iiii

million older adult households cannot afford basic necessities

Source: Increases in Older Americans' income and Husselfold Assets Still Cannot Support Most During Enancial Hardship, NCOA and LeadingAge. ITSS Center & LiMass Bastion, 2024 **80%** O

of older adults face financial insecurity

ince: Increases in Older Americans' income and Huiseffulo Assets 508 Cannot Support st During Enancial Hardship, NCOA and LoadingAge, ITSS Center & UMass Baston, 2024

Plan early and accordingly, so that you do not become part of this statistic!



- Back to our example:
- You want to retire at the age of 65, with then-current income of \$200K

SO, YOU MUST SAVE FOR RETIREMENT

- Assume you need 80% to maintain your lifestyle  $\rightarrow$



How long will you live? Let's say another years (typical)





& COMPUTER ENGINEERING

## HOW IS THAT POSSIBLE???

year -> That's almost my entire

#### That is over starting salary!

#### Saving that amount seems impossible!





- ... it requires meticulous planning
- ... unwavering and disciplined savings
- ... painstaking patience
- ... exceptional understanding of the markets and compounded growth
- ... being abreast of and taking (legal!) advantage of tax laws
- ... nerves of steel to ride market fluctuations
- ... and most importantly, it requires





#### Do this on day one when you start working:

 Go to your company HR / Benefits Coordinator, and set aside the minimum required to maximize the company match

This is



The return of investment on the company match is





HOW TO SAVE? 2. Add as much as possible to that amount until you reach the federal limit

, which increases your

- for the maximum amount you can contribute to a company-sponsored retirement plan (401K)
  - For 2025, that limit is
  - Each year, that contribution limit goes up a bit
  - When you are over 50, you can contribute an additional

### 3. Reduce your taxes!!!

- 401K contributions are tax-deferred
- The amount you contribute is deducted from your income, as if you have never earned it, and hence reduces your taxable income!
- If you are in the 24% tax bracket, this is equivalent to Uncle Sam giving you a 24% discount on your taxes! That, too, is free money!
- For a \$10,000 contribution, you reduce your taxes by take-home pay.





#### 4. Contribute to an IRA / Roth-IRA plan

- You can contribute up to a year to an IRA / Roth-IRA plan
- The limit is \_\_\_\_\_\_ if you are over 50
- That limit also goes up a bit every year.



HOW TO SAVE

#### ... that is all well and good, but how will I ever get to saving \$6K/month to get to \$3M by the time I retire?

# YOU DON'T HAVE TO!

#### That is the beauty of compounded earnings and the power of time!



# **RETIREMENT CALCULATORS**

LET'S ASK SOME

#### https://www.bankrate.com/retirement/retirement-plan-calculator/

ankrate Banking Mortgages	Investing	Credit cards	Loans Home equity	Insurance	Q	
tirement >> Retirement Plan Calculator	Plan C	alculat	or			
Do you know what it takes to work towards a secure retirement? Use this retirement calculator to create your retirement plan. View your retirement			ent			
vings balance and calculate your withdraws	als for each year. Soo	cial security is calculate	d on a sliding scale based on	your income. Including a no	on-	
orking spouse in your plan increases your social security benefits up to, but not over, the maximum.						
Retirement Calculator						
What's your current age?						
22		Your t	otal savings at retirem <b>3.823.682.43</b>	ent		
What age do you plan to retire?	0	•	-,,			
67			You're on track			
67 What's your current annual household income?	0	Savings needed \$999,783.7	You're on track I for retirement (i) Extra savir 79 \$2,823	1gs <b>,898.64</b>		



- There is no shortage of financial calculators retirement calculators, savings calculators, compounded interest calculators, salary increase calculators, etc.
- They each make different assumptions, so try several different ones.
- Bottom line: Start small but as much as you can; then increase it as much as you can.
  - Every time you get a salary increase, a bonus, a windfall → Add it to your retirement accounts.
  - Increase your contributions over time.

SPOUSAL IMPACT

- While you should not be getting married for this reason alone...
  - Having an income-generating spouse dramatically increases your chances of reaching your financial goals
  - The federal government rewards being married and filing jointly with special tax limits, incentives, and brackets
  - Having a second income allows you to save more after paying all your bills.
    - Most of your living expenses are fixed and do not increase (much) with a second person in the house; but the second person's income can add significant funds!
- But, choose your spouse wisely!
- Discuss and plan financial goals together

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- Bank savings / online accounts
- Treasury bills/government bonds
- Commodities (gold, energy, corn, lithium, etc.)

WHERE TO INVEST?

- Bond market
- Stock market / common stocks
- Mutual funds / exchange traded funds (ETFs)
- Money markets
- Options
- Currency hedging
- Cryptocurrency / Bitcoin
- Art collection
- Real estate



com/napkin/risk-tolerance

https://napkinfinance

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### LOW RISK, LOW RETURN

- Bank / online savings / CD accounts → interest-bearing bank accounts, FDIC-insured, and your principal is guaranteed + an interest, but usually below inflation. CDs have slightly higher interest, but also a penalty if withdrawn before maturity.
- U.S. Treasury securities → Earnings are exempt from local / state taxes
  - T-Bills: short-term securities with a certain face value. You buy them at a discount and receive the face value at maturity (4 – 52 weeks). No other interest is paid.
  - T-Notes: Intermediate-term securities that pay a fixed interest every six months until maturity (2 10 years). Longer-term → moderate interest rate risk.
  - T-Bonds: Long-term securities that pay a (higher) fixed interest rate every six months until maturity (20-30 years). Long-term → high interest rate risk
  - U.S. Saving Bonds: Series EE Bonds earn a fixed interest rate that is guaranteed to double the principal in 20 years. Series I Bonds earn a fixed+variable interest adjusted every 6months and protects against inflation. Interest is paid every 6-months. Savings bonds can be free of federal taxes if earnings are used for educational purposes. Both series earn interest until maturity (30 years), but they can be redeemed after 1/5 year (with/without penalty).

CURRENT RATES

U.S. Department of the Treasury

#### (April 2025) Bank online accounts: Around 3.6~4% APY (annual percentage yield) CDs: Around 4% (12 months); 3.5% (24 -48months); 4.15% (60 months)

	Treasury Bills	Treasury Notes	Treasury Bonds
Maturity	Up to one year	Two, three, five, seven, or 10 years	20 or 30 years
Interest Payments/Coupons	None	Every six months	Every 6 months
Pricing	Sold at a discount	Sold at par, premium, or discount	Sold at par, premium, or discount
Liquidity	High	High	Relatively lower
Interest Rate Risk	Low	Moderate	High
Current Yields	<b>3-Month T-Bills</b> 4.403%	<b>5-Year Treasurys</b> 4.277%	<b>30-Year Treasurys</b> 4.606%
		<b>10-Year Treasurys</b> 4.414%	

IreasuryDirect, Mailing Lists News About Forms Help Center Contact Us Search. Q Savings Bonds Treasury Marketable Securities Auctions Laws and Regulations Research Center Government Users Todav's Rates Series EE Savings Bonds Series I Savings Bonds 2.60% 3.11% For EE bonds issued November 1, 2024 to April 30, 2025. This includes a fixed rate of 1.20% For I bonds issued November 1, 2024 to April 30, 2025. More About Savings Bonds **30-Year Bonds 10-Year Notes** 4.625% 4.625% Issued 04/15/2025. Price per \$100: 97.026877. CUSIP 912810UG1 Issued 04/15/2025. Price per \$100: 101.490492. CUSIP 91282CMM0.

Table: Investopedia/Peter Gratton • Source: U.S. Department of the Treasury • Created with Datawrapper **2 Investopedia** 

https://www.investopedia.com/ask/answers/difference-between-bills-notes-and-bonds

https://www.treasurydirect.gov

Click on the boxes or the links for updated rates / information

🚐 An official website of the United States government 🛛 Here's how you know 🗸

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- Commodities (agricultural, metals, energy): you buy the commodity in the open market (see current prices), may fluctuate wildly.
- Bond market: IOUs issued by government or companies. Generally, lower fluctuations → lower risk but lower return than the stock market. High yield(junk) bonds, however, have higher risk/return profile
- Stock market / common stocks: you own a share of a company purchased on the open market. You make money if the company's stock price goes up and/or the company pays dividends.

#### Mutual funds/exchange-traded funds (ETFs):

A group of stocks jointly owned by a group of investors. Reduces risk through diversification.

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# WHERE TO INVEST?



- **RowanUniversity** DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING
  - **Options:** contracts that give the buyer the right, but not the obligation, to buy or sell a security at a specified price within a specific time frame. Generally used to bet against the market/company. **Highly risky!**
  - Cryptocurrency (bitcoins): a digital and decentralized currency market that operates outside of a central bank or a single regulator. Limited number of bitcoins (21M) makes it a scarce asset, whose value can fluctuate wildly. Highly risky!
  - Currency hedging: You buy / sell foreign currency, hoping its value will change favorably against another currency (e.g. USD). Highly risky!
  - Art collection: You buy a piece of art in hopes that the artist will become very famous, and his/her work gain value. Highly risky!
- **Real estate:** You buy a piece of real estate. You make money by either renting it or by selling it in the future, presumably at a higher value.





# Worst Forms of Investments

- 1. No investment
  - Self-explanatory!

#### 2. Any investment tool that you do not fully understand!

 Unfortunately, most people <u>think</u> they understand what they are investing in, but in reality, do not quite comprehend the reward–risk spectrum.

#### 3. Speculative investment tools

Options, cryptocurrency, certain commodities, penny stocks

#### 4. Interest-bearing bank accounts

 You should use bank accounts for your emergency fund (immediately liquid), but they are not good for long-term, high-return investment





 Since there are so many forms of investment, and each has different risk-reward characteristics, how do we know where to invest?



- <u>Diversification</u>: An asset allocation strategy, where you place different amounts of your assets in different investment "baskets" based on your financial goals and risk tolerance.
  - Put some of your assets in low-risk, low-return investments, some in medium-risk investments, and some in high-risk, high-return investments
  - The most common asset allocation consists of stocks, bonds, and cash
    - ...but each of these has multiple subcategories. For example, there are large cap, mid cap, small cap, domestic, international, sector-specific companies and funds; there are government and municipal, high grade and low grade (junk) bonds, etc.

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# BEST FORM OF INVESTMENT

- If you do not know much about investing (and you don't!), stick to a few simple mutual funds.
- A mutual fund is a collection of stocks or bonds (i.e., securities), picked by an investment company/professional based on set criteria
  - Small/mid-size/large company stocks
  - Domestic vs. international stocks
  - Industry-specific stocks: energy, financial markets, technology, healthcare, AI, etc.
  - Investment grade vs. high return vs. government vs. municipal bonds
  - Funds of funds
  - Actively managed vs. index funds, target-date funds
  - Exchange-traded funds ( a slightly different form of mutual funds)



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#### A COMPUTER ENGINEERING HOW do I get one?

- Your employer 401K/403b plan most likely offers a menu of these, and/or
- Choose from many financial companies\*, such as Vanguard, Charles Schwab, Fidelity, among others.
  - Go to their site and read about their products
  - Pay attention to expense ratios, risk vs. reward charts, investment criteria and priorities, current holdings, past performance (which cannot guarantee future performance), turn over ratio, etc.

#### Active vs. passive investing and expense ratios

- Active mutual funds have professional analysts who study companies and actively make buy/sell decisions. Therefore, active funds → higher expense ratios.
- Passive (aka index) mutual funds simply replicate the market based on their investment criteria: e.g., a large-cap index fund buys the stocks of all large companies in the ratio of their market value. No analyst is involved; therefore, passive index funds → lower expense ratios.
- Over long periods, index funds typically outperform active funds!
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\* This list is for illustration purposes only. Inclusion or omission of a fund company does not imply endorsement or lack thereof it. Do your own research to decide which company and which specific funds you want to invest in.
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### INVESTMENT STYLES

### For Mutual Funds



https://jemmafinancial.com/financial-glossary/what-is-the-morningstar-style-box

#### Top 10 holdings

Holdings	% Portfolio Weight	First Bought	Market Value as of Mar 31, 2025	Cur	Share Change %	1-Year Return	Forward P/E
Apple Inc	7.03	Jun 30, 1984	92,739,035,100	USD	↓ 0.41	23.77	28.57
Microsoft Corp	5.88	May 31, 1994	77,559,585,418	USD	↑ <b>0.20</b>	-1.01	26.18
NVIDIA Corp	5.59	Dec 31, 2001	73,767,864,210	USD	<b>↑ 0.05</b>	34.39	25.38
Amazon.com Inc	3.78	Dec 31, 2005	49,875,327,751	USD	<b>↑ 1.00</b>	8.82	28.57
Meta Platforms Inc Class A	2.66	Dec 31, 2013	35,079,646,509	USD	<b>↑ 0.67</b>	24.45	21.51
Berkshire Hathaway Inc Class B	2.06	Mar 31, 2010	27,130,776,105	USD	↑ <mark>0.21</mark>	31.13	26.53
Alphabet Inc Class A	1.90	Mar 31, 2006	25,069,764,839	USD	<b>↑ 0.04</b>	4.33	18.02
Broadcom Inc	1.65	Apr 30, 2018	21,811,970,374	USD	↑ <b>0.57</b>	50.30	29.41
Alphabet Inc Class C	1.56	Oct 31, 2015	20,525,954,060	USD	↓ 0.46	4.24	18.21
Tesla Inc	1.53	Dec 31, 2020	20,156,144,898	USD	↑ 0.42	67.44	129.87

<b>C</b>	1991 C 1997		
	ctor	eyna	SIIP
JU		CAPO	Juic

Exp	osure Sector Region	Country vs. Category % v	
ical	Sectors Basic Materials	Investment % 1.79	<b>Cat %</b> 2.20
Cycl	🚗 Consumer Cyclical	10.36	10.43
	🚅 Financial Services	14.15	14.71
	🚹 Real Estate	2.26	1.91
tive	Communication Services	9.34	8.81
ensi	o Energy	3.66	3.41
S	🔅 Industrials	7.45	9.30
	🔜 Technology	31.03	29.48
sive	🔚 Consumer Defensive	6.03	5.77
efen:	Healthcare	11.20	11.45
Õ	<b>V</b> tilities	2.72	2.52

or doile 1		14119							Por	ttolio
Quote Chart Fund A	Analysis Perfo	ormance	Sustai	inability	Risk	Price	Portfolio	People P	arent	
Portfolio										
Asset Allocation						Stock	Style (	Map Weigh	t Historical	)
Asset Class	Net	Short	Long	Cat.	Index		Value	Blend	Growth	
J.S. Equity	99.52	0.00	99.52	96.32	99.26	o				Weight %
Von-U.S. Equity	0.52	0.00	0.52	2.18	0.74	Larg	20	43	19	50+ 25–49
ixed Income	0.00	0.00	0.00	0.66	0.00					10-24 0-9
)ther	0.00	0.00	0.00	1.04	0.00	E.	C	0	0	
Cash	-0.04	0.12	0.08	1.67	0.00	Med	б	9	3	
Vot Classified	0.00	0.00	0.00	0.03	0.00					
nvestment as of Mar 31, 202	5   Category: Large	e Blend as	of Mar 31,	, 2025   Inc	lex:	mall	Ο	0	Ο	

https://www.morningstar.com/funds/xnas/vfiax/portfolio



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## SIMPLEST FORM OF INVESTING

- Target date funds Balanced funds (mix of stocks and bonds)
  - Change the composition of a <u>fund of</u> <u>funds</u> based on how close the date is to the target date.
  - A fund with a target date over 10 years (or more away) will have most of its holdings in high-risk high-return stocks
  - A fund with a target date within 5 years will have increasingly more bonds and fewer stocks
  - As the target date gets closer, the fund becomes more conservative and less risky (because you have less time to recover from a bad market).





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<b>R</b>	wanUniversity							AN	E		AP[	LE
& COMPUTER ENGINEERING Medalist Rating as of Jan 31, 2025   See Charles Schwab Investment Hub >				forningstar Medalist Rating				<u>A 20</u>	12	5 F	UN	
		NAV / 1-Day Return Total Assets 14.40 / +0.35% 407.2 Mil	Adj. Expense Ratio ① E: 0.320% 0.	xpense Ratio         Distribution Fee Level           .000         Low           tatus         TTM Viold	Share Class Type No Load							
		Target-Date 2025 Large Blend	Rate Sensitivity 0 Medium/Moderate	pen 3.01%	12%	https://www.morn	ingstar.	com/funds/xnas/swhrx/q	<u>uote</u>			
Schwab Ta Portfolio   Medalist Ratin	arget 2025 SWHRX ★★★ 읍 ng as of Jan 31, 2025   See Charles Schwab Investment Hub >	Morningstar Medalist Rating	Schwab Portfolio   Medalis	Target 2025 SWHRX ***	Hub >	ist Rating		Holdings	76 Portfolio Weight	Market Value Cur	Prospectus Net Expense Ratio	1-Year Return
Quote Chart Fu	und Analysis Performance Sustainability Risk	Price <mark>Portfolio</mark> People Parent	Quote Chart	Fund Analysis Performance Sustainability	Risk Price Portfolio	People Parent		Schwab US Aggregate Bond Index Schwab® S&P 500 Index	23.27 14.12	96,573,966 USD 58,597,084 USD	0.04	4.94 8.21
Portfolio Faut	V Bond		Portfolio (	Equity Bond				Baird Aggregate Bond Inst	11.83	49,107,689 USD	0.30	5.22
Asset Allocation		Stock Style Map Weight Historical	Asset Allocation	n	Fixed Income St	tyle Current Historical		Schwab Short-Term Bond Index Schwab Treasury Infl Protected	7.00 6.09	29,075,359 USD 25,278,571 USD	0.06 0.05	5.76 6.26
Asset Class U.S. Equity Non-U.S. Equity	Net         Short         Long         Cat.         Index           30.98         0.00         30.98         27.72         33.58           11.91         0.00         11.91         13.07         14.59	Val Bld Gwth   Centroi Owners	d U.S. Equity ship Zone Non-U.S. Equity	Net         Short         Long         Cat.           30.98         0.00         30.98         27.72           11.91         0.00         11.91         13.07	Index         Ltd         Mod           33.58         말              14.59         말	Ext Fixed Income Measures Investment Effective Duration 5.69 Modified Duration 5.61	Category Average 4.85	Secs Idx Schwab International Opportunities	5.87	24,379,549 USD	0.85	1.99
Fixed Income Other	54.41         3.31         57.73         45.49         49.15           -0.00         0.05         0.05         13.78         2.68	Big Schwat as of 03 Target-	Fixed Income           //31/2025         Other           0ate 2025         0ther	54.41         3.31         57.73         45.49           -0.00         0.05         0.05         13.78           2.66         4.62         7.02         4.02	49.15 <u>8</u> 2.68	Effective Maturity 7.32 Avg Credit Rating	6.49	Schwab <sup>®</sup> International Core Equity Schwab Select Large Cap Growth	4.45 3.96	18,480,530 USD 16,436,497 USD	0.86 0.74	9.29 4.75
Cash	2.66 4.69 7.36 4.38 0.00	≅ as of U3 ■ Mornin Mod 20	gstar Lifetime 25 TR USD	2.00         4.09         7.36         4.38           0.03         0.00         0.03         0.12	0.00	(surveyed) AA- Weighted Coupon 3.43	3.42	Dodge & Cox Stock I	3.16	13,131,679 USD	0.51	9.27
Investment as of Mar 31 Index: Morningstar Lifet based calculations.	0.03 0.00 0.03 0.12 0.00 1, 2025   Category: Target-Date 2025 as of Mar 31, 2025   time Mod 2025 TR USD as of Mar 31, 2025   Source: Holdings-	as of 03	//31/2025 Investment as of N Index: Morningsta based calculations	vlar 31, 2025   Category: Target-Date 2025 as of Mar 31, 2025 Ir Lifetime Mod 2025 TR USD as of Mar 31, 2025   Source: Hol S.	dings-	Weighted Price 94.86 Yield to Maturity 3.70	94.88 4.89	Schwab Global Real Estate	2.76	11,437,335 USD	0.71	3.66
Market Can		Measures			As of Mar 31, 2025 holdings-based cal	I Category: Target-Date 2025   Source: Manager-reported culations.	ana					
Avg Market Cap	Category Avg Market Index Avg Market Cap	Value & Growth Measures Investment Cat. Averag	e Index	s. Category % 🗸	Bond Breakdow Grades	n (Credit Quality v) (vs. Category % v) Investment %	Cat %					
101.72 Bil	Cap 86.84 Bil 120.76 Bil	Price/Earnings 17.04 17.7 Price/Book 2.59 2.6	0 17.60 Sectors	Investment %	Cat % AAA	19.59	37.32					
Size	Investment % Cat. Average % Index %	Price/Sales 1.90 2.0	6 1.89 Aunicipal	0.27	0.19 AA	52.04	38.95					
Giant	16.41 17.46 17.92	Price/Cash Flow 10.61 11.4	7 11.03 O Corporate	20.61	22.14 A	11.03	6.08					
Large	12.25 12.37 13.74	Dividend Yield % 2.10 2.1	2 2.21 Securitized	19.64	18.76 BB	15.92	8.38					
Mid	9.88 7.30 11.85	Long-Term Earnings % 10.13 10.0	8 10.06 🚅 Cash & Equ	uivalents 9.41	6.53 B	0.15	4.8Z					
Small	2.69 2.13 3.74	Historical Earnings % 6.08 4.4	0 5.89 Derivative	2.60	2.14 Below B	0.15	2.30					
Micro	1.13 0.55 0.80	Sales Growth % 6.29 6.2	8 -0.03 As of Mar 31, 202	5   Category: Target-Date 2025   Sector data is based on the re	scaled Not Rated	0.15	1.26					
USD   As of Mar 31, 202 Mod 2025 TR USD   Data	25   Category: Target-Date 2025   Index: Morningstar Lifetime a is based on the long position of the equity holdings.	Cash-Flow Growth %         22.48         18.6           Back Value Crowth %         1.01         2.1	1 4.18 long position of th	e holdings.   Source: Holdings-based calculations.	As of Mar 21, 2025	U.40	1.20					
		BOOK-VAIUE GROWTH % 1.81 3.1	2 5.70		As ur ividi 31, 2020	n Gategory, rarget-bate 2020   Great duality Data IS Das	a off the					

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DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING	Fidelity Freedom 2065 FFSFX ** Medalist Rating as of Jan 5, 2025   See Fidelity Investment Hub >	★ 🗙 🔒 Morningstar Medalist I	Rating					<b>_</b> /\	<b>V U U</b>	UUl	كاد
	Quote Chart Fund Analysis Performance Sustainability	Risk Price Portfolio Peopi	ole Parent			/	A 200	55		UN	
	NAV / 1-Day Return         Total Assets         Adj. Expense Rai           13.25 / +0.53%         1.9 Bil         0.750%	tio (i) Expense Ratio 0.750%	Distribution Fee Level         Share Class           High         No Load	Гуре		4				<b>-</b> u (	
	Category         Investment Style         Credit Quality / In           Target-Date 2065+         Large Blend         Rate Sensitivity           High/Extensive         High/Extensive	iterest Status Open	TTM YieldTurnover1.03%12%	<u>https:/</u>	/www.mornin	gstar.com/fun	<u>uds/xnas/ffsfx/quote</u>				
Fidelity Freedom 2065 FFSFX ****	General Morningstar Medalist Rating	Fidelity Freedom	2065 FFSFX ★★★★ 1025  See Fidelity Investment Hub >	Average Averag	t Rating		Holdings	% Portfolio Weight	Market Value Cur	Prospectus Net Expense Ratio	1-Year Return
Quote Chart Fund Analysis Performance Sustainability Risk	Price Portfolio People Parent	Quote Chart Fund Analysis	Performance Sustainability Risk	Price Portfolio Peop	ple Parent		Fidelity Series Emerging Markets Opps Fidelity Series Large Cap Stock	9.79	184,895,912 USD 182,705,102 USD	0.01	9.16
Portfolio Equity Bond		Portfolio Equity Bond					Fidelity Series Growth Company Fidelity Series International Value	9.61 7.94	181,417,185 USD 150,014,209 USD	0.00	4.43
Asset Allocation	Stock Style Map Weight Historical	Asset Allocation		Fixed Income Style	Current Historical		Fidelity Series Overseas	7.69	145,158,315 USD	0.01	4.07
Asset Class         Net         Short         Long         Cat.         Index           U.S. Equity         50.45         0.00         50.45         41.37         56.10           Non-U.S. Equity         42.28         0.00         42.28         31.11         36.78	Val Bld Gwth © Centroid Ownership Zone Eidalty: Erondom 2005	Asset Class U.S. Equity 5 Non-U.S. Equity 4	Net         Short         Long         Cat.         Index           50.45         0.00         50.45         41.37         56.10           12.28         0.00         42.28         31.11         36.78	Ltd Mod Ext	Fixed Income Measures Effective Duration Modified Duration	Investment Category Average 13.47 9.04	Fidelity Series Stk Selec Lg Cp Val Fidelity Series Value Discovery Fidelity Series Opportunistic	6.57 6.09 5.91	124,061,816 USD 114,948,765 USD 111,631,424 USD	0.00 0.00 0.00	-0.35 9.39 4.20 9.97
Fixed Income         10.76         0.00         10.76         5.01         7.05           Other         0.88         0.01         0.89         21.79         0.08           Cash         -4.41         7.66         3.25         1.80         0.00	Bit         Image: Second 2005           Bit         Image: Second 2005	Fixed Income         1           Other         -           Cash            Nat Classified	IU.70         U.UU         10.76         5.01         7.05           0.88         0.01         0.89         21.79         0.08           -4.41         7.66         3.25         1.80         0.00           0.04         0.00         0.04         0.04         0.02	LOW	Effective Maturity Avg Credit Rating (surveyed)	19.49 16.05 AA A+	Insights Fidelity Series Blue Chip Growth	5.25	99,133,713 USD	0.01	4.78
Not Classified         0.04         0.00         0.04         0.00           Investment as of Feb 28, 2025   Category: Target-Date 2065+ as of Mar 31, 2025   Index: Morningstar Lifetime Mod 2065 TR USD as of Mar 31, 2025   Source: Holdings- based calculations.	J         Television         Mod 2065 TR USD         as of 03/31/2025	Investment as of Feb 28, 2025   Category Index: Morningstar Lifetime Mod 2065 T based calculations.	y: Target-Date 2065+ as of Mar 31, 2025   IR USD as of Mar 31, 2025   Source: Holdings-		Weighted Coupon Weighted Price Yield to Maturity	3.55 3.66  0.00 5.14				Market Value	
				Investment as of Feb 28, 2 Source: Manager-reported	2025   Category: Target-Date 2065 1 and holdings-based calculations	i+ as of Mar 31, 2025   १	Holdings		% Portfolio Weight	as of Feb 28, 2025	Cur
iviarket Gap Avg Market Cap Category Avg Market Index Avg Market Cap	weasures Value & Growth Measures Investment Cat. Average Index	Exposure (vs. Category % v)		Bond Breakdown	Credit Quality v vs. Cate	rgory %  v	US Treasury Bond Future June	e 25	2.57	48,536.531	USD
100.66 Bil <b>Cap</b> 67.28 Bil 85.87 Bil	Price/Earnings         17.34         16.71         16.62           Price/Book         2.62         2.40         2.29	Sectors	Investment % Cat %	Grades AAA	Investme 8	ent % Cat % 14.23 30.46	10 Year Treasury Note Future	June 25	1.63	30,772,969	USD
Size Investment % Cat. Average % Index %	2.02         2.40         2.20           Price/Sales         1.92         1.82         1.72	Government	72.86 46.84	AA		4.42 17.61					
Giant 42.71 30.74 34.79	Price/Cash Flow 11.07 10.55 10.23	Corporate	6.08 15.83	A		1.55 24.28					
Mid         15.17         13.12         20.63	Long-Term Earnings % 11.05 10.26 10.11	Securitized	0.18 11.40	BB		5.03         25.39           6.22         1.41					
Small 5.97 4.72 9.11	Historical Earnings % 7.50 4.67 5.46	Cash & Equivalents	20.54 19.38	В		6.31 0.22					
Micro         1.26         1.53         2.13           USD   Investment as of Feb 28, 2025   Category: Target-Date 2065+ as of Mar 31, 2025         Date 2065+ as of Mar 31, 2025	3         Sales Growth %         5.94         5.69         -0.97           Cash-Flow Growth %         5.44         15.22         3.68	Derivative	0.33 6.19 y: Target-Date 2065+ as of Mar 31, 2025	Below B Not Rated		0.00 0.08 6.36 0.55					
Index: Morningstar Lifetime Mod 2065 TR USD as of Mar 31, 2025   Data is based on the long position of the equity holdings.	Book-Value Growth % 7.67 3.93 5.45	Sector data is based on the rescaled long	ng position of the holdings.   Source: Holdings-		10051-0		]				

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### Computer engineering

## Some Final Thoughts & Life Advice

- Establish and grow your emergency / rainy day fund as soon as possible
- Avoid buying anything on credit (except a house)
- Pay your credit card in full every month. If you cannot pay it at the end of the month, you cannot afford it (emergencies notwithstanding)
  - Credit card debt is the worst! If you have it, pay that down first!
- Delay expensive purchases as long as possible
  - No, you do not need a new car. If you need a car, buy a good 5–10-year-old used car until you can buy new in cash.
- Have a good health insurance plan
- Be meticulous in planning and saving for major life events. Save religiously!
- Do not invest in any financial instrument you do not understand. Avoid exotic investments and stick to mutual / exchange-traded funds
  - And only to passively managed index funds!
- Renting can be financially more advantageous than owning a house, depending on the circumstances. Do not blindly jump into the "American dream." Owning a house is expensive!
  - Owning a large house is even more expensive. Pools are overrated (and expensive)!







- The final grading will be as follows:
- Project Approval and Evaluation Form: 15 %
- Project 70%
  - Grade given by client:40%
  - Engineering Design & Impact Statement: 30%
    - Part I: 10 %
    - Part II: 10 %
    - Part III: 10%
  - Final Exam covering the most critical aspects of lecture content: 15%

## ECE 09.461 Professionalism & Consulting in Engineering

DR. ROBI POLIKAR

Electrical & Computer Engineering

Lecture 1

Welcome!



## Why Are We Here?

### History of this class:

- This class goes back to the very beginning of this program
  - Prior name: Clinic Consultant in ECE
- What to do with four credits?
  - After the credits were doled out for the Engineering Clinic sequence, all programs except ECE used the remaining 4 credits for technical courses
  - ECE decided to use these credits for skills and knowledge-building on entrepreneurship



- The core focus was on simulating a consulting experience through the Engineering Clinics, and that core remains in this course to this day.
- Great! But, do you really need to repeat this four times?
  - Reduced to two credits in mid-2010s, with one credit going to Modules in ECE. Now only 1 credit.
  - OK, but what is in this class?



## WHAT IS IN THIS CLASS?

- Traditionally, some basic concepts on how to find clients, managing client expectations, some project management, and some ethics.
  - 2021 Course instructor suddenly retired
  - Review of course content showed a missed opportunity

### Starting Fall 2021: A reluctant new instructor

- An opportunity:
  - To revamp the class to ensure that ABET student outcomes for this class are fully met
  - Also include new topics on starting a business, project management, contract issues and a more principled coverage of the ethical and professional judgment
  - Continuous improvement:
    - More recently, we also noticed a lack of certain background in professionalism, financial literacy, etc.
- So: a new approach







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Rowan University

### Welcome!

### PROFESSIONALISM & CONSULTING IN ENGINEERING

Your Host:Dr. Robi PolikarOffice & Phone:EH 346B, (856) 256-5372E-mail:polikar@rowan.eduClass Meeting:Mondays, 15:30 – 16:45; Science 126Office Hours:Whenever I am in my office, and the door is open (which is often)Prerequisites:ECE Senior / Senior Engineering Clinic (concurrent)Required Text:None



## WHAT IS IN THIS CLASS? A CLASS IN TWO PARTS

### Part I: Best Practices in Professionalism & Consulting

- Resume writing and interviewing skills
- Basic elements of being a successful professional and a successful consultant
- Soft skills: people skills, communication skills.
- Finding clients; marketing of skill/interest set to a customer with a requirement
- Managing client expectations
- Negotiation of project scope and resources
- Financial considerations
- Intellectual property and other legal considerations
- Project management methodologies and tools
- Project completion (analysis, design, prototype, test, demonstrate, present)
- Informal and formal status reporting
- Ethics in the workplace
- Financial literacy
- ...and some of the best advice from people who have done (and are still doing)
  - Guest lectures

## WHAT IS IN THIS CLASS? A CLASS IN TWO PARTS

### Part II: Practicum of Consulting

- Completing an actual consulting work
  - Other Engineering Clinics
  - Faculty with research projects
  - Teaching / lab development
  - Clients outside of Rowan Engineering (subject to conflict-of-interest rules)



## PRACTICUM OF CONSULTING

### In this class, you will:

- Identify a client who has a specific <u>engineering design problem</u> that can be addressed with the expertise and skills you have.
- Analyze the problem and
  - formulate a problem statement
  - identify the requirements, constraints and resources
  - negotiate a scope (plan) of work that includes specific deliverables in order to address the problem with an optimal solution.
- Implement (and validate) the optimal solution, given requirements, specifications, constraints, and resources, and provide the client with an appropriate and acceptable solution that meets the requirements, specifications, and constraints.
- Obtain client approval of successful completion.
- Provide oral updates on your progress, as well as a final, formal, written report that describes your activities and solution for each of the above-listed items.
- Submit Engineering Design and Impact Statement



ROW P C	Pr	ROJECT APPROVAL FORM
	ELECTRICAL & COMPUTER         ENGINEERING         Consultant Name       Project / Client Type         Consultant Name       Project / Client Type         Consultant Name       Project / Client Type         Replace This Text with Project Title. For clinic projects, also include department and project #         Narrative Description: Describe the intent and nature of the umberalla project under which the consultant will work.	Image: A complete the work. If you need purchase parts / supplies / components, attach a bill of materials.
General Project Narrative Requirements and Specifications	Requirements & Specifications: Provide the specific details of your work and task(s) within the above-described overall project. Clearly and concisely state the requirements, including a technical description of what needs to be done, engineering details, project attributes, and any specifications.	Milestones: (Identify dates of key milestones/deliverables.)         Project Initiation         Supplies/equipment obtained, orders placed for non-local acquisitions         Preliminary prototype, design, solution / design review         Final Project Completion & Sign-Off         Project Initiation Signatures/Dates         Consultant:         Client:         Project Completion Signatures/Dates         Client:         Project Completion Signatures/Dates         Client:         Project Completion signatures/Dates         Project Completion signatures/Dates
Constraints (what can you not do?)	Constraints: Briefly explain the constraints of the project, i.e., specific limitations and restrictions on how you may solve the problem (i.e., what can you <u>not</u> do to address the issue).	Disclosure: Through these signatures, the consultant and the client confirm that there are no real or perceived conflict of interests between them. Must, when and how to submit: At project initiation, the Consultant submits this form and a Gant chart (client leaves evaluation area and grade blank) to course Canvas page. At project conclusion, the Client e-maile this form (with all signated and completed coup of this form, as final report, and the Engineering Design & Impact Statement through class Canvas page. If client's signature is not electronic, consultant requests the client to send his/her grade and evaluation to polikar@rowan.edu as an e-mail. Moli Polikar, Rowan University, (c) 2021-2021

Cunto Care			Engi	NEERINO	5 DES	SIGN &
The Front Barrow			[	IMPACT	<u>Stat</u>	EMENT
F	Rowan ELECTRICAL & COMPU University ENGINEER	TER ING	Rowan University	ELECTRICAL &	& COMPUTER	
Co Cli Pro	CLINIC CONSULTANT IN ECE ENGINEERING DESIGN & IMPACT STATEMENT onsultant Name & Rowan ID ient Name oject Title	J.	Part 2 – Consideration of Impact Factors design or service decisions on the following Describe the public health, safety and welf	You must think about and consider the impact of yog factors. All questions must be answered. Fare factors considered in your design/service, along	ur solution, with their impact	
Bri Pic yo	rief Description of the Consultant Work (150 words or less) lease answer <u>all</u> of the following questions. The font size will decrease as you add text to accommodate all the text ou enter. You can also use additional space and pages if needed. Completed form must be attached / submitted		Describe the global, social and cultural fact	tors considered in your design/service, along with th	eir impact	1
Wi Pa W ad we	itm your report. art 1 – Engineering Design Process /hat is the engineering design process you used? Briefly describe: i) problem definition and opportunities for dvancing technology; ii) technical requirements; iii) timeline / tasks / deliverables; iv) trade-offs and alternatives that ere considered, v) risks considered; vi) final design: how did you test, analyze, evaluate and verify your solution?		Describe the environmental factors conside	ered in your design/service, along with their impact		Impact Factors
Engineering Jesign Principles			Describe the economic factors considered i	in your design/service, along with their impact		
Wh al	<u>Vhat are the multiple realistic constraints in your project</u> : Constraints are specific limitations and restrictions on ow you may (or may not) solve the problem. Constraints are different than design specifications (already described bove). Every project must mention the applicable constraints.		Part 3 – Professional Practice & Growth Ethical and professional considerations: Using t (or did) in the context of global, economic, envii addressed. Identify the capabilities, consequenc	the four-corners approach, explain what ethical and profes ronmental, and societal factors; how you address them or ces, duties and virtues associated with your design / servic	ssional issues may arise how can they be re / decisions.	
Constraints	Vhat engineering standards were applicable or did you use / follow? Every report must mention the <u>applicable</u>					Ethical Considerations
Engineering Standards	ngineering standards. Include the name/citation (e.g., IEEE 1451) and brief description of each standard.		Consultant Signature:		© Real Feature, 2021 - 2023	Rowan University



### WHAT IS YOUR SUPERPOWER? Yes, You Have One... or More

### Want others to pay you for your skills?

- Yes, you all have skills that may be useful to other people – so much so that they may even want to pay you for it!
- But first: identify your strength
  - What are you good at? What is your superpower?
    - Make a list of your skills
    - In-class exercise: let's do it right now!
  - It can be a common topic (that others also do), but it can also be narrow, a niche topic:
    - In fact, the narrower / the more niche the topic, the more you may be able to charge for your services



## IDENTIFY YOUR SKILLS

- Make a list of everything that you think you have a particular knowledge or skill (don't worry yet whether that is marketable):
  - Any specific technical topic:
    - Hardware design
    - Software design
    - An emerging topic (e.g., IoT, AI, blockchain, VLSI / chip design, etc.)
  - " Use of a particular tool (perhaps a software platform, e.g., Matlab, Cadence, etc.)
  - Certain standards
  - Regulatory information
  - Anything that requires licensure or certification
  - Certain processes / methodologies / functions
    - Remember: this need not be technical: tax preparation, project / personnel management
  - Even perhaps a hobby photography, carpentry, flying drones, art, ballroom dancing, can all lead to a type of consulting business (but the consulting you do in this class must be engineering related).



## IDENTIFY YOUR SKILLS

### Further edit that list:

- " Which of these skills do you think are very common (more competition)?
  - Working knowledge of Calculus, C++, Python, Matlab, basic circuit design
- Which of these skills are less common (less competition)?
  - Complex software / hardware platforms, expert knowledge of Cadence or other EDA tools, or even ability to use common platforms to do uncommon things
- Which of these require some sort of additional training / certification (even less competition)?
  - Licensure (P.E.), accreditation officer, security clearance

• For the purposes of this class, you need to focus on technical / engineering skills.





### • Put it out there:

• Resume

20

LinkedIn Profile



 There is almost always demand for any skill / knowledge, if you know where to look for it.

YES, THERE IS DEMAND!

- My first consulting business:
  - Tutor math / science as a college student to high school students who were struggling and/or preparing for standardized exams!
  - Yes, that is consulting: charging money for sharing your specific knowledge
    - Again, for this class, tutoring Calculus would not be an appropriate project; however, serving as a learning assistant in a lab may be, so long as there is some meaningful engineering design component.





ABET defines engineering design as follows, a definition we will also use for the purposes of this course.

### **ABET's Definition**

Engineering design is a process of devising a system, component, or process to **meet desired needs and specifications within constraints**. It is an **iterative**, **creative**, **decision-making process** in which the basic sciences, mathematics, and engineering sciences are applied to convert resources into solutions. Engineering design involves **identifying opportunities**, **developing requirements**, **performing analysis and synthesis**, **generating multiple solutions**, **evaluating solutions against requirements**, **considering risks**, **and making trade- offs**, for the purpose of obtaining a high-quality solution under the given circumstances.

For illustrative purposes only, examples of possible constraints include accessibility, aesthetics, codes, constructability, cost, ergonomics, extensibility, functionality, interoperability, legal considerations, maintainability, manufacturability, marketability, policy, regulations, schedule, standards, sustainability, or usability.



## FINDING PROJECTS

Start looking for them now!

To do so:

- Identify your expertise: what are you good at?
- Identify your passion: what do you enjoy working on?
- Identify your client: Is there a clinic or research project that requires that expertise?
  - Reach out to the clinic project manager (cannot be your own current clinic project)
  - Check out the <u>ECE Consultant Requests for Spring 2025</u> for projects from Engineering Faculty
- Is there a class that you really enjoyed, and understood really well?
  - Reach out to the course instructor to become a learning assistant (must be an ECE class). Need to think
    carefully how to cast LA responsibilities as engineering design. It can be done, but requires a bit of thinking.
- Can a client be outside of Rowan Engineering?
  - Yes! ... as long as there are no real or perceived conflicts of interest.
- Remember: Consulting for a non-ECE project also satisfies your "out of discipline" (OOD) requirement
- Suggested time for identifying a client project: September 26.
  - The faster you do so, the more time you have to work on the project.





## Professionalism Part

WHAT ABOUT THE

- Identified lack of certain essential skills:
  - Resume writing
  - Oral communications / interviewing
  - Lifelong learning
  - Ethical and professional judgment
  - Financial literacy

• We will have dedicated discussions on these topics





- Which of these acronyms do you recognize?
  - NDA, IP, PTO, LLC, S-Corp, NCC, IRA, PE, SOW, BOM, CV, 401K/403A/403B/457
    - Quietly raise your hand for each of these you know
- How many resumes do you currently have?
- How much should you save to be able to retire when you are 65?
- What would you do if you discover a design flaw in your company's latest product, but raising the alarm bell will get you fired?
  - How about getting an offer from a company whose business practices / culture / values you despise, after months of being unemployed with your dependents' well-being at risk?
- How would you answer the interview questions:
  - "Tell me about yourself," or "What is your greatness weakness/strength?" or "Why should we hire you?"
  - How many windows are there in Istanbul?



### ....BUT FIRST

## LET'S START WITH RESUMES

### An interview is what gets you the job, but a good resume is what gets you the interview.

- For each position, it is not unusual for employers to receive hundreds of applications
- How will you make sure that yours will be chosen for the interview?
- Remember that in many cases, the resumes are pre-filters by automated algorithms (bots!)
- A good resume is simple, professional, factual and responds to the specific position description
- A good resume includes
  - Key skills
  - Qualifications
  - Projects/ experiences
  - Education

#### FIRST LAST

New York, NY | P: +44 123456789 | first.last@resumeworded.com

#### EDUCATION

RESUME WORDED UNIVERSITY	Boston, MA
Bachelor of Science	
Major in Electrical Engineering	Expected May 2022
Cumulative GPA: 3.93/4.0; Dean's List 2015-2016	
Relevant Coursework: Electrical Engineering, Digital Electronics, Logic Design, Power System Analysis	
DUBLIN CITY UNIVERSITY	New York, NY
Study Abroad Program in Electrical Engineering	Jul 2018 - Jul 2019

#### WORK EXPERIENCE

<b>RESUME WORDED &amp; CO.</b> (8-employee venture-backed recruitment startup)	New York, NY
Electrical Engineer Intern	Jun 2021 – Sep 2021
· Performed analysis on product performance, provided recommendations that improved product product	performance by 10%.
<ul> <li>Assisted two engineers in developing engineering solutions, which reduced company costs by 15%</li> </ul>	0.
<ul> <li>Ran weekly tests and validity checks on data, equipment, and software, reducing error rates by 129</li> </ul>	/0.
GROWTHSI	New York, NY
Electrical Project Engineer Intern	Jun 2020 - Sep 2020
· Worked with 3 senior electrical engineers to design PV systems that converted sunlight into electr	icity, reduced costs by 45%.
· Designed and sized solar PV systems for over 30 customers using AutoCAD to generate detailed	computer drawings.
· Conducted efficiency and price comparisons, provided recommendations that increased efficiency	by 15% and cut costs by
25%.	

#### **VOLUNTEERING & UNIVERSITY PROJECTS**

#### COMMUNITY PROJECT

Feb	2020

• Installed 20+ solar panels on 20+ local homes and businesses, reducing electrical costs by 30% • Ran diagnostics on 5+ businesses and provided recommendations that improved electrical efficiency by 15%.

#### ELECTRICAL ENGINEERING PROJECT

Jan 2020 • Researched and designed a solar-based swimming pool heating system. Presented to 6 college board members that approved the plan and cut amenity electrical costs by 20%.

#### ACTIVITIES

RESUME WORDED ELECTRICAL ENGINEER SOCIETY Head of Events	Boston, MA Sep 2020 – Present			
<ul> <li>Founded the first-ever Electrical Engineering Series to organize hands-on training for 200+ students</li> <li>Organized and advertised 5+ quarterly networking events with 200+ participants, securing jobs for 60% of attendees.</li> </ul>				
ELECTRICAL ENGINEER CLUB	Boston, MA			
Committee Member	Jan 2020 – Present			
<ul> <li>Designed RFID-based prepaid energy meter with a team of 10 that the university uses today.</li> </ul>				

#### ADDITIONAL

Technical Skills: Energy Efficiency, C++, Microsoft Access, Electrical Design, Power Systems Languages: Fluent in French, English; Conversational Proficiency in Italian, German Certifications & Training: Online Course in Project Management (Coursera), Passed Resume Worded examinations

https://resumeworded.com/electrical-engineer-resume-examples





- The following are examples of actual resumes submitted for this class, used here with permission.
- The identity of the individual is hidden (to the best of my ability), unless the individual gave me specific permission to do so.
  - Any identifying information left is unintentional and is due to the content of the resume.
- My comments are intended to help everyone prepare a better, more professional looking resume.
  - These comments should be taken as personal criticism.









Poorly written, does not provide much actionable information Possibly irrelevant depending on the job you are applying Too much volunteer information and not enough technical project / skills / irrelevant / unnecessary Not distinguishing skills for Rowan University Irrelevant / unnecessary



Big mistake Potential problem Warning Point of information Well done!

#### **EDUCATION**

BSE Electrical and Computer Engineering, Rowan University – Glassboro, NJ
 Minor: Comp Sci, Data Sci; Class of 2025; GPA 3.89

#### SKILLS

- Programming languages: Python, SQL, C/C++, MATLAB, JavaScript
- Machine learning: PyTorch, TensorFlow, Keras, GANs, classification, regression, object detection, YOLO, explainable AI, sentiment analysis
- Data science: data cleaning, normalization, databases, web scraping, statistics
- Data visualization: Tableau, OpenRefine, D3, Power BI
- Cloud services: Azure, AWS, cloud security
- Automation: Microsoft Power Automate

#### **RELEVANT COURSEWORK**

Cybersecurity Fundamentals & Database Systems & Reinforcement Learning & Info Visualization & Data Mining & Prob & Stat for ECE & Discrete Math & Data Structures & Algorithms & Computer Laboratory Techniques & Machine Learning & Generative AI & Embedded Software & Computer Architecture & Digital Signal Processing

#### WORK EXPERIENCE

Delmarva Power & Light, Intern – Distribution Standards, (06/2024) - (08/2024)

- Wrote an updated booklet on standard upgrade policy for engineering designers regarding Distribution worksites
- Assisted with developing text detection AI models in Azure for extracting data from equipment
  evaluation forms
- Rowan University, Undergraduate Research Assistant, (06/2023) (07/2024)
  - Performed data analysis on electrical outages in Python, solely authoring programs for relative risk evaluation of 10 different natural hazards
- Assisted in the NJ State Energy Security Plan project to recommend emergency preparedness and risk
  mitigation strategies for a government audience
- Analyzed and integrated data from over 25 states' energy assurance plans to formulate a risk assessment model, ranking threats to NJ's infrastructure

#### PROJECTS

- Data Driven Analysis of the Jewelry Industry, Metalsmith Magazine, (04/2024) (06/2024)
- Researched and authored two articles on data-driven analysis of the art jewelry and commercial jewelry industries
- Used Python to pull and analyze data from web sources such as Google Trends and social media
- Developed conclusions based on data and presented them in the context of social, economic, and political factors for a non-technical audience

#### **PROFESSIONAL SOCIETIES**

Institute of Electrical and Electronics Engineers & Society of Women Engineers & Tau Beta Pi (Engineering Honors Society) & Pi Mu Epsilon (Math Honors Society)

AWARDS IEEE PES Scholar 2023 �

IEEE PES Scholar 2024

Robi Polikar Rowan does not award a degree called "BSE" Robi Polikar Spell out Robi Polikar Good to put skills up top. Make sure to update it based on the qualifications needed for each position Robi Polikar Great if you are comfortable with all of these. If not, do not lie! Perhaps. you can provide a relative scale for each indicating your level of knowledge / expertise in each Robi Polikar These are weak verbs, they do not convey confidence and expertise. Robi Polikar These are better as power verbs, they project an image of confidence expertise, can do attitude. Robi Polikar Use "published" Robi Polikar IEEE no longer stands for this. It is simply IEEE. Robi Polikar

...but should indicate what the award is for. Also indicate national nature of

the award

SOME EXAMPLES



© All Rights Reserved, Robi Polikar, 2021 - 2025

**Potential problem** 

Point of information

**Big mistake** 

Warning

Well done!

# ROME CALLER C

Big mistake Potential problem Warning Point of information Well done!

### **Jacob Drennen**

#### Secret Security Clearance (Active)

1024 W. Somerdale Rd, Somerdale, NJ [856-449-8902] JakeDren0526@gmail.com

#### EDUCATION

#### EXPECTED GRADUATION DATE: MAY 2025

Rowan University Major: Electrical and Computer Engineering

#### GPA: 3.55

Honors: Dean's List

Relevant Coursework: Engineering Clinic, Intro to IOT, Principles of Circuit Analysis, Computer Architecture, Signals and Systems, Embedded Systems, Electronics 1, Digital Signal Processing

#### WORK AND PROJECT RELATED EXPERIENCE June 2024 - Current

System Engineer Co-Op Lockheed Martin, Camden, NJ

- · Leverage Python create graphical user interface for generating simulation runs
- Performed data analysis to determine outcomes for simulated events via MATLAB
- Collaborated with peers on radar analysis simulation

#### May 2023 - August 2023

Electrical Engineering Intern Novelis, Clayton, NJ

- Responsible for cataloguing and updating electrical drawings utilizing AutoCAD.
- Developed and documented programmable logic circuits leveraging AutoCAD.
- Implemented efficiencies in logistics process by leveraging third party-contracts to improve safety metrics in the warehouse.

#### SPRING 2021-SPRING 2023

ROWAN UNIVERSITY PROJECTS

- Embedded Systems Course Project, Spring 2023
  - Developed a system to test water clarity leveraging I2C and ADC to determine purity of drinking water.
- Computer Architecture Course Project, Fall 2022
   O Designed and built a 32-bit processor that leveraged bit wise operators to perform
- mathematic functions using Verilog.
   Digital Systems Course Project, Spring 2021
  - Designed and built a 32-bit processor that leveraged bit wise operators to perform mathematic functions using Verilog.

#### ACTIVITIES

Member, IEEE, Rowan University Student Branch SEPTEMBER 2019 - June 2021 First Robotics Competition Team, Camden County Technical High School, Sicklerville, NJ

#### SKILLS

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Python, Verilog, C/C++, PCB Design Software, PSPICE, AutoCAD, Test Equipment Hardware, MATLAB, Office 365, MS Project, Project Management



SOME EXAMPLES





#### Summary of Qualifications Outstanding leadership, teamwork, and communication skills. ٠ Ability to learn new skills quickly and efficiently. · Strong research and information gathering capabilities. Education Bachelor of Science, Electrical and Computer Engineering Anticipated Dec 2025 Rowan University, Glassboro, NJ GPA 3.93, President's Scholar Fall '23, Dean's List Spring '24, Fall '25 Transfer Trustee Scholarship 2023, 2024 Associate of Science, Engineering Science May 2023 Camden County College, Blackwood, NJ GPA 3.7. Honors. Permanent Dean's List Engineering Projects Junior Engineering Clinic: Continual Learning May 2024 - Dec 2025 Served as project manager of research team, analyzed several continual learning and interpretability algorithms, combined both algorithms into a novel continual learning interpretability algorithm, and analyzed effect of backdoor poisoning attack on continual learning algorithms using novel interpretability algorithm Sophomore Engineering Clinic: Drone Design Jan 2024 - May 2024 Worked in a multidisciplinary team, researched various drone designs, designed drone frame and propellors, proposed innovative use of drones for social good, and assembled small-scale drone. Sophomore Engineering Clinic: Autonomous Car Sept 2023 - Dec 2023 Worked in a multidisciplinary team, tested various rubber materials, designed tire treads, and designed Arduino-based autonomous movement for a small-scale self-driving vehicle. Skills Programming Languages: C++, Arduino, Verilog, and Python Software: Microsoft Office, MATLAB, Onshape, and Intel Quartus Prime **Professional Societies** Phi Theta Kappa Tau Sigma National Honor Society Golden Key National Honor Society Tau Beta Pi Achievements Camden County College Program Excellence Award in Engineering Science May 2023 • • William G Rohrer Charitable Foundation Transfer Scholarship May 2023 • Camden County College Honors Program Transfer Scholarship May 2023 Chatman-Smith Memorial Scholarship May 2023 ٠ Lenora DiGiacobbe Memorial Scholarship April 2022 • Work Experience IT Support and Data Management July 1, 2021-Current Samlin Consulting, Blackwood, NJ

#### Robi Polikar Sounds like bragging with no proof. Use technical qualifications / skills instead Robi Polikar Good to include these Robi Polikar No one knows what these mean. Robi Polikar Too much detail, most hiring managers will not be able to follow this level of detail. Save it for interviews. Robi Polikar strong / power verbs Robi Polikar Weak verbs Robi Polikar Not a marketable skill anymore (certainly not for engineers). Robi Polikar Explain what these societies focus on Rowan University Robi Polikar Should be listed earlier and with more detail / content
# COMMON MISTAKES IN RESUMES

- Having only a few or just one (gulp!) resume(s)
  - <sup>a</sup> Submitting an identical resume to more than one position
- Resume not including key terms from the job posting or position description
  - Not using power (or action) words (developed, designed, performed, improved, supervised, etc.), and using weasel or buzzwords or cliché words (worked on, researched, responsible for, team player, fast learner, hard worker, etc.,)
- Typos, awkward sentences, grammatical mistakes, incorrect contact information
  - " Use only firstname.lastname@provider.com/edu/org, or just lastname@provider.com/edu/org
  - Do not use cryptic or even amusing addresses: ajcxyy24@gmail.com; jedimaster@fargalaxy.com; I.am.the.best.for.this.job@hireme.com
- Listing hobbies or irrelevant experiences
  - Do not list unrelated jobs (such as working at McDonalds), irrelevant volunteer activities, hobbies, high school information
  - Volunteer / outreach activities that relate to job description are fine.
- Listing all / too many classes you have taken, or other non-distinguishing skills
  - Calculus, Circuits, Electronics, Office / Google Suite are concepts every ECE graduate knows. These are not discriminating skills / abilities.
- Using jargons, acronyms, not defining acronyms
- Using terms a recruiter, headhunter, hiring manager or a bot would not understand
  - " How many of you have "clinics" mentioned in your resumes?
- Starting with overly flowery "career objectives" or cliché statements (instead use "Key Skills & Abilities")
- Not enough technical detail or too much technical detail
- Unprofessional look and feel; too many colors; too crowded or too sparse, using multiple fonts, using graphics



FIRST LAST

New York, NY | P: +44 123456789 | first.last@resumeworded.com

• Performed analysis on product performance, provided recommendations that improved product performance by 10%.

Worked with 3 senior electrical engineers to design PV systems that converted sunlight into electricity, reduced costs by 45%.

· Conducted efficiency and price comparisons, provided recommendations that increased efficiency by 15% and cut costs by

• Researched and designed a solar-based swimming pool heating system. Presented to 6 college board members that approved

• Designed and sized solar PV systems for over 30 customers using AutoCAD to generate detailed computer drawings.

Assisted two engineers in developing engineering solutions, which reduced company costs by 15%.

• Ran weekly tests and validity checks on data, equipment, and software, reducing error rates by 12%.

• Installed 20+ solar panels on 20+ local homes and businesses, reducing electrical costs by 30%.

• Ran diagnostics on 5+ businesses and provided recommendations that improved electrical efficiency by 15%.

### John Smith

(1) GENERAL SKILLS

Commercial Power Systems echnical Conference (2019)

Institute of Electrical and Electronics Engineers

INTERESTS

A Renewable Energy

Meditation

*certificate* • Tucson, AZ.

https://novoresume.com/career-blog/electrical-engineer-resume-example

- AGI

### in linkedin.com/in/john.smith

Dedicated electrical engineer with 8 years of experience designing, testing, and implementing industrial installations. Skilled in AutoCAD, LabVIEW development, and circuit desian. Uparaded several installations bu finding out various transmission line faults, minimizing upkeep time by 40%.

### B WORK EXPERIENCE

**Electrical Engineer** 

Ness Engineering Inc.

- Upgraded and maintained over 20 clients' installations by finding out transmission line faults using AutoCAD, minimizing upkeep time by
  - Designed linear circuits using complex analysis, increasing production efficiency by 25%.
- Performed a variety of engineering tasks using computer-assisted design and software
- Communicated with customers and other engineers to discuss the design and implementation of engineering projects that meet company standards.
- Ensured that design, construction, installation, or upkeep of products complies with customer requirements and specifications.

#### **Electrical Engineer**

Spark Power Corp.

- Gathered and analyzed complex data regarding existing and potential electrical engineering projects and studies to write and compile reports
- Designed and tested electrical circuits for industrial purposes.
- Worked with a variety of technicians across departments to ensure compliance with customer needs and requirements.
- Supervised and trained project team members.

### 

**Bachelor of Science in Electrical Engineering** University of Colorado Boulder

### 

Certified LabVIEW Developer (valid until 11/2024) C National Instruments Corporation

Certified Systems Engineering Professional (valid until 06/2023)

#### N novoresume.com

### First Last

Entry Level Electrical Engineer

#### WORK EXPERIENCE

#### Resume Worded, New York, NY

- Entry Level Electrical Engineer 01/2015 - Present Assisted in designing electrical systems for 20+ residential construction projects, leading to an 18.5% reduction in monthly
- energy consumption. Collaborated with a 10-person team to create a new circuit board
- layout that increased operational efficiency and reduced \$7300+ in quarterly production costs. · Partnered with cross-functional units to troubleshoot and resolve electrical equipment issues, decreasing downtime by 97%.
- Conducted comprehensive testing and analysis of power distribution systems, ensuring 100% compliance with industry standards

#### Growthsi, San Francisco, CA

#### Power Systems Engineer (Intern)

- Partnered with a team of senior engineers in executing a major substation upgrade project, reducing downtime by 70+ minutes and improving system reliability by 44%.
- Conducted detailed power flow and fault analysis to identify and resolve voltage and stability issues, which boosted system performance by 73% in the first year.

#### VOLUNTEERING ACTIVITIES AND EXTRACURRICULARS

#### Resume Worded's Business Society, New York, NY Welding Supervisor

- Recommended procedures that improved welding safety for RWBS at 120+ construction sites across Europe.
- · Worked on installing water mains using high-strength, low-alloy steel structures for 50+ companies throughout the US.

#### PROJECTS

https://resumeworded.com/electrical-engineer-resume-examples

#### **Optimizing Solar Energy for Corporate Use** 05/2009

- · Examined the efficiency of 20+ solar-powered charging stations and wind turbine generators.
- · Designed an automated system to reduce energy usage in a corporate setting by 200W annually.

#### A Review of Wireless Sensors & Amplifiers

- Researched a project to deploy a wireless sensor network to observe air quality, noise levels, and 20+ other environmental parameters.
- 92% below high-quality sound reproduction.

#### CONTACT Topeka, KS (Open to Remote) · +1-234-456-789

### linkedin.com/in/usemame · github.com/resumeworded SKILLS Hard Skills:

email@resumeworded.com

Programming

Control Systems Design Electromagnetic Field Analysis Tools:

· SPICE Simulink Spectrum Analyzer

Multimeter

Don't forget to use Resume Worded to scan your resume

proven to get you more jobs)

Resume Worded University Bachelor of Science

Awards: Resume Worded Teaching

#### OTHER

- Professional Engineer (PE) 2022

#### 04/2009

- Critiqued the construction of a digital audio amplifier that produced

### Relevant Coursework: Electrical Engineering, Digital Electronics, Logic Design, Power System Analysis DUBLIN CITY UNIVERSITY Study Abroad Program in Electrical Engineering WORK EXPERIENCE **RESUME WORDED & CO.** (8-employee venture-backed recruitment startup)

EDUCATION

Bachelor of Science

RESUME WORDED UNIVERSITY

Cumulative GPA: 3.93/4.0; Dean's List 2015-2016

Major in Electrical Engineering

Electrical Engineer Intern

Electrical Project Engineer Intern

COMMUNITY PROJECT

**VOLUNTEERING & UNIVERSITY PROJECTS** 

ELECTRICAL ENGINEERING PROJECT

ELECTRICAL ENGINEER CLUB

the plan and cut amenity electrical costs by 20%.

RESUME WORDED ELECTRICAL ENGINEER SOCIETY

GROWTHSI

25%

ACTIVITIES

Head of Events

https://resumeworded.com/electrical-engineer-resume-examples before you send it off (it's free and

### List 2012 (Top 10%)

https://resumegenius.com/blog/resume-help/bad-resume-examples

Certified Energy Manager (CEM) · Certified Electrical Safety Compliance Professional (CESCP)

#### Committee Member · Designed RFID-based prepaid energy meter with a team of 10 that the university uses today.

### ADDITIONAL

Technical Skills: Energy Efficiency, C++, Microsoft Access, Electrical Design, Power Systems Languages: Fluent in French, English; Conversational Proficiency in Italian, German

· Founded the first-ever Electrical Engineering Series to organize hands-on training for 200+ students

Certifications & Training: Online Course in Project Management (Coursera), Passed Resume Worded examinations

• Organized and advertised 5+ quarterly networking events with 200+ participants, securing jobs for 60% of attendees.



Boston, MA

Expected May 2022

New York, NY

New York, NY

New York, NY

Feb 2020

Jan 2020

Boston, MA

Boston, MA Jan 2020 - Present

Sep 2020 - Present

Jun 2020 - Sep 2020

Jun 2021 - Sep 2021

Jul 2018 - Jul 2019

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### 06/2009 - 04/2010 EDUCATION

06/2010 - 12/2014



### PROFILE

Sales Maestro with more than 10 years experience in retail environments. Recognized for my ability to close deals, provide excellent custo service, and generate cold hard cash. Hire me to boost your company and get the job done.

### CONTACT

PHONE 678-555-0103

EMAIL: TheHamMan@hotmail.com

#### HOBBIES

Jiu-jitsu Philosophy

### Dugo 📄 Sales \$\$ HAM DUGO

#### Sales Associate

EDUCATION

University of Phoenix – Tempe, AZ Graduated 2008 AS in Business Administration President of Jiu-jitsu Club

### WORK EXPERIENCE

Walmart Sales Associat 2015-Present -Help like 50 customers per day by answering questions and helping them find products -Recommended advanced merchandise display techniques to management, which were implemented and resulted in better sales -Close roughly \$500 in sales every week -Named "Employee of the Month" 4 separate times

#### ZARA Sales Associate

2008-2015 -Stocked and organized inventory with accuracy and efficiency -Personally broke state-wide records for the number of bootcut jeans

-On average, sold more than \$1,500 in merchandise each week -Once convinced a Chechen businessman to buy our entire collection of button up shirts

### SKILLS



# (OBVIOUSLY) BAD EXAMPLES

200 H Street, Washington, D.C.

charlie·foghorn@gmail·com (203) 451-2216

### Charles Foghorn

### EXPERIENCE

Reporter at McClatchy Washington Bureau, Washington, D.C.

#### September 2018 - August 2020

- Pitched and wrote weekly stories for McClatchy's national newspapers, the Miami Herald in particular
- Reported on 2018 congressional races, as well as Senate hearings
- Assisted lead editors with short and long-term economic research

Organizer at Orange County Democratic Committee, Orange County, CA

#### June 2017 - August 2018

- Used NGP VAN to update voter profiles, pull voter registration lists, and track contribution
- Planned and prepped for grassroots events aimed at recruiting new members from more than 100 precincts.
- Ran voter registration drives, having received voter registration certification in Virginia

### ABOUT ME

Vegan, thrill-seeking single dad of two beautiful children, ages 10 and 13. Looking to expand my horizons through full-time employment with a flexible schedule that accommodates my morning mindfulness and goalsetting routine. Born hustler and big believer in the transformative power of meditation. #StavHumble #ProudDad

### CONTACT

EMAIL: partyhardy75@hotmail.com

ADDRESS: 285 Wheeler Ave. Jacksonville, FL 32210

BIRTHDAY: July 17, 1978

MARITAL STATUS: Single

https://resumegenius.com/blog/resume-help/bad-resume-examples

### Rachel Maxwell

#### RESUME SUMMARY

College graduate with internship experience. Seeking to leverage acquired academic knowledge and work experience into effectively filling your office clerk position. A dedicated worker aiming to help achieve company goals and take on more responsibility as quickly as possible.

### (212) 657-8934

rachel.maxwell@gmail.com

linkedin.com/in/rachelmaxwell/

### PROFESSIONAL EXPERIENCE

#### February 2018 – Present | Western Digital Inc., New York, NY Office Clerk Intern

- Perform document scanning (100+/day) and log them in the company's proprietary computer system for future review by internal departments, as well as the company's international offices
- · Typing and distributing confidential letters for senior members daily
- · Lead internship team of 8 in developing new inventory filing system
- · Respond to more than 15 client emails daily (on average), quickly resolving issues as they arise
- Worked with management to optimize the storage process for regulatory
- documentation, saving the department several hours per week

- EDUCATION May 2017 University of California, Berkeley Berkeley, CA M.S., Marketing
  - May 2012 University of California, LA Los Angeles, CA
  - B.A., Economics

Rowan University

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PHONE: 274-038-1937

Online political debates

on Main Street

Yoga Instructor - Mystik

July 2017 - August 2017

program to the bakery

and organized studio

- Vegan baking

Held private yoga sessions for VIP clients

· Worked both front and back of house in a vegan bakery

Introduced a successful waste-reduction and composting

Led personalized classes with focuses on stress relief

Worked closely with other instructors to maintain a clean

SKILLS & HOBBIES

and introduction to meditation

Reiki Level 2 practitioner

- Making people laugh
- Poker



# TOP 5 RESUME MISTAKES

https://resumegenius.com/blog/resume-help/bad-resume-examples





### **Getting Ready**

- Make a formal list of your skills
- Identify which ones are technical / engineering skills
- Organize them with respect to how common or specialized those skills may be
- Identify potential clients for each
- Update your Resume
- Prepare your LinkedIn Profile



### Assignment 1:

## PROJECT APPROVAL FORM

Complete and submit the <u>P&C Project Approval Form.</u>

- Please provide as much detail as possible for
  - Narrative Description / Scope of the Work,
  - Requirements / Specifications,
  - Constraints
  - Deliverables, and
  - Budget & Resources.
- Provide the dates for
  - project initiation,
  - ordering the supplies/equipment,
  - preliminary prototype/solution.
- Make sure to sign and obtain the Client's signature on the left side, under Project Initiation.
- Attach a Gantt chart. Lack of Gantt chart will lead to loss of points!

Read the additional information on Assignment 1 on Canvas.



# ROAD MAP: WHEN WE COME BACK ....

- February 3: Mastering Interview Skills
  - Are you \*really\* ready for an interview?
- Mock interviews need volunteers
- If you would like to participate in a mock interview:
  - Let me know that you would like to participate
  - Send me an updated resume by Friday
  - Send me a position description / job ad to which you are applying by Friday
  - Come to class next Monday ready for the interview (in business formal attire)
  - Full disclosure
    - Be ready for honest and frank comments and feedback (in criticism or in praise) provided publicly.
  - Benefits:
    - You will get instant feedback
    - A great test run if you are preparing for an interview soon
    - I will meet with you again later (privately) to coach you and help you prepare for future interviews.



# ECE 09.461 Professionalism & Consulting in Engineering



Mastering the Art & Science of





Electrical & Computer Engineering

### The job interview

- Layers and stages of a job interview
- Pre-interview preparing & planning
- The interview
  - Planning
  - It is go time!
  - Answering the questions / Common (and tough) questions
  - The STAR method
  - The last question
- After the interview



THIS WEEK IN P&C

### JOB INTERVIEW

- A job interview is one of the most critical components of your professional career.
  - It is the second and the more difficult hurdle after clearing the resume review.
  - It is not just a mechanism for the employer to find the right employee, but also for you to find the right employer.



- The job interview is a process; it does <u>not</u> start when you walk into the room and does <u>not</u> end when you walk out.
  - A successful job interview starts with thorough planning and preparation and continues with further interaction/communication after the interview meeting itself.
- Most people think that they are good at interviewing.
  - Most of them are wrong often catastrophically so!



### LAYERS OF INTERVIEW

- Depending on the company and the job, you may go through several layers of interviews:
  - Technical interview to test whether you have the right background, knowledge, and skills to do the job. This is essentially an oral (and sometimes even a written) exam. There may even be multiple such technical interviews. Technical interviews are often given by supervisors, managers, and other technical staff.
  - Behavioral interview to determine whether you are the right kind of <u>person</u>, who shares the company's values and culture, whether you have the right attitude, whether you are a true team player, whether you can work under pressure, etc. Behavioral interviews are often given by HR personnel who are specialized in evaluating / profiling people, and it is the harder of the two main types of interviews (where more people are eliminated).
    - In this class, we will focus on the behavioral interview.



# THREE STAGES OF THE INTERVIEW

Pre-interview – Steps you need to take, the research you need to make, the preparation you need to complete long before you step into the interview room.

- During the interview Knowing what to say and when (and perhaps more critically, what not to say), reading the room and the interviewer, conducting yourself professionally, having the right body language and gestures.
- 3. After the interview Following up with a thank you note, or additional information that might have been requested, keeping the company posted with any other employment decision you take



# PRE-INTERVIEW PLANNING

90% of applicants skip or do not pay proper attention to this step, yet this is the most critical part. The vast majority of applicants are eliminated because they skip this step.



- Before attending an interview, you must <u>thoroughly</u> research the company, the job description, and the industry in which that company operates.
- You must prepare answers to commonly asked questions from the perspective of that company and the industry in which they operate.
- Just like you must have a different resume for each job you apply to, your answers to even the most common questions should also be different for each interview





Actual snippet from an interview in January 2025 at Inductotherm



THIS DID HAPPEN!

**Interviewer:** So, what do you know about us?

Rowan Engineering student: You guys heat stuff up, right?



• Update your LinkedIn profile. Make sure that it is professional (you've already done this, right?)

1. Carefully (re)read the job description

- <sup>D</sup> Learn the qualifications, qualities, the background that are needed.
  - Align yourself with respect to the job description how do your experience/skills match the requirements?

### 2. Answer this question: Why do I want this job?

" What is the specific draw? Why do you feel you are uniquely qualified?

### 3. Research and learn everything you can about the company

- " What is/are their line(s) of business? What are their products and services?
- Learn the company's history, triumphs and failures, high and low points
- Find out about the recent news, their industry positions, their stock price, shareholders, and investors (if applicable)
- " Find out about the company's mission/vision, credo, values, and culture
- 4. If you know who the interviewer will be, learn everything you can about him/her (you <u>can</u> ask who that person will be)

Search their LinkedIn profile, webpage, current and prior roles in the company
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PRE-INTERVIEW STEPS

### https://youtu.be/qpkegRmPgis

**Pro-tip:** Strategically integrate what you learned into your answers during the interview.



## PRE-INTERVIEW STEPS



Learn about the common questions, and prepare your answers to those questions in light of best practices for those questions

- Strategically weave the knowledge you have gained during the research phase into your answers.
- Learn and practice the STAR method: situation, task, action, result (more on this later)
- 6. Practice, practice, practice, and then practice some more
  - Record and then watch yourself pay attention to <u>body language</u>, <u>speaking voice</u> and <u>your smile</u>
  - Conduct mock interviews with trusted family, friends, advisors
- 7. Prepare <u>thoughtful</u> questions for the interviewer
  - Ensure that the questions are well-thought, indicating your interest in the position and the company, a typical day on the job, the company's future plans and how you may fit into those plans, professional development opportunities, etc.





# THE INTERVIEW

# Part I: Planning

Having already done the pre-interview research, you now need to prepare for the actual event itself.

- Find the location / address of the interview
  - Plan how you will get there, how long it takes, whether there is parking, public transportation, etc. Practice your route.
  - Plan to arrive at least 10 minutes prior to scheduled interview time
- Get your documents in order
  - Have a copy of your resume (\*<u>that</u>\* one!), transcript, certificates, your notes, company literature, and other relevant document that may be necessary

### Professional attire

- Take a shower in the morning, use deodorant if necessary; hair/nails should look clean/trimmed and well attended to
- Have a business formal interview suit that is also dry-cleaned and pressed, have shoes polished
- If possible, have a back-up suit, at least a shirt, etc.







# THE INTERVIEW Part II: It Is Go Time

You researched, you rehearsed, and you are prepared; time to impress the interviewer. Do the following – and in this order:

- 1. Walk into the room with a natural <u>SMILE</u> learn to have a natural smile. Also smile often during the interview when appropriate, but switch to a serious tone when called for. *Men (and women, if wearing suit jackets): Make sure that your suit jacket is buttoned (top buttoned only), and remains buttoned when you are standing up.*
- 2. Give the interviewer a **FIRM HANDSHAKE** not a wimpy one, but do not overdo it: no one likes their hand crushed, while...
- 3. Make EYE CONTACT look at the interviewer in the eye when shaking hands (and as appropriate when talking), ~ 1-3 seconds at a time.
- 4. Have a relaxed, open, and inviting posture: **BODY LANGUAGE** continue this posture throughout the interview, use your hands and arms as appropriate.
- 5. **<u>SIT DOWN</u>** only when asked (in words or a gesture). Unbutton your suit jacket while sitting down.

During the interview:

- **<u>NEVER</u>** look at your watch, or anything else for that matter, in the room. Always face the interviewer, making frequent and subtle eye contact.
- **<u>DO NOT</u>** FIDGET if you are too nervous, use a pen as a prop (but only if you must)
- Project confidence and competence by effective use of VOICE MODULATION Adjust the volume, pace, tone and even pitch to convey meaning, emphasize important areas, create emotion and excitement, for a more engaging conversation.
- Use **BODY LANGUAGE** to further draw your interviewer into your answer, and also to avoid filler words





# PART III: ANSWERING THE QUESTIONS COMMON (AND TOUGH) QUESTIONS

- Tell me about yourself / Walk me through your resume / Tell me something about yourself that is not on your resume / Tell me your story that brought you here today
  - Past experiences and achievements ←→ job description; highlight strengths / positive personality; past → present → future
- 2. What interests you in this position? / <u>Why do you want to work for us?</u> / Why do you think you would be a good fit for this position? Why do you want this job? (Also see #6)
  - Relate a true experience, memory, interest or your value to the specific job, position and/or the company you are interviewing. You cannot
    answer this question correctly unless you have already done your research about the company/position first!
- 3. What are your strengths? / What praise do you receive most often?
  - Make sure that your answer relates to the job/position
- 4. What are your greatest weaknesses? / What critical feedback do you receive most often? / What regrets do you have in your professional career?
  - <sup>a</sup> Self-awareness and continuous improvement; avoid fake weaknesses (overachiever, perfectionist, etc.).
  - To the extent possible list weaknesses/regrets that are least relevant to job, and/or those in which you have made demonstrable improvement.
- 5. Tell me about a time when \_\_\_\_\_\_ (overcame obstacle, faced a dilemma, made a mistake, solved a problem, disagreed with your supervisor / colleague, was under a tight deadline / stress, etc.)
  - Classic interview questions in which to use the STAR method: Situation, Task, Action, Result



# PART III: ANSWERING THE QUESTIONS COMMON (AND TOUGH) QUESTIONS

What do you know about us? / Which specific line of our businesses are you most interested in? / What do you think our primary mission is? / What do you see the role of our company in this industry? If you were the CEO of this company, what would be your priority?

<sup>•</sup> These questions are all designed to see whether you have done your homework and researched the company.

- 7. <u>Why should we hire you?</u> What makes you the best candidate for this position? / What is your superpower?
  - A most critical question: this is where you need to differentiate yourself from all other candidates. Describe how your experience, knowledge, skills, attributes, values align perfectly with the the job description as well as company mission / vision / values / credo.
- 8. What is your definition of (professional) success? How do you define success? Your goals for the future?
  - List a few goals, achievements, or accomplishments if realized in 3~5 years you would consider yourself successful. These should relate to the job / position / company. These can also relate to personal growth.
- 9. <u>How do you handle stress</u> / conflict / pressure / challenging situations?
  - Talk about planning and prioritizing to avoid and/or mitigate stress and pressure; using communication skills, being calm and transparent to avoid and/or mitigate conflict and other challenging situations. Use the STAR method to give examples.
- **10**. What was your last salary? What are your salary expectations?
- The former is an illegal question; the latter is not. Know the range for that position / geographical location / experience levels; then provide a reasonable range based on your specific skills and experience. Always indicate that are open to negotiation, and you would also consider other tangible and non-tangible benefits.
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# THE STAR METHOD

Set the scene by describing a specific situation you faced. Provide relevant background and context



As a result of this situation, what (tasks) did you need to accomplish? Highlight relevant challenges, constraints, deadlines, and expectations

Action What exactly did you do to accomplish those tasks? Highlight teamwork, your leadership, initiatives, integrity, ethical and professional judgment

R Result ber

Describe the outcomes, what happened at the end? Highlight achievements, benefits, rewards, improvements, cost savings, etc.



# Using the STAR Method

### **CareerAddict**°



- 1. Understand the question
- 2. Be specific and quantitative
- 3. Focus on your own contributions
- 4. Prepare in advance
- 5. Use relevant examples and experiences
- 6. Be concise
- 7. Highlight your achievements
- 8. Be honest
- 9. Keep it positive
- 10. Be relatable



- Use the STAR method when you are asked to share a specific example, situation, problem, competency, or problem solving
- These 10 tips:
  - ... require that you are prepared to talk about a specific scenario, and that
  - ... requires that you know which scenario to talk about for which questions, and that
  - ... requires that you know or at least anticipate the questions



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https://www.careeraddict.com/star-interview-technique

# Use STAR Method When Asked:

- "Describe a project you worked on that you enjoyed. Can you share what your role was and how you contributed to its success?"
- "Describe a time when you went above and beyond at work. Why did you take that initiative and what was the outcome?"
- "Give me an example of when you set a goal at work and managed to accomplish it."
- 4. "Describe a time when you had to work under a really tight deadline."
  - "Work can sometimes get hectic, especially during busy periods. Can you describe a time you felt overwhelmed and what you did about it?"
- 6. "Talk me through your process of ensuring your work gets delivered on time, giving an example."
- 7. "Have you ever failed to meet a client's expectations? What was the reason, and how did you navigate the situation?"
  - "Have you ever dealt with a customer making a very unreasonable request? Describe how you handled the situation."
  - "Tell me about a time when a client requested last-minute changes. What was your response?"
- 10. "Can you describe a situation at work that you wish you had dealt with differently?"
- 11. "Tell me about a time when you had to juggle a few urgent projects at once. What was your method for prioritizing them and managing your time?"
- 12. "Give me an example of when your interpersonal skills, such as communication and empathy, helped you resolve an issue at work."
- 13. "Have you ever had to motivate others while working as part of a team? Describe the situation to me."
- 14. "Describe a time when you had to correct a colleague or manager on something. How did you communicate to them that they were wrong?"
- 15. "Tell me about a time when a colleague wasn't collaborating well with you and how you handled it."
- 16. "Tell me about a time when you found yourself in <u>conflict with a colleague</u>. How did you resolve it?"
- 17. "Tell me about a time when you had to collaborate with someone who had a very different personality to you. How did you make it work?"
- 18. "Tell me about a time when you experienced a sudden change in the workplace and how you navigated it."
- 19. "Have you been met with a situation at work that forced you to think on your feet? Describe it for me."
  - . "What is your process for addressing and fixing mistakes at work?"

3.

5.

8.

9.



careeraddict.com/star-interview-techniqu

https://www.

# STAR INTERVIEW WORKSHEET

### Prepare one for yourself

• Or, purchase the template from

https://www.etsy.com/listing/1584879371/star-method-interview-worksheet

### **STAR INTERVIEW PREPARATION**

	S	Т	Α	R
	SITUATION Describe the situation, context, and background	TASK Describe what was required of you	ACTION Describe what you did, how you did it, and tools you used	RESULT Describe what was required of you
an you describe a ituation where you faced a hallenging deadline or oal?				
escribe a time when you emonstrated leadership kills.				
hare an example of a time /hen you took initiative to nprove a process or solve problem.				
ell me about a time when ou had to resolve a onflict within a team				
hare an example of a time when you took initiative to nprove a process or solve problem				
an you describe a ituation where you uccessfully handled a issatisfied customer?				



# PART III: ANSWERING THE QUESTIONS

### BRAIN TEASER QUESTIONS

### Here are some brain-teasers.

- How many windows are there in Istanbul?
- " How many pennies are needed, if stacked on top of each other, to reach the top of the Empire State Building?
- Here is a \_\_\_\_\_ (red, blue, green, etc.) \_\_\_\_\_ (cube, sphere, pen, etc.). Prove to me that this is not \_\_\_\_\_ (red /cube).
- How big is this room?
- How much does this building weigh?
- " How many \_\_\_\_\_ (jellybeans, golf balls, Oreos etc.) would fit in \_\_\_\_\_ (this building, a 747, this box)?
- How many people in \_\_\_\_\_ (this company / Shanghai / the world) currently use \_\_\_\_\_ (cellphones, computers, TVs)?
- I have never \_\_\_\_\_ (cooked, built, coded, etc.) anything in my life before. Teach me how to \_\_\_\_\_\_ (make an omelets, build a staircase, code matrix inversion in Pyhton, etc.)
- You have \$\_\_\_\_\_. What problem would you try to solve and how? What would invest in and why?
- These questions are asked to test your analytical thinking, and **not** to get an accurate answer.
  - Reword and state the question in your words to ensure that you understood what is asked. Ask clarifying questions to resolve any ambiguity and/or if/when needed.
  - State your assumptions, and why / how you make that assumption
  - Divide complex problems into easier, smaller, manageable parts.
  - Describe your thought process and/or your steps to solve the problem
  - Make reasonable estimates in calculations / computations.



# PART III: ANSWERING THE QUESTIONS

### THE LAST QUESTION

- The last question is almost all interviews and this is also very critical is "Do you have any questions for us?"
  - This is your opportunity to ask a question about the position, the company, your role, growth potentials, any clarifications to prior questions, or anything else that is important to you about this position
- Choose wisely the questions you ask should:
  - Show that you were engaged and paying attention
  - " Give an opportunity to clarify something or address an issue that was not covered
  - Allow you to learn more about the company values / culture
  - Allow you to make an informed decision.

### Good questions to ask:

- " What is a typical day on the job for this position?
- " What are the company's future plans and how do you see me fit into those plans?
- " What professional development and career growth opportunities are there available for me in this company?
- What are the biggest challenges in this position?
- Anything else that is important to you: e.g., What are the benefits? Does your company use animal testing for its products? Do you
  have tuition reimbursement for life-long learning / graduate school?, etc.
- What are the next steps in the hiring decision? ← This should be the <u>last</u> question you ask.



# ENDING THE INTERVIEW

Do the following, and in this order, before leaving the facility:

- At the interviewer's gesture, stand up, give another firm handshake with a natural smile, and thank them for their time and the opportunity for the interview.
  - Remember to button your jacket (top button only) as you stand up.
- (If one is available) Thank the assistant / secretary for their help





# **AFTER THE INTERVIEW**

Provide any other requested information as soon as possible. If professional references are requested, provide advance notice to each reference you list so they are not alarmed if contacted.



- Send a thank you email to your contact or those you interview. Use this e-mail to highlight your strengths or areas from the interview you wish to provide more context.
- Be patient. Remember the hiring process takes time. You can follow up with your point-of-contact (POC) if you have not been contacted within the established timeframe.
- Notify your HR Specialist and POC if you choose to withdraw your application. This
  may occur as a result of you accepting another job in the time you are waiting for a
  response or change your mind about being open for consideration.





The interview process consists of pre-interview, interview and post-interview actions. Your goal is to convince the interviewer that you are the right candidate for the job and <u>distinguish yourself</u> from the rest of the candidates.

### Pre-interview

- Research and rehearse
- Prepare for common questions

### Interview

- Be on time, properly dressed
- Confidence: natural smile, firm hand-shake, eye-contact, comfortable body language
- STAR method for answering certain questions

### Post interview

- Thank you notes
- References







Please share your experiences from your prior interviews.

- How did you prepare?
- What questions were asked?
- What were your best practices?
- Any unusual / memorable moments?
- Submit a Word or PDF document.



**Assignment 1** 

Complete and submit the Project Approval and Evaluation Form. Please provide as much detail as possible for

- Narrative Description / Scope of the Work,
- Requirements / Specifications,
- Constraints
- Deliverables, and
- Budget & Resources.

Provide the dates for

- project initiation,
- ordering the supplies/equipment,
- preliminary prototype/solution.

Make sure to sign and obtain the Client's signature on the left side, under Project Initiation. Attach a Gantt chart. Lack of a Gantt chart will lead to a loss of points!



### **Assignment 1**

### Important notes on the Project Approval Form:

- Requirements and specifications:
  - Technical engineering details on what needs to be done and how it needs to be done. They are the specific requirements your design (or approach, or method, or work) must meet.
  - In other words, these are things you MUST do to meet the client's needs.
- Constraints:
  - Limitations and restrictions on how you must meet the requirements and specifications.
  - In other words, these are the things that you CANNOT do, or that LIMIT you in what / how you do your work.
- Project deliverables
  - <u>Specific</u> items that you will provide and/or deliver to the client. Do not be vague!
  - A "report" or "advice" without additional clarifications is not an appropriate deliverable
- Use additional pages if needed.
- Must be signed by both you and the Client



### **Assignment 1**

### Important notes on clients:

- Outside clients are welcome, so long as there is no real <u>or</u> perceived conflict of interest
- Family members, friends of family members, supervisors / bosses of family members, significant others, people over whom you have power, or anyone with whom there may be a conflict of interest cannot be clients.
- Other students, including graduate students, cannot serve as clients.
- Clients must be professors, staff members (if within Rowan or an academic institution), and/or people with sufficient technical background and authority to oversee the proposed work (particularly if outside of Rowan).
- Pet projects, hobbies, your own personal projects cannot be valid projects.



# ROAD MAP: NEXT WEEK IN P&C Preliminaries for Becoming a Consultant

- Identifying your skills (review)
- Identifying your clients
- Identifying your revenue model
- Determining your fee
- Marketing yourself, and getting your name out there
- Having a contract
- Communication skills





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# ECE 09.461 Professionalism & Consulting in Engineering

Lecture 3

PRELIMINARIES:

BECOMING A CONSULTANT



Dr. Robi Polikar

Electrical & Computer Engineering





- Identifying your skills (review)
- Identifying your clients
- Identifying your revenue model
- Determining your fee
- Marketing yourself, and getting your name out there
- Having a contract
- Communication skills


# IDENTIFYING YOUR STRENGTH & SKILLS

- Make a list of everything that you think you have a particular knowledge or skill:
  - Any specific technical topic:
    - Hardware design
    - Software design
    - An emerging topic (e.g., IoT, AI, blockchain, etc.)
  - Use of a particular tool (typically a software platform)
  - Knowledge of certain standards
  - Knowledge of regulatory information
  - Anything that requires licensure or certification
  - Certain processes/methodologies/functions
    - Remember: this need not be technical: tax preparation, project / personnel management
  - Even perhaps a hobby photography, carpentry, flying drones, art, ballroom dancing, can all lead to a type of consulting business.



### IDENTIFY YOUR SKILLS

#### • Further edit that list:

- " Which of these skills do you think are very common (more competition)?
  - Working knowledge of Calculus, C++, Python, Matlab, basic circuit design
- " Which of these skills are less common (less competition)?
  - Complex software / hardware platforms, expert knowledge of Cadence or other EDA tools, or even ability to use common platforms to do uncommon things
- Which of these require some sort of additional training / certification (even less competition)?
  - Licensure (P.E.), accreditation officer, security clearance

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# IDENTIFY TYPES OF CLIENTS

- A specific industry
  - Companies that need technical know-how in a specific field
- A specific cohort of individuals
  - People who need specific skills/expertise for their own work
- A specific type of organization
  - Profit vs. non-profit organizations, government agencies, start-up companies, etc.
- Each has its own specific ways of doing business and pros & cons





# IDENTIFY REVENUE MODELS

#### How are you going to make money?

- Fee for service hourly rate
  - The longer the project takes, the more you make but there is no incentive to be efficient. Usually good for tasks you do not know how long it will take
- Project-based fee / fixed-fee
  - One-time fee, the faster you complete, the higher your effective hourly rate
- Unit-based fee

- Make more money for each extra output (say, charge per person for a training program)
- Licensing: allow clients to use your prior work for (typically an ongoing fee)
  - Good passive income (particularly if you have IP)
- Retainer fee
  - Get paid a monthly fee to be on the call for immediate / emergency need

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#### Obvious costs:

- Personnel (if you are hiring people or subcontractors)
- Use of software (subscription fees)
- Use of specific, expensive tools: purchase and replacement costs
- Materials and supplies you need to complete the project
- Hidden costs:
  - Use of phone, internet, and other utilities
    - Professional services: do you need to hire or retain
      - An IT professional
      - An accountant
      - A tax consultant
      - An attorney / general counsel
  - Travel: actual cost as well as opportunity cost (time spent on travel)







### DETERMINE YOUR FEE

#### You need to determine a rough hourly rate

- Either because you are in fact charging by the hour
- Or, if you are charging by project, you need a know approximately how long the job will take and charge accordingly.
- Big question:



Please download and install the Slido app on all computers you use





# How much do you think a typical engineer can charge as an hourly consulting fee?

(i) Start presenting to display the poll results on this slide.



#### DETERMINE YOUR FEE

2000

- If you are otherwise employed, start with your annual total compensation, such as salary + bonuses, etc.
- Multiply by three
- Divide by 2000

Your Hourly Rate = Annual Total Compensation ×3

Why?

• Why multiply by 3? • Why divide by 2000?

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# A POINT OF REFERENCE FROM IEEE

#### Median Hourly Rates by Experience



#### **Median Hourly Rates by Experience**

The median hourly rate charged this year by consultants is \$150; a \$10 decrease from last year, and the same as in 2018. The typical rate begins at \$135 an hour for those with less than five years of consulting experience. The rate increases to \$175 an hour, for those with 20-24 years' experience. The highest deciles show lower rates (\$360/hour) than the highest seen in previous reports (\$400/hour).



Median Hourly Rate by Years of Consulting Experience

#### 2020 IEEE Consulting Survey: https://www.youtube.com/watch?v=e3XQrB05jX8&list=PLiiJpBA\_zVDn hpx0YULZIgoUZR8-fAcJC&index=3



### A POINT OF REFERENCE FROM IEEE

#### Median Hourly Rates by Education



#### **Median Hourly Rates by Education**

Education levels are an important factor in what consultants charge. Those with a Ph.D. or an MBA have a \$43 advantage in their median hourly rate, over those with Bachelor's or Master's degrees.

Median Hourly Rate by Higest Degree Held



#### 2020 IEEE Consulting Survey:

https://www.youtube.com/watch?v=e3XQrB05jX8&list=PLiiJpBA\_zVDn hpx0YULZIg0UZR8-fAcJC&index=3

# **Constant State St**

# A POINT OF REFERENCE FROM IEEE

#### Median Hourly Rates by Region



#### **Median Hourly Rates by Region**

When looking at which parts of the United States offer the highest rates of compensation, the Middle Atlantic Region (New Jersey, New York, Pennsylvania) had the highest average hourly rate — \$175, down from \$195 in 2019. The East North Central Region (Wisconsin, Michigan, Illinois, Indiana, Ohio) and the New England Region (New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut) both reported an average hourly rate of \$143, which is \$7 below the overall median hourly rate of \$150.



2020 IEEE Consulting Survey:

https://www.youtube.com/watch?v=e3XQrBo5jX8&list=PLiiJpBA\_zVDn hpxoYULZIgoUZR8-fAcJC&index=3



#### UPDATE ON CONSULTING SALARIES

- IEEE Released its <u>2024 Consulting Fee Survey</u>
- Since 2020, the median hourly consulting fee for EE/ECEs has increased by \$30 (20%) to \$180/hour<sup>[1]</sup>.
  - Those who hold an advanced degree, such as MBA, M.S. or Ph.D., charge even higher: \$200/hour or more
  - Among EE/ECE, the highest fee is sought by those who work in power and communications, as well as systems engineering.
  - As for experience, the median for those with fewer than 5 years of experience was \$140/hour, whereas for those with 25+ years of experience, the median fee was \$200/hour.
- Most charge hourly (74%), with the remaining charging fixed price (22%) or per day (4%).

[1] 2023 IEEE-USA Consultants Fee Survey: Consultant Rates Up \$30 Over Past Two Years, By Paul Lief Rosengren – Available at this link. Last accessed: 09/11/2024

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### **AREAS OF CONSULTING**

- According to the 2023 Report, most common areas of consulting for ECEs are:
  - Systems Engineering (34%)
  - Project Management (27%)
  - Management (24%)
  - Electrical Power Systems (24%)
  - New Product Development (22%)
  - Technical Writing (21%)
  - Communications (21%)



 Average total compensation for an ECE by 5<sup>th</sup> ~ 10<sup>th</sup> year of employment is about \$120,000.

• This would result in an hourly rate of: \$180

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#### BE CONSISTENT

- Generally, do not charge a different rate to different customers
  - Clients may cross-check

 Be aware of discounts, rebates, tiered pricing



- In general, avoid these except in rare, well-justified cases.
- On occasion, consider offering your services free (more on that later).



# Marketing Yourself

#### • How will people find you?

- This is, in part, why you have to identify your customers in the first place
- You need to go where your customers are
  - Do they attend specific conferences?
    - Then go to those events
    - Better yet, get a speaking engagement at those events!
  - Do they read specific trade publications?
    - Subscribe to those and place ads in them
  - Do they have active web / social media presence?
    - Then, you should too but you must commit to it
    - If your customers are on LinkedIn, so should you







# GETTING YOUR NAME OUT THERE!

- But beyond everything else, the one source that will get you clients is:
  - Drum roll...? No, no need for a drum roll this should come at no surprise:



# GETTING YOUR NAME OUT THERE

- Networking is by far the most effective way to get your name out there and ultimately to find clients
  - More specifically, for clients to find you





- This is why you must take advantage of every networking opportunity
  - Conferences/trade events are great for networking
  - Friends/colleagues
  - Former employers (yes, former employers)!
  - Former clients!

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# **GETTING YOUR NAME OUT THERE**

- But how do you make a name for yourself if you have not consulted before? How do you find your first client:
  - Be opportunistic: When you hear someone mentioning a problem that you may be able to help, tell them that you may be able to help
  - Tell your friends, peers, colleagues even (former or current) employer that you are consulting
    - If you are employed, make sure that your employer is OK with your consulting activities
    - If you are a public employee, then you are most likely \*required\* to do so



# **GETTING YOUR NAME OUT THERE**

- Consider offering your services for free (not reduced cost free!) when you
  are starting out to get your name established.
  - Why?
    - If you do a good job, that first "free" client can get you many paid clients!
    - The best way to expand your client base is in fact getting referrals from your former or existing clients
    - In consulting, word of mouth can significantly grow your consulting business, but can also ruin it if you do not deliver.
  - Why free and not reduced cost or discount?
    - Discounts cheapen your image
    - Once given, the client will ask for a similar discount in the future for being a loyal client. Asking for a discount – again and again – is easy, asking for a free service is not!
  - Consider volunteering your services to a charity / not-for-profit organization
    - Their referral and good word may get you well-paying clients in the future



- A well-written contract protects both you and the client.
- If you are able to afford one, or as your business grow, retain a contract attorney.
  - A good attorney can save you from a lot of headache down the line.



HAVE A CONTRACT

- Hiring a contract attorney is a good and prudent investment in your own business.
- If you cannot afford one (or until then and even after then) use reputable online resources, <u>and</u> read/write every term very carefully.
- Create your own "General Services Contract" (with the help of an attorney)
  - Make sure to be fair, and protect your as well as the client's interest; a one-sided contract starts your engagement on an adversarial footing.
- Contracts are (usually) legally binding



# WHAT GOES INTO THE CONTRACT

- Anything that you or the client deems important.
- In general, <u>at a minimum</u>, the contract stipulates:
  - Scope and statement of tasks and services
  - Requirements, deliverables, timelines
  - Ownership of the work / intellectual property considerations
    - Most work is "made-for-hire," meaning the client owns everything. If you have a specific IP, you need to protect it. Put it in writing ahead of time.
    - Be aware of terms such as perpetual, global, worldwide, royalty-free rights, ability to sell to use your content, etc.
    - Also be aware of nondisclosure, non-compete, non-recruit clauses/documents
  - Liability
  - Confidentiality
  - Compensation/consideration and terms of payment
  - Arbitration, state of law

• We will have a separate class discussing these issues in more detail



#### • In order for a contract to be legal:

- There must be an offer/terms
- There must be an acceptance
- There must be awareness: both parties are aware that they are entering into a binding contract
- Consideration: what each party promises to do
- Capacity: each party must have the legal capacity to enter into an agreement
  - Minors, for example, cannot enter into a legal agreement with a non-minor
- Legality: what is being offered, and the terms of the agreement must comply with the law.
- We will have a separate lecture on Contracts & IP issues later.



...TO BE LEGAL



# COMMUNICATION SKILLS

- Undoubtedly, one of the most important skills you need is that of professional communication skills.
- Your communication skills can make or break your professional career, consulting or otherwise



- Take the time, effort, and training to hone your oral and written communication skills:
  - Proofread all written communications
  - Rehearse (as much as you can) oral communications, in particular, planned important ones, such as negotiating.
    - Take Dr. P.'s Frontiers in Engineering class 😊



# WRITTEN COMMUNICATIONS

- You may have many different elements of written communications with your clients:
  - Preliminary/formal proposal
  - Contract
  - E-mail communications
  - Intermediary and final reports
- Make sure to maintain the appropriate, formal language in all of them
- Know the difference between e-mail and text messages
  - While e-mail is more formal, maintain professionality even in text messages
  - In e-mails: always have proper greeting, proper closing and – very importantly – proper subject line
  - Do <u>not</u> attempt humor <u>ever</u> in any form of written communication with clients.
    - Why not?



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# ORAL COMMUNICATIONS

- Oral communication is a big part of consulting and professionalism from networking to negotiating
- To be professional in your communication skills, you need to:
  - First and foremost: do your research about the client, the work that needs to be done, as well as your competition
  - Know key names in your field and in the client's organization
  - Be articulate
  - Be courteous
  - Be respectful
  - Be polite
  - Be aware of and try to stay clear of words, phrases, figures of speech, and jokes that may have unintended consequences or may be misinterpreted
- Be sensitive to (and knowledgeable about) local, cultural, and social customs and norms

 Also, stay clear of hot-button issues (politics, religion), or better yet, any issue that does not relate to your professional work.





#### • Can an employer fire you for :

- Saying something that is against his/her political views?
- ...or religious views? ...world view? (PRW views)
- Having a bumper sticker on your car that is against his/her PRW views?
- Seeing a social media post that is against his/her PRW views?
- Seeing you outside of work wearing a t-shirt with a message that is against his/her PRW views?

#### • How about a client? Can a client fire you for similar reasons?



Please download and install the Slido app on all computers you use





### Can your employer fire you for sharing your political / religious / world view?

(i) Start presenting to display the poll results on this slide.

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- In professional settings, you may not always have an opportunity to clarify yourself or even to apologize
  - Or, even if you do, it may be too late, at least for that client;
  - But we all make mistakes, and when you do, it is important to make every effort to make it right even if it is late; better late than never.







# Words Matter!

- Certain words (or jokes) may be hurtful or trigger strong feelings or reactions, even if you did not mean to, or you meant no disrespect.
  - While intention is certainly important, what ultimately matters is what the other person hears, interprets or perceives
    - Their perception is their reality
    - So, it is your responsibility to make sure that you speak clearly and professionally
- Know that we all have our own implicit biases. <u>Recognize yours</u>, and work towards minimizing it.
   Consider attending workshops and trainings on implicit bias.

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# WHAT'VE WE LEARNED?

- Identifying your clients
  - Determine what kind of clients you wish to serve
- Identifying your revenue model
  - Hourly? Fixed price? Licensing? Retainer?
- Determining your fee
  - How much can you charge? Should you give discounts (no!)
- Marketing yourself, and getting your name out there
  - Conferences, trade shows, most importantly: networking!
- Having a contract
  - Have an attorney help you protect you, limit your liabilities, protect your IP. Spell out everything that pertains to your agreement with the client
- Communication skills
  - Be professional, courteous, respectful. Watch you say (and write). Be aware of (and minimize) your implicit bias. Be sensitive to cultural / social norms.





**Assignment 1** 

Complete and submit the Project Approval and Evaluation Form. Please provide as much detail as possible for

- Narrative Description / Scope of the Work,
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Provide the dates for

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- Pet projects, hobbies, your own personal projects cannot be valid projects.



#### **ROAD MAP: NEXT WEEK IN P&C** Determining the Structure of Your Business

#### • To LLC or not to LLC?

- Structure, advantages, and disadvantages of different types of business entities:
  - Sole Proprietorships
  - Partnerships
  - Limited Liability Companies (LLC)
  - Corporations
- Starting a business in New Jersey

# ECE 09.461 CLINIC CONSULTANT IN ELECTRICAL & COMPUTER ENG.

#### LECTURE 4

BECOMING A CONSULTANT: STARTING A BUSINESS



ELECTRICAL & COMPUTER ENGINEERING


# THIS WEEK IN CC: TO LLC OR NOT TO LLC

- How to structure your business?
- Structure, advantages and disadvantages of different types of business entities:
  - Sole Proprietorships
  - Partnerships
  - Limited Liability Companies (LLC)
  - Corporations
- Starting a business in New Jersey

References: NOLO

Business Ownership Structures Should You Form an LLC for Your Consulting Business? Piercing the Corporate Veil: When LLCs and Corporations May be at Risk



# Your Consulting Business?

HOW TO STRUCTURE

- When deciding to get into the consulting business, one of the first decisions you have to make is the type of *business entity* you want to form.
- The type of business entity you form has many consequences:
  - Ease of set up (formation)
  - Liability
  - Taxes
  - Control over the business
- ... so think carefully before making that decision.





- There are several types of business entities you can operate under. The most common ones are:
  - Sole Proprietorships
  - Partnerships
  - Limited Liability Companies (LLC)
- Less common ones at least for consulting businesses
  - Corporations
  - Non-profit corporations
  - Cooperatives





- Sole Proprietorships this is the simplest type of business entity.
  - Here is the list of things that you have to do to form a sole proprietorship:
    - Step 1: Decide to have a Sole Proprietorship
    - ...and that completes the list
  - A sole proprietorship is simply a one-person business that is not officially registered with the State government.
  - You do not need to do anything to form sole proprietorships: no filing, no paperwork to have such a business.
  - In sole proprietorships, the business is legally not a separate entity from its owner: the income, loss, assets and liabilities of the business, are the personal income, loss, assets and liabilities of its owner.
    - Be aware of that last part: the liability of the business is the liability of its owner!
    - If the business is sued, or has a court judgment against it, the owner is personally responsible.



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## Sole Proprietorships

#### Advantages:

- Simple to start no paperwork or registration is needed, no fee to pay.
- Complete control over the business, no partners, no shareholders.
- No corporate tax the business income is taxed as your ordinary income (pass-through income)
  - You report business income / expenses on your individual Form 1040 / Schedule C
  - and may be eligible for the new <u>20% pass-through tax deduction</u>\*
- You own all of the income and all of the profit of your business

#### Disadvantages

- P You are personally liable for all taxes, debts, obligations, and court judgments against your business.
  - You need to withhold necessary taxes, e.g., self-employment taxes, Social Security and Medicare
- Extremely unlikely that an investor will give you funding (should you ever need it)
- You cannot really sell this "entity" to someone else later.
- Shall I use sole proprietorship for my consulting business? Yes, if:
  - You are unlikely to be sued, you are unlikely to rack up big debts
  - You will not need to borrow (much) to run your business.



#### \*consult a tax advisor.

### PARTNERSHIPS

- Partnerships are just like sole proprietorship, except for two or more partners.
- Much of the advantages and disadvantages of sole proprietorship apply to partnerships:
  - Advantages: simple to form no fuss, no paperwork; pass through taxation;
  - Disadvantages: share the profit/loss with the partners; no protection on liability including those due to partners' action!
  - All other dis/advantages of sole proprietorship also apply
- Shall I use a partnership for my consulting business? Yes, but only if:
  - Your consulting business relies on the expertise of your partner(s)
  - P You are unlikely to be sued, you are unlikely to rack up big debts
    - And you have <u>complete</u> trust in your partners and their actions
  - You will not need to borrow (much) to run your business.



- For most small businesses, operating as a limited liability company (LLC) is the most logical option.
- While it does require registering with the State government (read: has some paperwork (), it is not too onerous, but the main benefit is protection against personal liability.
- Other than the initial cost and filing needed for registration, LLCs share most of the advantages of sole proprietorship, while protecting against their biggest disadvantage.



LIMITED LIABILITY

COMPANIES (LLCS)

# COMPANIES (LLCS)

LIMITED LIABILITY

### Advantages:

- Relatively simple and inexpensive to start compared to some other forms of businesses (such as corporations)
- No corporate tax\* the business income is taxed as your ordinary income (pass-through income); and may also be eligible for the 20% pass-through tax deduction
- Flexible management: you can have partners and members of the LLC, and still not have to report to a board.
- Business recognition: you are better recognized as a professional business, and hence, potential clients may trust your "company" more than a sole proprietor. You may also have a better chance of raising funds from an investor.
- And the biggest benefit: as the name implies: <u>limited liability</u>. Owner of an LLC is generally not personally liable for the debts and obligations of the business as long as <u>you play by the rules</u>.

\* unless you choose to follow a C Corporation tax status – consult a tax advisor, as these issues can get more complex. © All Rights Reserved, Robi Polikar, 2021-2023

### **ABOUT THAT**

# "PLAYING BY THE RULES"

You can lose your liability protection by a court order (also called "piercing corporate veil), if:

- You do not formally separate your personal and business finances:
  - Paying personal bills using business account or vice versa (comingling assets)
  - Follow proper corporate formalities and record-keeping rules (e.g., hold regular meetings with directors, record all decisions in meeting minutes, adopt company bylaws, etc.)
  - Otherwise act as if you and the business are one and the same
- You act fraudulently, wrongfully, or maliciously
  - The business irresponsibly borrows and loses money, thinking that the LLC provides personal liability protection against losses
- Your creditors face an unfair, unnecessary, unexpected cost because of your actions
- Closely held corporations and LLCs (those owned by one or few people) are most at risk of having their corporate veil pierced
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# COMPANIES (LLCS)

LIMITED LIABILITY

#### ...and the disadvantages:

- Well, there is (some) paperwork / registration with your State in order to form an LLC
- You may be subject to additional tax (such as franchise tax) in some states (such as California)
- You \*<u>must</u>\* keep your personal and business assets / bank accounts / spending separate
  - This is a biggie! If you do not, you can lose the liability protection!
- Still less likely that an investor will give you funding, compared to a corporation.
- Shall I use LLC for my consulting business? Yes, if:
  - There is a likelihood that you may be sued, and/or racking up big debts
  - You have lots of personal assets that you want to protect from business liability
  - You will not need to borrow (much) to run your business.



## PROTECT YOURSELF!

To protect yourself from being personally responsible for your LLC business debt / loss, make sure to:

- Do not comingle your assets with those of the business: maintain a separate bank account for your LLL. All business income should go to that account, and all business expenses should be paid from that account.
  - So..., how do you get paid?
- Comply with formal business practices for establishing and maintaining a business: keep meeting minutes, file necessary legal forms, have bylaws.
- Make sure the business is properly capitalized (funded)
- Do not tell anyone ever that you personally guarantee the business's work, liabilities, or other debt.
- Clearly tell everyone that they are doing business with an LLC: have "LLC" be part of your business name (and show on business cards, invoices, etc.)
- Do not engage in any illegal, reckless, negligent activity





Corporations are entirely separate business entities from their owners, both as a legal entity, as well as a tax entity.

- They have a more complex structure, such as having boards and shareholders
  - Owners of a corporation are shareholders (stockholders), who elect a board that manages the activities of the corporation.
- Corporations by virtue of being entirely separate entities also provide liability protection to their owners.
- There are two main types of corporations
  - C Corporations
  - S Corporations

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- An S corporation is not really a business entity, but rather a federal tax status: the name comes from such an entity choosing to be taxed under Subchapter S of the IRS code.
  - <sup>o</sup> So, an LLC may choose to be an S-corporation (and many do!), or even a C corporation
  - S Corps are pass-through entities (just like LLCs and sole proprietorships): taxes on profits are paid through the personal income taxes of its owners.
    - ...and benefit from the 20% qualified business income (QBI) tax deduction
    - ... and they can declare losses and use them to offset some other profit.
- S corporations are designed for small businesses that satisfy these conditions:
  - Owned by US persons
  - Cannot have more than 100 shareholders
  - Have only one class of stock all shareholders must be treated the same





Like all corporations, C corporations are incorporated in their state, have a board of directors, which hire managers or officers to conduct the day-today activities.

• C corporations are typically large, for-profit corporations

- May have foreign owners
- Can have an unlimited number of shareholders
- Can have different classes of stocks, with the ability to treat different shareholders differently (for example, some may have different voting rights)
- They must distribute stock shares to their owners (shareholders)
- C corporations must pay corporate taxes (21%) on profits <u>and</u> any profit distributed to owners are also taxed as personal income: double taxation!

 When someone files a claim against the C corporation, the owners are usually not personally liable.
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### CORPORATIONS

So, let's take a look at the advantages and disadvantages of corporations:

#### • Advantages:

- Very favorable to investors, because they can be shareholders (hence owners) of the company
- Owners do not pay taxes for the (S) corporation's business income, but only personal income for the compensation provided by the Corporation
- Shareholders have (limited) liability protection

#### Disadvantages

- Difficult and complex to form and maintain.
- Expensive to form and maintain with filing fees, annual fees, etc.
- Higher taxes
- More complex structure and the requirement to maintain such a structure (must have a Board)
- Shall I use Corporation for my consulting business?
  - Generally, no.
  - <sup>D</sup> But, if you want to grow it, it may make sense to have a S Corporation



## BOTTOM LINE

#### For most consulting type businesses, you are most likely to operate as a:

- <sup>o</sup> Sole proprietorship, if you work alone and have low risk of being sued
- Partnership, if you have partner(s), but low risk of being sued
- Limited liability company, if there is an elevated risk of being sued, and have substantial personal assets that you want to protect from business risk.



# STARTING A BUSINESS

# IN NEW JERSEY

New Jersey Tax Guide

Starting a Business in New Jersey

START

- Should you choose to form a formal business entity in the State of New Jersey:
  - Start here: <u>https://business.nj.gov/</u>
  - Choose the type of business entity / structure you want to form <u>https://business.nj.gov/pages/choose-a-business-structure</u>
  - Register your business: <u>https://business.nj.gov/pages/register-your-business</u>
  - Check if you need licensing / certification: <u>https://business.nj.gov/licensing-and-certification-guide</u>
  - Do you need to hire employees? <u>https://business.nj.gov/pages/hiring-employees</u>
  - Create a free, personalized guide to register and find funding for your business: <u>https://navigator.business.nj.gov/</u>
  - Registering and for paying taxes <u>https://business.nj.gov/pages/register-for-taxes</u>
  - General tax guidance for starting a business in NJ <u>https://www.state.nj.us/treasury/taxation/documents/pdf/guides/Starting-a-Business-in-New-Jersey.pdf</u>



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DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

# ECE 09.461 PROFESSIONALISM & CONSULTING IN ENGINEERING



PROJECT & RISK MANAGEMENT

Prof. Bruce Oestreich

EXPERIENTIAL ENGINEERING EDUCATION ECE Advisory Board Member



### **ECE Clinic Consultant**

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# Management of Your Consulting Project / Contract



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31 March 2025

**Bruce Oestreich** 

### Management of Your Consulting Project / Contract

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**Bruce Oestreich** 

### **AGENDA** – Today and Next Week

- Project Planning / Management 101
- Work Breakdown Structure (WBS)
- Change Management
- Project Status Reporting

Risk Management

- Project Completion Planning
- Creating a Consultant Budget
- Project Challenges including Ethical Issues

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# Project Planning / Management 101

### All Efforts Can BENEFIT from PROJECT MANAGEMENT

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No matter how small or simple...

#### •Tutoring Students in Calculus / Physics?

- -How do you keep track of Students?
- -Their respective progress?
- -When will they be complete / caught up?
- -How are you communicating with them / potential other Students?
- -Are you getting paid?
  - If so, how are you recording / tracking it?



### **Project Management 101**

#### •What is the Difference Between a "Project" and a "Program"?

Project – a temporary task undertaken to create a unique product or service
 Program – a Group of Projects that are managed in a coordinated way (longer term)

#### Project Management is a "Process"

#### The Process is used to:

- -Initiate and Conceptualize the "Idea" or Task / Service Presented to You
- -Plan for how you will actually complete the Task / Service
- -Execute to YOUR Plan
- -Control YOUR Plan
- -Close out the Task / Service with Your Customer



### **Project Initiation**

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#### How does your Project get started?

- Formal Response to a Request For Proposal (RFP)
  Informal Request to tackle a Project
- -Cold Call Can you work this Project for me?



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Once you AGREE to take this Project on – many, many wheels get set in motion

- -**Mission**: WHY are you doing this?
- -**Objective**: WHAT do you want to achieve?
- **–Deliverables**: WHAT is needed to complete the Project?

-Client / Customer: WHO has interest in this Project (usually beyond your Client / Customer – called Stakeholders)

### **Project Planning**

#### Most Projects utilize some form of a Project Management Plan (PMP)

 PMP is created to define HOW changes to the Plan will be made / approved then managed

#### Areas to Cover:

- -Scope of Project / Tasks
- -Time Requirements
- -Cost Discussion
- -Known Issues that need to be addressed
- -Risk Management
- -Quality Control Requirements
- Communications how will you interact / exchange information / data / status
- -Resource Requirements
  - Personnel
  - Materials
  - Other



### **Project Planning**

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### Some Helpful Artifacts to help with Project Planning:

# Work Breakdown Structure (WBS) Project Budget

-Including Bill of Material (BOM)

- Project Schedule
  - -START and FINISH Dates
  - -HOW to fill in everything in between
  - -Major Milestones Definition

Responsibility Assignment Matrix (RAM)

- Configuration Change Control Process
- Risk Management Plan





### **Project Execution**

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•Up to this point, HOPEFULLY, you have spent considerable time planning this Project in close coordination with your Client / Customer

•At some level (WBS or other) – work packages are defined that describe what has to be done along with by whom and what resources are required to complete it

	A	В	С	D	F	F	G	н	
1	Work Package List		description of work package						
2	ltem #	Area/Process	Sub-category	Description	Priority	Assigned To	Requested by	Status	Due date
3	WP-100	Requirements	Requirements	Requirement specification	high	Ashley	PM	open	31.01.21
4	WP-101	Requirements	Requirements	System concept	high	Tom	PM	open	31.01.21
5	WP-104	Migration	Data migration	Migration concept	high	Ricky	PM	open	30.04.21
6	WP-105	Migration	Data migration	Mapping table for customers	high	Ricky	PM	open	30.04.21
7	WP-106	Migration	Data migration	Mapping table for vendors	medium	Ricky	PM	open	30.04.21
8	WP-107	Software	Customization	Customization internal logic	high	Stefan	PM	open	31.05.21
9	WP-108	Software	Customization	Customization interfaces	medium	Stefan	PM	open	31.05.21
10	WP-109	Software	Customization	Customization user interface	low	Francois	PM	open	31.05.21
11	WP-110	Training	User training	Training schedule for end-users	medium	Rose	PM	open	30.09.21
12	WP-111	Training	User training	Training documentation (Powerpoint)	medium	Rose	PM	open	30.09.21

•Now is the time to **EXECUTE**!

### **Project Execution**

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#### You are off and running and things are going well

### HOW DO YOU KNOW?

#### Schedule Tracking & Status

- –All of your planned tasks / work packages should be incorporated into some form of a Schedule
- -Schedule should be created in a software package such as Microsoft Project to enable tracking / resource loading / status updates
- -This tracking will advise you of whether or not you are meeting commitments on schedule / with the appropriate number of resources, etc...

#### Project Scheduling Management

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### **Project Execution**

- Using Project Software of some type (Project of Equivalent) allows you to "measure" Project Activities
  - -A given amount of effort due in a given amount of time
  - -Did this happen or still happening?
  - Measurement of progress allows you to "report" progress to your Client / Customer
    - Also reinforces to yourself that you are really on track or not

#### It is 100% likely that your Schedule will need to be adjusted before you are done

 No one is good enough to plan even to a modest level of detail without changes

1. monday.com - Best project scheduling tool for customization 2. Resource Management by Smartsheet - Best for matching resources and team members to specific projects 3. Runn - Best project scheduling tool for growing IT and software teams 💋 4. Mavenlink - Best project scheduling tool for workflow automation 5. Resource Guru - Best project scheduling software for optimizing resource utilization 6. Wrike - Best project scheduling tool for teams of all sizes 7. Forecast.app - Best project scheduling software for capacity planning RO - Best project scheduling software for usability and intuitive UX/UI 8. GanttP 9. FunctionFox - Best for creative businesses and teams 10. Celoxis - Best for complex project scheduling 11. TeamGantt - Best project scheduling tool for beginners 12. MS Projects - Best project scheduling software for general users 13. Workfront - Best for robust feature set 14. Microsoft Project Online - Best for general users 15. Notion - Best project scheduling tool for small businesses

> Generally Available Project Software Packages

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# Work Breakdown Structure (WBS)

### Work Breakdown Structure (WBS)

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•What is a WBS?

• "A product-oriented 'family tree' division of hardware, software, services, and other work products which organizes, defines, and graphically displays the products and services necessary to achieve the specified product and/or service

•A logical breakdown and graphical display of all work to be performed

### WBS Provides a Vehicle to Manage What You Are Doing

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- Think of the WBS as a hierarchical breakdown of products and services
- ALL products and services required to successfully complete the project!
- •While Consulting Projects will not usually get to this level of detail, it is important to practice the discipline for when you do need it!



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### The WBS is the Central Element of Project Management

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#### In a Traditional Project – the WBS helps Control:

- Budget
- Integrated Master Schedule
- Organization Charts
- Contract Tasking (Compliance)
- Risk Management

#### Reporting

- Analysis
- Projections
- Control



### **Typical WBS Example**



### WBS for ECE Related Consulting Projects

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### **Clinic Consultant Exercise**

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#### Let's Create a Work Breakdown Structure

•WHY?

•To get you to appreciate the need to focus on the details and ensure you can deliver EVERYTHING your Client / Customer expects
### **Class Exercise – Create a Work Breakdown Structure**

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- Let's Plan to Find Office Space for our Consulting Practice
  - What are the products and services?
  - Create a "New Office WBS"
- Somewhat Impractical in This Setting to Create Teams
- Let's Crowdsource This Exercise
  - Work through Top Level 1st
  - Get Concurrence
  - Then Decompose to Next Level



### **Office Space WBS Summary**

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How did we do?

Is this sufficient to move forward and execute the Project (of finding new Office Space)?

#### Work Breakdown Structure — Consulting Business Office Location Page 1 of 2

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#### Work Breakdown Structure — Consulting Business Office Location Page 2 of 2

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### **Change Management**

### **Change Management**

keenly interested in any changes as well

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Change Management Process When (not if) Changes are required – they need to be **Request for Change** carefully controlled and approved Review / Reporting 5 Impact Analysis •WHY? It is likely you are on some form of a FIRM FIXED Implement Change 🚺 Approve / Denv **PRICE** Contract or Agreement -There is no more money coming to you - regardless of mistakes / errors / oversight / simple bad luck Your Client / Customer is paying the bill – they are

### **Change Management**

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- Some type of Formal Configuration Change Control should be implemented
  - -Even if it is series of signed and dated bar napkins



- Change Control allows for you and your Client / Customer to understand what is changing and why it is the best approach
  - -Will this change result in an increase or decrease in the overall cost?
  - –If that is not desirable, is there some other task that can be reduced / eliminated to account for this change?
- Sometimes the Cost just needs to change and your Client / Customer is willing the pay for the increase
  - -Just be careful that you don't spend all of your Project time worrying about changes and not getting the work done!

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### **Project Status Reporting**

### **Project Status Reporting**

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There are 2 basic Types –

-Informal

-Formal

 While you can suggest one approach or the other, it is ultimately your Client / Customer's decision

Not as easy as it sounds!



### **INFORMAL Project Status Reporting**

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#### Informal Status Reporting

More of a "How Goes It?" Discussion with Client / Customer
 Could be a Phone Call, Zoom Meeting, Face-to-Face

-Tends to allow for more open / honest communication

 Even though formal Project Management Metrics are not used, YOU need some form of Metrics to manage yourself

You can still share Metrics informally with Client / Customer

#### How will you manage your own Project Status?

-If working independently (as a single entity) – think about what suits you best



### **FORMAL Project Status Reporting**

#### Formal Status Reporting

- -Project Management Metrics
  - If you choose this approach, you need to define which metrics to track
  - Additional effort to implement just keep this in mind
- -How often will you report? Daily, Weekly, Monthly, etc...?
  - Again, it depends on Client / Customer level of interest
  - Also depends upon the amount of work necessary to provide status



### **Project Execution**

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#### With your Project humming along, whatever Deliverables or Services should be in work

-This could be in prototyping, manufacturing, testing, etc...

#### ACCEPTANCE

- -When complete you will need to define some level of "ACCEPTANCE"
  - How will you know whether the Product / Service is ACCEPTABLE to your Client / Customer?
  - Clear Criteria doesn't always exist!

#### APPROVAL

- Who and when is/are your Project deliverable(s) / service(s) APPROVED
- -Again, may not necessarily be your direct Client / Customer
- -In many cases, it is THEIR Client / Customer

31





### **Review of Results to Date**

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#### Learn the Project Management Fundamentals

#### Practice with simple, mundane tasks

- -Work Related or
- -Home Related

#### Be REALISTIC when planning things

- -Schedule
- -Resources
- -Challenges

#### More on Challenges Next Week

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# QUESTIONS?

### **ECE Clinic Consultant**

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07 Apr 2025

**Bruce Oestreich** 

## Management of Your Consulting Project / Contract



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### Management of Your Consulting Project / Contract

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### **AGENDA – Today**

- Project Planning / Management 101
- **Work Breakdown Structure (WBS)**
- Change Management
- Project Status Reporting

Risk Management

Project Completion Planning

Creating a Consultant Budget

 Project Challenges – including Ethical Issues

### **Project Status Reporting – Quick Review**

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We Identified 2 basic Types –

-Informal

-Formal

 While you can suggest one approach or the other, it is ultimately your Client / Customer's decision

Not as easy as it sounds!



### **INFORMAL Project Status Reporting**

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#### Informal Status Reporting

More of a "How Goes It?" Discussion with Client / Customer
Could be a Phone Call, Zoom Meeting, Face-to-Face

-Tends to allow for more open / honest communication

 Even though formal Project Management Metrics are not used, YOU need some form of Metrics to manage yourself

•You can still share Metrics informally with Client / Customer

#### How will you manage your own Project Status?

- -If working independently (as a single entity) think about what suits you best
- -DO NOT brush this off and convince yourself it's so easy I can just keep track in head



### **FORMAL Project Status Reporting**

#### Formal Status Reporting

- -Project Management Metrics
  - If you choose this approach, you need to define which metrics to track
  - Additional effort to implement just keep this in mind
- -How often will you report? Daily, Weekly, Monthly, etc...?
  - Again, it depends on Client / Customer level of interest
  - Also depends upon the amount of work necessary to provide status
- –Many times your personal bandwidth cannot accommodate this type of reporting – how will you complete?



# Risk Management



### **Risk Management**

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- •Understanding Risk Management
- Single Most Important Aspect of Cementing Relationship with Client / Customer
- Be Able to Explain It to Client / Customer –When and How You will Use It



### **A Practical Definition Of Risk**

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#### **Uncertainty About A Bad Outcome**

An undesirable situation or circumstance that has a realistic non-unity probability of occurring and an unfavorable consequence

### **Characteristics of Risk**

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### Likelihood, Probability, or Uncertainty



### **Risk Management**

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A systematic **decision-making** process that efficiently identifies risks, assesses risk levels, and effectively reduces or mitigates risks to achieve program goals.

### **A Practical Definition Of Risk**

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### **Five Risk Management Questions**

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- What Could Go Wrong? (Define / Identify)
- How Likely Is It? (Characterize / Analyze)
- What Would Be The Consequences? (Analysis / Impact)
- What Can We Do About It? (Mitigate)
- Are Things Getting Better Or Worse? (Communicate Status)

### How Do We Identify Risks?

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### **Likely Sources of Risk**

#### **Sources of Program Development Risk**

- Management
- Engineering
- Material Control
- Purchasing
- Manufacturing / Production
   Engineering
- Manufacturing
- Quality
- Logistics
- Test

#### More Typical Sources of Risk

- Hardware Failure
- Software Failure
- Organization Failure
- Human Failure
  - **Consulting Risks**
- Communications
- Over Commitment
- Resources

### **Risk Identification**

- The process of determining which risks are likely to impact the Project / Systems Engineering Effort
- Analyzing the SOW and Work Breakdown Structure help for Risk Identification
  - $\circ~$  Need to look beyond identification
  - Anticipate occurrence of events
    - Resource availability
    - Technology status
    - Familiarity/ training/ knowledge

### **Risk Identification in WBS**

- An evaluation of project risk is based upon the examination of the Work Breakdown Structure (WBS) product
- Evaluate each WBS element against sources/areas of risk
- It is important to consider each WBS element as a distinct product



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Example of WBS Dependent Evaluation Structure

### **Risk Identification in WBS** (Questions)

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Who?	Who contributes to activity?
What?	What is the role of contributors?
Why?	What is the goal of activities?
Which way?	How is the activity to be done?
When?	When is the activity to be done?
With what?	What resources are required?

#### Uncertainty with questions represents risks

### **Typical Risk Types**

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### **Typical Risk Grid**

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### **Typical Likelihood Template**

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1	Low	Proven Or Completely Mitigated By An Approved Plan
2	Minor	Demonstrated Or Well Mitigated By Approved Plan
3	Moderate	Partially Demonstrated Or Somewhat Mitigated By Approved Plan
4	Significant	Analytically Demonstrated With Possible Mitigation Plan Identified
5	High	Speculative With No Identified Mitigation Plan

### **Typical Consequence Template**

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1	Low	Little Or No Impact
2	Minor	Minor Problems That Can Easily Be Handled
3	Moderate	Major Problems That Could Be Tolerated
4	Significant	Significant Damage to program Viability If Not Mitigated
5	High	Major Crisis That Could Result In Program Termination If Not Mitigated
## **Techniques For Risk Mitigation**

- Risk Reduction Tests
- Parallel Developments
- Multiple Suppliers
- Probabilistic Analysis



## **Risk Mitigation Plans**

- Plans Include a Series of Steps Defined to Lower the Uncertainty or Decrease the Likelihood That the Risk will Occur
  - Events, Actions or Activities
  - Planned Dates, Actual Dates
  - Success Criteria
  - Risk Level if Successful
  - Comments
- Risk Plan Events Should be Included in Integrated Team Schedules
- Approved Risk Plans Should Provide Resources (Budget, Staff, ...) to Mitigate the Risk
- Risks Should Decline Over Time
  - As Mitigation Events are Accomplished Successfully
- Fallback or Alternate Plans May be Required
  - Decision Points are Needed for When Fallback Plans are Implemented





## **Follow the Plan**

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- Utilize Approved Risk Reduction Resources
- May Require Working Alternate & Fallback Plans As Well
- Report Progress
- Ask for Help Needed
- Maintain Risk Database





## **Risk Metrics**

#### Risk Levels

- -Likelihood / Consequence
- –High, Medium, Low

### Status of Mitigation Plans

On Track, Falling Behind, Need HelpGetting Better or Worse

## Quality of Risk Mitigation Plans

- -Sufficient Number of Timely Events
- -Success Criteria for Every Event
- -Declining Risk Over Time
- -Closure Event



## Sample Program Risks

Cost, Schedule and Technical Risk Assessment



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#### Sample Consultant Program Risks Cost, Schedule and Technical Risk Assessment

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## **Key Success Factors for Risk Management**

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#### Program / Project Management Commitment –You / Your Team / Customer

#### Total Team Involvement & Commitment

- -Design Team Takes Ownership of the Risks and Works Them
- -Risk Management is a Part of the Team Culture (including Customer)

#### Focus on Mitigation Plans

-Stay in Front and Manage the Issues

## **Risk Management Summary**

- Risk Management is an essential Project Management function
- Many tools exist to help perform effective Risk Management
- There is a natural resistance by many to ignore risk
- You, as the Project Manager must ensure Risk Management is performed properly

**Bruce Oestreich** 

# QUESTIONS?

**Bruce Oestreich** 

# **Project Completion**

## **Project Completion**

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## Project Tracking / Metrics

## How Do You Know When You are "Complete"?

Closure Criteria

## **Project Completion Planning**

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One of the most important portions of Project Planning is determining when your Project is actually complete

Most Projects ignore or do not pay sufficient attention to this phase

- -Assume it's simply paperwork / bureaucracy
- -All of the work is "done" so we must be complete!

I strongly suggest very specific Completion Criteria agreed to and signed by the Client / Customer as part of the Contract / Agreement

- -Deliverables Completed and Available
- -Formal Acceptance with signed off Documentation by You AND Client / Customer

## **Project Completion Planning**

Formal Acceptance is much more than just signing Documents

#### Is the Client / Customer happy with Deliverables?

-Acceptable and Approved?

#### Financial Considerations

- -Payments up to date / planned?
- -Any outstanding Invoices / Bills to pay?

 Good Consultants create an Incremental Project Completion Plan that allows for 'completion' as the Project Matures and specific tasks / deliverables occur



**Bruce Oestreich** 

# Creating a Consultant Budget

## **Consultant Budget – Why Do I Need One?**

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- Your plan is to supplement your primary Job as an Engineer by 'consulting' in particular areas of expertise
  - -In this situation why do I need a Budget?
  - –I'm just supporting / providing information / technical data to my Customer

#### It starts with the basics Salary

- -Consulting Engineers pay their own taxes
  - Example: If your consulting rate is \$15/hr. and you consult for 10 hours – you will get paid \$150
  - At the end of the year, YOU will be responsible for pay taxes on this money
  - •Many people don't realize this and you will pay the tax rate commensurate with your Engineering job



## **Consultant Budget – Why Do I Need One?**

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#### **OTHER CONSIDERATIONS**

#### Equipment

- Do you own whatever equipment might be necessary to perform the work?
- -Is your computer sufficient to complete all required tasks?
  - Don't forget about software packages that might be required

#### Travel Requirements

- -While in most cases, travel considerations can be factored into the hourly rate, it is not always true
- -Airline travel / lodging / rental car typically covered by Customer
- -Current US Government travel rate is \$0.70 per mile
  - This is to offset gas, wear and tear on your Vehicle, etc...
  - Is that enough?

#### Time Management / Expectations

-Customers typically expect you to support THEIR schedule and demands -Potential impact on your 'real' job, time off, vacations, other commitments

## **Consultant Budget**

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#### Okay – we now recognize we need a Budget

#### What does it look like?

- -Salary are you consulting solo, or will you require assistance from others?
  - If you need some short-term help, how will you pay them?
- Taxes do a quick calculation on how much tax you will owe on your Consulting work
- -Space / Utilities if you require additional space (other than your residence) you will need to consider Office Rental / Utilities / Equipment / etc...
- -Supplies / Equipment
  - •While it sounds trivial, these expenses start to add up
  - Printers / Copiers / 3D Printer / paper, etc...
  - Not every Customer does everything electronically!



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# Project Challenges

## **Project Challenges**

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#### No matter how well you plan, organize, and execute your Project, not everything will go according to that Plan

 Things change, unforeseen circumstances pop-up, commitments get missed, and of course

-Sh\*\* Happens!

#### Think about how you will react to and respond when these Challenges arise

#### -Never act surprised!

-Your Job is to anticipate these types of situations

#### Bruce Oestreich

#### Typical Project Challenges

- · Misalignment between projects and their business objectives
- Late or delayed projects
- Dependency conflicts
- Execution difficulties
- Overlapping and redundant projects
- Resource conflicts
- Unrealised business value
- Diffuse decision making
- No accountability
- Fragmentation

## **Project Challenges – Client / Customer "Centric"**

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#### Your Client / Customer really doesn't know what they want

- -They think they do but are asking you for your help (You're the Expert!)
- –Ask Yourself: Do you understand what the Problem is and what could be the best solution?
  - Don't Guess! You must be Confident and Certain that you can provide a solution
  - •Or at least get your Client / Customer to AGREE on what the problem is!

#### •Your Client / Customer is REALLY hard to work with!

- -They are uncooperative, non-committal, defiant, argumentative, etc...
- -Keep in mind they are the Customer AND they are paying you!
- -This will not be your only challenging Client / Customer determine whether or not you can accept this type of environment

## **Project Challenges – Your Actions "Centric"**

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#### You do not fully understand the task at hand (in other words – "You're in over your head!")

- -DON'T PANIC! It happens
- -Determine what you do and do not understand
- -Meet with your Client / Customer
- -Explain the situation and why you have stopped
  - Will additional information / research resolve this quickly?

 Perhaps you can rely on other resources (friends, colleagues, others) to get you back on track

#### •Worst Case: You mutually agree with Client / Customer to end at this point

- -Highlight you have not wasted resources / time
- -Hopefully there is rationale behind why you ended up this way
- -It is not necessarily a lost cause / end of a Client / Customer relationship

## **Project Challenges – Your Actions "Centric"**

#### Your Attitude and/or Performance upsets the Client / Customer

- -Be realistic are you uniquely qualified to help the Client / Customer?
- -What can you do to remedy the situation?
  - Sometimes another 'face' can resolve the situation (you continue the work someone else talks to Client / Customer)
- -Put yourself in their situation would you continue working with (and paying someone) that you are not necessarily happy with?

## Project Challenges – Unknown Unknown "Centric"

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• Unexpected Emergencies Arise

- Personal Emergencies Personal / Family Illness / Tragedy / etc...
  - How will this impact your Client / Customer? Not all will be sympathetic
  - Can you work out an acceptable arrangement to continue?

#### Natural Disasters

- I've been impacted by Tornadoes, Earthquakes, Floods
- Not only happens to you but your Client / Customer
- How would this impact your ability to continue

#### Financial Instability

- Your Client / Customer is experiencing "Cash Flow" problems and cannot pay you as agreed to
- How long are you willing to continue without knowing about payment?
  - Be careful it is not a simple answer
  - Might be quite valid reasons or it could be carelessness on your Client / Customer's part
- What alternatives do you have?
  - Stop Work
  - Defer / Delay most work but keep low level activity going
  - "Trust" and continue wait for eventual payment
  - Defer / Cancel portions of work / deliverables
- Don't burn any bridges!

## **Project Challenges – Potential Ethical Situations**

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#### Client / Customer Driven Issues

- -Overt Actions
- -Attitude
- -Assignment Issues
- Your Client / Customer is paying you to perform Tasks and/or deliver Products per a Contract or equivalent agreement
  - -Some Clients will expect you to do things simply because they are paying you to do so
  - Sometimes, these requests may go beyond what you believe is reasonable or 'ethical'
    How do you respond?
  - –What if your Client / Customer 'overrides' your concern or tells you not to worry about it?

•Are you willing to walk away from this Contract?

- Is there a Term or Condition in the Contract that allows you to do so?
- Even if there is consider the ramifications on future work

## **Project Challenges – Potential Ethical Situations**

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## Areas That Can Get "Sticky"

Conflict of Interest – A Client asks you to work with their competitor simultaneously

Intellectual Property / Control of It

Inappropriate Data Collection or Data Release (Confidentiality Breach)

Incomplete / Skipped Tasks to Keep the Project Moving Forward

Client / Customer Tells You to Ignore / Discount What is Documented in the Statement of Work / Contract / Other Data

-"We'll Fix It Later..."

## **Project Challenges – Potential Ethical Situations**

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**Bruce Oestreich** 

## **NOT All Ethical Situations are OBVIOUS!!**

#### Example: Dual Role Conflict

- -You serve on your local municipal Zoning Board as part of good citizenship
- -You decide to provide 'pro bono' engineering consulting to your local Church or non-profit organization
- -Your influence in both roles can become problematic and inadvertently favor one over the other...

## Wrap Up - Management of Your Consulting Project / Contract

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Being a CONSULTANT – in ANY field, discipline, or line of expertise...

-Is HARD and Constantly Challenging!!

•You are running a Business! Keep in mind, the Business needs to come first in order to survive

 Paying attention to your Client / Customer will make or break you

 Be disciplined, organized, and willing to accept / drive Change when necessary

•The Customer is ALWAYS RIGHT – Even when they are not!



**Bruce Oestreich** 

# QUESTIONS?

# Engineering Clinic Consultant: What's All This Licensure Stuff, Anyway?\*

Professor: R. Polikar, Ph.D. Guest Lecturer: J. Schmalzel, Ph.D., P.E.

Rowan University Electrical and Computer Engineering Department

\*A credit nod to Bob Pease for "What's all this..."

### The Role of Licensure in Consulting (& Engineering)

- What is a Professional Engineer (P.E.)?
- Who needs the P.E.?
- Pathways to the P.E.?
- Maintaining the P.E.
- Tales from the crypt...



### What is a Professional Engineer (P.E.)?

- An engineer who has met the requirements defined by a State's Board of Professional Engineers and Land Surveyors
  - There is no universal licensure—just like Teachers, Doctors, and Lawyers and such
  - Some states have reciprocity arrangements with other states
- What are typical steps?
  - Earn an accredited engineering degree (counts as 4 years)
  - Pass the Fundamentals of Engineering (F.E.) exam
  - Complete a minimum period of work under a P.E.
  - Pass the P.E. exam



### What is a Professional Engineer (P.E.)?

45:8-28. Definitions (a) The term "professional engineer" within the meaning and intent of this chapter shall mean a person who by reason of his <u>special knowledge of the mathematical and physical sciences and</u> <u>the principles and methods of engineering analysis and design,</u> <u>acquired by professional education and practical experience</u>, is qualified to practice engineering as hereinafter defined as attested by his license as a professional engineer.



#### Who Needs a P.E.?

The State Board of Professional Engineers and Land Surveyors regulates the **practice**, licensure and certification of **engineers**, land surveyors, **engineers-in-training**, land surveyors-in-training and **companies offering professional engineering and land surveying services in the State of New Jersey in order to safeguard life, health and property, and promote the public welfare**.

→ If you're performing ("practicing") engineering in NJ, you need a license. Exceptions: You work for a company that is licensed; you work for the Federal government; you teach...

#### Who Needs a P.E.?

45:8-42. Employment of licensed engineers by governmental departments No department, institution, commission, board or body of the State Government, or of any political subdivision thereof shall designate, appoint or employ an engineer or any person to be in responsible charge of professional engineering work other than a duly qualified professional engineer who has been licensed by the State of New Jersey, prior to the designation, appointment or employment by such department, institution, commission, board or body of the State Government, or any political subdivision thereof.

# Pathways to the P.E.—New Jersey State Board of Professional Engineers and Land Surveyors

 Website: <u>https://www.njconsumeraffairs.</u> <u>gov/pels/Pages/default.aspx</u>
 Contact: Keith Miller
 Email: <u>MillerK@dca.njoag.gov</u>
 Phone: (973) 504-6460
 Fax: (973) 273-8020
 Address:124 Halsey Street, Third Floor
 Newark, New Jersey 07102
 United States • Members Manar Alsharaa P.E. Magdy Hagag P.E. Gary Paparozzi P.L.S. Lisa Peterson P.E., P.L.S. James "Jim" Purcell P.E. Tam Sillick P.E. Michael Venuto P.E., P.L.S.
- a. <u>Graduation from a board approved curriculum in engineering of four years or more; a specific record of an additional four years or more of experience in engineering work of a character satisfactory to the board, and indicating that the applicant is competent to be placed in responsible charge of such work; and successfully passing all parts of the written examination;</u>
- a. Graduation from a board approved curriculum in engineering or engineering technology of four years or more; and successfully <u>passing the</u> <u>fundamentals portion of the written examination</u> which is designated as Part F.

Part F--**Fundamentals of Engineering-**-This examination is intended to assess the applicant's competency in the fundamental engineering subjects and basic engineering sciences, such as <u>mathematics, chemistry, physics, statistics,</u> <u>dynamics, materials science, mechanics of materials, structures, fluid</u> <u>mechanics, hydraulics, thermodynamics, electrical theory, and economics.</u> A knowledge of P.L.1938, c.342 (C.45:8-27 et seq.) is also required.

https://ncees.org/wp-content/uploads/2022/09/FE-Electrical-and-Computer-CBTspecs.pdf



- Mathematics (11-17) A. Algebra and trigonometry B. Complex numbers C. Discrete mathematics D. Analytic geometry E. Calculus (e.g., differential, integral, single-variable, multivariable) F. Ordinary differential equations G. Linear algebra H. Vector analysis
- Probability and Statistics (4–6) A. Measures of central tendencies and dispersions (e.g., mean, mode, standard deviation) B. Probability distributions (e.g., discrete, continuous, normal, binomial, conditional probability) C. Expected value (weighted average)
- 3. Ethics and Professional Practice (4–6) A. Codes of ethics (e.g., professional and technical societies, NCEES Model Law and Model Rules) B. Intellectual property (e.g., copyright, trade secrets, patents, trademarks) C. Safety (e.g., grounding, material safety data, PPE, radiation protection)

- Engineering Economics (5–8) A. Time value of money (e.g., present value, future value, annuities) B. Cost estimation C. Risk identification D. Analysis (e.g., cost-benefit, trade-off, break-even)
- Properties of Electrical Materials (4–6) A. Semiconductor materials (e.g., tunneling, diffusion/drift current, energy bands, doping bands, p-n theory) B. Electrical (e.g., conductivity, resistivity, permittivity, magnetic permeability, noise) C. Thermal (e.g., conductivity, expansion)
- 6. Circuit Analysis (DC and AC Steady State) (11–17) A. KCL, KVL B. Series/parallel equivalent circuits C. Thevenin and Norton theorems D. Node and loop analysis E. Waveform analysis (e.g., RMS, average, frequency, phase, wavelength) F. Phasors G. Impedance

- Linear Systems (5–8) A. Frequency/transient response B. Resonance C. Laplace transforms D. Transfer functions
- **8. Signal Processing (**5–8) A. Sampling (e.g., aliasing, Nyquist theorem) B. Analog filters C. Digital filters (e.g., difference equations, Z-transforms)
- 9. Electronics (7–11) A. Models, biasing, and performance of discrete devices (e.g., diodes, transistors, thyristors) B. Amplifiers (e.g., single-stage/common emitter, differential, biasing) C. Operational amplifiers (e.g., ideal, nonideal) D. Instrumentation (e.g., measurements, data acquisition, transducers) E. Power electronics (e.g., rectifiers, inverters, converters)

- 10. Power Systems (8–12) A. Power theory (e.g., power factor, single and three phase, voltage regulation) B. Transmission and distribution (e.g., real and reactive losses, efficiency, voltage drop, delta and wye connections) C. Transformers (e.g., single-phase and three-phase connections, reflected impedance) D. Motors and generators (e.g., synchronous, induction, dc)
- **11.Electromagnetics** (4–6) A. Electrostatics/magnetostatics (e.g., spatial relationships, vector analysis) B. Electrodynamics (e.g., Maxwell equations, wave propagation) C. Transmission lines (high frequency)
- 12.Control Systems (6–9) A. Block diagrams (e.g. feedforward, feedback) B. Bode plots C. Closed-loop response, open-loop response, and stability D. Controller performance (e.g., steady-state errors, settling time, overshoot)

13.Communications (5-8) A. Basic modulation/demodulation concepts (e.g., AM, FM, PCM) B. Fourier transforms/Fourier series C. Multiplexing (e.g., time division, frequency division, code division) D. Digital communications **14.Computer Networks (**4–6) A. Routing and switching B. Network topologies (e.g., mesh, ring, star) C. Network types (e.g., LAN, WAN, internet) D. Network models (e.g., OSI, TCP/IP) E. Network intrusion detection and prevention (e.g., firewalls, endpoint detection, network detection) F. Security (e.g., port scanning, network vulnerability testing, web vulnerability testing, penetration testing, security triad)



- **15.Digital Systems (**8–12) A. Number systems B. Boolean logic C. Logic gates and circuits D. Logic minimization (e.g., SOP, POS, Karnaugh maps) E. Flip-flops and counters F. Programmable logic devices and gate arrays G. State machine design H. Timing (e.g., diagrams, asynchronous inputs, race conditions and other hazards)
- **16.Computer Systems (**5–8) A. Microprocessors B. Memory technology and systems C. Interfacing
- 17.Software Engineering (4–6) A. Algorithms (e.g., sorting, searching, complexity, big-O) B. Data structures (e.g., lists, trees, vectors, structures, arrays) C. Software implementation (e.g., iteration, conditionals, recursion, control flow, scripting, testing)

Completion of a <u>master's degree in engineering</u> shall be considered as equivalent to <u>one year of engineering experience</u> and completion of a <u>doctor's</u> <u>degree in engineering</u> shall be considered as equivalent to <u>one additional year</u> <u>of engineering experience</u>. In considering the qualifications of applicants, <u>engineering teaching experience</u> may be considered as engineering experience for a <u>credit not to exceed two years</u>.



Part P--<u>Specialized Training-</u>-This examination is intended to assess the extent of the applicant's more <u>advanced and specialized professional training</u> and experience especially in his chosen field of engineering.

https://ncees.org/exams/pe-exam/electrical-and-computer/

PE ELECTRICAL AND COMPUTER: COMPUTER ENGINEERING ELECTRONICS, CONTROLS, AND COMMUNICATIONS POWER



Engineering experience of a character satisfactory to the board shall be determined by the board's evaluation of the applicant's experience relative to the ability to design and supervise engineering projects and works so as to insure the safety of life, health and property.

→ Provide documentation, letters of reference

The mere execution, as a contractor, of work designed by a professional engineer, or the supervision of construction of such work as a foreman or superintendent, or the observation of construction as an inspector or witness shall not be deemed to be experience in engineering work.

### Maintaining the P.E.

- Renewal Fee
- Completion of Continuing Education Units (Credits)
- → If your registration lapses, you will have to reapply!



### Tales From the Crypt

- Expert Witness(ing)
  - Field work
  - Reports of opinions
- Working w/ Lawyers
  - Depositions
  - Court testimony
- Review, review, review
- Write, write, write
- "Yes" or "No"
- Those hoof beats are.....



Rowan University April 14, 2025

# Intellectual Property and Consulting For Engineers

**Gregory S. Bernabeo** Direct 610.647-2850 greg.bernabeo@fisherbroyles.com

Fisher Broyles®

### What Can IP Protection Do?

- Block competition
- Build/protect brand
- Obtain a monopoly/boost profit margins
- Build value for investment or exit
  - sold or licensed for profit
  - drives innovation

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### Forms of IP Protection

### <u>Copyrights</u> Protect Your Original Work of Authorship

### Patents

Protect machines, manufactured articles, compositions of matter, processes, ornamental designs for objects, plants

### **Trade Secrets**

Protect a process or formulation known only to you from disclosure to competitors

**Trademarks** 

Protect a Brand for Goods and Services

### Where Do IP Rights Come From?

The US Constitution – since the beginning!

Article I, Section 8, Clause 8 – the Patent and Copyright Clause

### Granted Congress the power:

"To promote the progress of science and useful arts, by securing for limited times <u>to authors and inventors</u> the exclusive right to their respective writings and discoveries."

PRESENTER: Greg Bernabeo

### What Is a Patent?

Limited-term governmental grant of a monopoly

Prevents others from practicing an invention by: Making / using / selling / offering for sale / importing

Valid only in the country of issuance

BUT NOTE – it is NOT a right to practice the invention – a license may be required from another patent owner

PRESENTER: Greg Bernabeo

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#### (12) United States Design Patent (10) Patent No.: (45) Date of Patent: Andre et al.

#### (54) MEDIA DEVICE

- (75) Inventors: Bartley K. Andre, Menlo Park, CA (US); Daniel J. Coster, San Francisco, CA (US); Daniele De Iuliis, San Francisco, CA (US); Richard P. Howarth, San Francisco, CA (US); Jonathan P. Ive, San Francisco, CA (US); Duncan Robert Kerr, San Francisco, CA (US); Matthew Dean Rohrbach, San Francisco, CA (US); Douglas B. Satzger, San Carlos, CA (US); Calvin Q. Seid, Palo Alto, CA (US); Christopher J. Stringer, Pacifica, CA (US); Eugene Anthony Whang, San Francisco, CA (US)
- (73) Assignee: Apple Computer, Inc., Cupertino, CA (US)

12/1990 Shaford et al. 4,976,435 A 3/1993 Inoue et al. 5,192,082 A 5,661,632 A 8/1997 Register D412,940 S \* 8/1999 Kato et al. ..... D21/324 5,964,661 A 10/1999 Dodge D430,169 S 8/2000 Scibora D437,860 S \* 2/2001 Suzuki et al. ..... D14/496 6,254,477 B1 \* 7/2001 Sasaki et al. ..... 463/1 D448,810 S \* 10/2001 Goto ..... D21/332 D450,713 S 11/2001 Masamitsu et al. D452,250 S 12/2001 Chan D469,109 S 1/2003 Andre et al. D472,245 S 3/2003 Andre et al. D483,809 S \* 12/2003 Lim ..... D21/324

US D497,618 S

\*\* Oct. 26, 2004

#### \* cited by examiner

Primary Examiner-Prabhakar Deshmukh (74) Attorney, Agent, or Firm-Beyer Weaver & Thomas, **LLP** 



#### (12) United States Design Patent (10) Patent No.: US D954,672 S Akana et al. (45) Date of Patent: \*\* Jun. 14, 2022

(54)	ELECTR	ONIC DEVICE	(52)	U.S. CL		D140387	
(71)	Applicant:	Apple Inc., Cupertino, CA (US)	(58)	Field of Cla	assification	n Search	
(72)	Inventors: Jody Akana, San Francisco, CA (US); Multy Anderson, San Francisco, CA (US); Bartley K. Andre. Palo Alto, CA (US); Bartley K. Andre. Palo Alto, CA (US); Shota Aoyagi, San Francisco, CA (US); Anthony Michael Ashcroft, San Francisco, CA (US); Marine C. Bataille, San Francisco, CA (US); Jeremy Bataillou, San Francisco, CA (US); Markus Diebel, San Francisco, CA (US); M. Evans Hankey, San Francisco, CA (US); Julian Hoenig, San Francisco, CA (US); Jonathan P. Ive, San Francisco, CA (US); Julian Jaede, San Francisco, CA (US); Juncan Robert Kerr, San Francisco, CA (US); Peter Russell-Clarke, San Francisco, CA (US); Benjamin Andrew Shaffer, San Jose, CA (US); Silical Silvanto, San Francisco, CA (US); Sung-Ho Tan, San Francisco, CA (US); Sung-Ho Tan, San Francisco, CA (US); Sung-Ho Tan, San Francisco, CA (US); Eugene Antony Whang, San Francisco CA (US); Bita Ziotenent Ca (US); Bita Ziotenenter, San		<ul> <li>D14/138 AB, 138 AC, 138 AD, 13</li> <li>D14/138 AB, 138 AC, 138 AD, 13</li> <li>D14/138 AB, 138 AC, 138 AD, 13</li> <li>D14/238, 1, 247, 248, 250, 257,</li> <li>D14/31-5318, 332, 336, 341-347,</li> <li>D14/374-377, 388, 359, 240, 424,</li> <li>D14/429, 432, 489, 402, 406,</li> <li>D14/433-453, 464, 468, 469, 471,</li> <li>D6/300-310, D10/90, 65, 98, 10</li> <li>D16/241, D17/24, 99, D18/4,</li> <li>D20/10, 19, 39, D21/329, 330,</li> <li>CPC . A6311 33/3016; G06F 1/1613; G06F 1/1647, C</li> <li>D16/241; G06F 3/0483; G06F 1/1647, C</li> <li>G06F 3/04837; G06F 3/04845, C</li> <li>3/04844; G06F 3/04837; G06F 3/04845, C</li> <li>3/04844; D/25; H04M 1/0237; H04B 1/0237; H04M 1/0226; H04M 1/0226; H04M 1/0236; H04M 1/026; H04M 1</li></ul>				
(73)	Assignce:	Apple Inc., Cupertino, CA (US)		U.S.	PATENT	DOCUMENTS	
(**)	Term:	15 Years		D337,569 S	7/1993	Kando	
(21)	Appl. No.:	29/739,035		D504,889 S D504,732 S	5/2005 8/2007	Andre et al. Cebe et al.	
(22)	Filed:	Jun. 22, 2020		D558,756 S D558,757 S D558,758 S	1/2008 1/2008 1/2008	Andre et al. Andre et al. Andre et al.	
	Rel	ated U.S. Application Data		D575,145 S	11/2008	Andre et al.	
(63)	Continuati Sep. 9, 20	on of application No. 29/705,046, filed on 19.		D597,067 S D599,342 S D600,241 S	7/2009 9/2009 9/2009	Oh et al. Andre et al. Andre et al.	
(51)	LOC (13)	Cl		D502,014 S D502,015 S	16/2009	Andre et al. Andre et al.	



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## **Design Patent Protection**

US D671,558





### US D604,305



US D728,624



## **Utility Patents**

- For:
  - new process, machine, article of manufacture, or composition of matter
- Protects:
  - how something works and/or
  - how it is made
  - NOT how something looks (design patent)
- Most common form of U.S. patent



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(12)	Unite Zadesky	d States Patent et al.	(10) <b>Patent</b> (45) <b>Date of</b>	No.: 'Paten	US 7,348,967 B2 t: *Mar. 25, 2008
(54)	TOUCH	PAD FOR HANDHELD DEVICE	3,005,055 A	10/1961	Mattke
(75)	<b>.</b>		3,965,399 A	6/1976	Walker et al.
(75) Invento	Inventors:	entors: Stephen Paul Zadesky, San Carlos, CA	4,103,252 A	7/1978	Bobick
		(US); Tang Yew Tan, San Francisco,	4,121,204 A	10/1978	Welch et al.
		CA (03)	4,129,747 A	12/1978	Pepper
(73)	Assignee:	Apple Inc., Cupertino, CA (US)	4,158,216 A	6/1979	Bigelow
	-		4,242,676 A	12/1980	Piguet et al.
(*)	Notice:	Subject to any disclaimer, the term of this	4,246,452 A	1/1981	Chandler
		patent is extended or adjusted under 35 $U \le C$ 154(h) by 126 days	4,293,734 A	10/1981	Peper, Jr.
		0.5.C. 154(b) by 156 days.	D264,969 S	6/1982	McGoutry
		This patent is subject to a terminal dis-	4,380,007 A	4/1983	Steinegger
		claimer.	4,380,040 A	4/1983	Posset
			4,475,008 A	10/1984	Doi et al.
(21)	Appl. No.:	: 11/386,238	4,570,149 A	2/1986	Thornburg et al.
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### (19) United States

#### (12) Patent Application Publication (10) Pub. No.: US 2020/0221002 A1 AKANA et al.

#### (54) PORTABLE ELECTRONIC DEVICE

(71) Applicant: Apple Inc., Cupertino, CA (US)

(72) Inventors: Jody R. AKANA, San Francisco, CA (US); Molly ANDERSON, San Francisco, CA (US); Bartley K. ANDRE, Palo Alto, CA (US); Shota AOYAGI, San Francisco, CA (US); Anthony Michael ASHCROFT, San Antiony Michael ASMCROPT, San Francisco, CA (US); Maríne C. BATAILLE, San Francisco, CA (US); Jeremy BATAILLOU, San Francisco, CA (US); Markus DIEBEL, San Francisco, CA (US); M. Evans HANKEY, San Francisco, CA (US); Julian HOENIG, San Francisco, CA (US); Dieherd D. ROWADTU Sci-(US); Richard P. HOWARTH, San Francisco, CA (US); Jonathan P. IVE, San Francisco, CA (US); Julian JAEDE, San Francisco, CA (US); Duncan Robert KERR, San Francisco, CA (US); Peter RUSSELL-CLARKE, San Francisco, CA (US); Benjamin Andrew SHAFFER, San Francisco, CA (US); Mikael SILVANTO, San Francisco, CA (US); Sung Ho TAN, San Francisco, CA (US); Clement TISSANDIER, San Francisco, CA (US); Eugene Antony WHANG, San Francisco, CA (US); Rico ZÖRKENDÖRFER, San Francisco, CA (US)

#### (21) Appl. No.: 16/586,736

(22) Filed: Sep. 27, 2019

300-A

(43) Pub. Date: Jul. 9, 2020

#### **Related U.S. Application Data**

- (63) Continuation-in-part of application No. 29/683,766, filed on Mar. 15, 2019, Continuation-in-part of appli-cation No. 29/676,128, filed on Jan. 8, 2019, Continuation-in-part of application No. 29/676,127, filed on Jan. 8, 2019.
- (60) Provisional application No. 62/897,901, filed on Sep. 9, 2019.

#### **Publication Classification**

(51)	Int. Cl.	
	H04N 5/225	(2006.01)
	H04M 1/02	(2006.01)
	H04N 5/247	(2006.01)
(52)	U.S. Cl.	
	CPC	H04N 5/2257 (2013.01); H04N 5/24

### (2013.01); H04M 1/0264 (2013.01)

#### ABSTRACT

According to some embodiments, a portable electronic device is described. The portable electronic device includes a housing member defining an external sidewall, a first glass cover and a second glass cover, where the second glass cover includes a first region having a first exterior surface, as second region having a second exterior surface vertically displaced from the first exterior surface, where the second region includes a first opening, a second opening, and a third opening, and a transition region having an exterior surface that extends between the first exterior surface to the second exterior surface. The portable electronic device further includes a first camera module disposed within the first opening, a second camera module disposed within the second opening, a strobe module disposed within the third opening, and a trim structure having an edge that overlays the second region of the second glass cover.





(57)

(22) Filed: Mar. 21, 2006

## Utility Patent Protection

### (12) United States Patent Hansson et al.

#### (10) Patent No.: US 9,079,097 B2 (45) Date of Patent: Jul. 14, 2015

#### (54) VIDEO GAME WITH REPLACEABLE TILES HAVING SELECTABLE PHYSICS

- (71) Applicant: KING.COM LIMITED, St. Julians (MT)
- (72) Inventors: Magnus Hansson, Stockholm (SE); Niclas Alftberg, Stockholm (SE); Tobias Nyblom, Stockholm (SE); Rikard Jaksch, Stockholm (SE)

#### (73) Assignee: KING.COM LTD., St. Julians (MT)

- (\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.
- (21) Appl. No.: 14/316,274
- (22) Filed: Jun. 26, 2014
- (65) Prior Publication Data
  - US 2014/0370950 A1 Dec. 18, 2014

#### **Related U.S. Application Data**

(63) Continuation-in-part of application No. 14/183.997, filed on Feb. 19, 2014, which is a continuation-in-part of application No. 14/029/201, lifed on Sep. 17, 2013, which is a continuation-in-part of application No. 14/029/38, filed on Sep. 17, 2013.

#### (30) Foreign Application Priority Data

Feb. 19, 2013	(GB)	 1302910.3
Jun. 21, 2013	(GB)	 1311119.0

#### (51) Int. Cl.

A63F 13/00	(2014.01)
A63F 9/06	(2006.01)
	(Continued)

(52) U.S. Cl.

 13/0 (2013.01); A63F 13/2 (2013.01); A63F 13/20 (2014.09); A63F 13/34 (2014.09); A63F 13/50 (2014.09); A63F 13/52 (2014.09); A63F 13/57 (2014.09); A63F 13/52 (2014.09); A63F 13/57 (2014.09); G66F %/44 (2013.01); G67F 17/32 (2013.01); (Continued)

#### (Common

- - References Cited

(56)

(57)

#### U.S. PATENT DOCUMENTS

#### FOREIGN PATENT DOCUMENTS

#### WO 2013/174933 A1 11/2013

Primary Examiner — Lawrence Galka (74) Attorney, Agent, or Firm — Saul Ewing LLP

#### ABSTRACT

A computer device has user interface configured to display user actuatable game elements and to detect user input when a user engages with a game element; and a processor configured to receive a detected user input and on detecting a match game condition to control the user interface to remove at least three game elements from the display and to provide on the user interface replacement user actuatable game elements, wherein the manner of providing each replacement game element has a graphical representation governed by a tile associated with each game element, wherein each tile has a selectable physics which controls at least one of (1) the direction in which it moves to replenish the vacancy left by the removed user game elements; and (ii) the speed at which it moves to replenish the vacancy.

#### 17 Claims, 32 Drawing Sheets





# Patent Requirements

- Must meet the legal standard
  - new
  - useful
  - non-obvious
- Must not have forfeited opportunity for patent rights

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# Trademarks

### • What is a Trademark?

• Any word, name, symbol, or device used to identify and distinguish goods from those manufactured or sold by another and to indicate their source

### Trademark rights arise from use

### • Trademarks may be registered for enhanced right

- Registration rights are territorial
- Consider U.S. and abroad
- No limitation on term



# **Purpose of a Trademark**

- To distinguish goods and services from those of others
- To provide **quality assurance** to consumers
- To create **business goodwill** and **brand awareness**

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## Traditional Trademarks

• Words

• Logos



Apple





• Taglines

### Think Different

What's Next





## Nontraditional Trademarks

TIFFANY & CO.



- Sound
- Color
- Scent
- Design









U.S. Reg. No. 4,811,606



U.S. Reg. No. 4,811,604



U.S. Reg. No. 4,651,889

## Trade Dress Registration

U.S. Reg. No. 3,470,983

U.S. Reg. No. 4,277,914





### What Is a Copyright?

Copyright protects works of authorship that are:

Fixed in any tangible form or medium of expression.

Original in the sense that they are: •Independently created by the author (or authors). •At least minimally creative.

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### Who is the "Author" of a Copyrighted Work?

The "author" may be one person, or two or more persons (jointly owned by its authors).

For a "work made for hire," the employer is the initial owner of the copyright

unless agreed differently in a signed writing.

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# Works Protected by Copyright

- Literary works
  - books, periodicals, manuscripts, film, tapes and computer programs
- Pictorial, graphic and sculptural works
  - fine, graphic and applied art and art reproductions, photographs, prints, maps, models and technical drawings
- Motion pictures, video games and other audiovisual works
- Architectural works



## Add Value using IP

- Key asset base of S&P 500 is intangible assets/IP
  - 1982 38% of market value
  - 2004 90% of market value
- Survey of CEOs/CFOs
  - 94% managing intangible assets is important
  - 37% 1 of their top 3 issues
  - 13% most important issue
- Successful companies are leveraging IP
  - 1990 \$18 billion in annual licensing revenues
  - 1998 \$100 billion
  - 2005 \$500 billion

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# What This Means . . .

Companies that use IP for strategic purposes **will surpass** those that do not



## **Engineering Consulting**

### The Law

- Favors creators/innovations
- Rewards creators/innovators with IP ownership

### The Client's Expectations

- Client is introducing you into their business/technology
- Client has proprietary/technical information
  - Client wants you to keep that information secret/confidential
- Claim may want you to help them develop their technology/business
  - Client wants to own any inventive contribution you may make

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# Confidentiality Agreement Non-Disclosure Agreement

#### 1- Can Be Mutual or One-sided

- 2- Don't be fooled by the title read it!
  - how is "confidential information" defined?
  - non-disclosure obligations?
  - non-use obligations?
  - term?
  - understand exceptions
  - understand permitted disclosures

#### **TYPICAL EXCEPTIONS TO CONFIDENTIALITY**

- (i) information publicly known or in the public domain prior to the time of disclosure,
- (ii) information publicly known and made generally available after disclosure through no action or inaction of the recipient,
- (iii) information already in the possession of recipient, without confidentiality restrictions,
- (iv) information obtained by the receiver from a third party without a breach of confidentiality, and
- (v) information independently developed by the recipient.



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## Why read NDAs?

Entering into an NDA increases the risk that you may face charges of trade secret misappropriation if you develop similar information in the future or inadvertently disclose or use the confidential information.

If you are applying your own confidential information, you need a MUTUAL NDA

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## **Consulting Agreements**

As a Consultant, YOU WANT a Consulting Agreement

- outlines the exact terms of the agreement
- avoids confusion
- protects your interests
- ensures you will be paid

## **Relationship Roadmap**

- Identify Consultant and Customer
- Terms of Service/Termination
- Compensation Details
- Confidentiality Obligations
- Independent Contractor Status
- Governing Law
- Entire Agreement
- Notices
- Signatures

#### Key Terms – Intellectual Property Rights

- Who will own any work product that is created?
- Generally, all work product and any IP created belongs to the client
  - Any exceptions should be clearly identified
- Consultant Agreement can assign ownership rights to either party.
- Consultant typically agrees to sign all documents necessary for client to protect the IP
- Pre-existing Consultant IP can be recognized/protected/excepted
- Sometimes a license to use Consultant IP is granted to a limited extent

#### Key Terms – Non-Competition

- Terms that prevent the consultant from directly competing with the client for a specific period of time
- Must be reasonable in time/field/geographic scope can't restrict you from having a reasonable job
  - "reasonable" scope can vary by state
- Negotiate terms if unreasonable/unworkable
  - Highly fact/situation-dependent

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#### Key Terms – Non-Solicitation

- Terms that prevent the consultant from soliciting customers of the client
- Can't "either directly or indirectly, call on, solicit, take away or attempt to do any of the such that pertains to any of the customers or clients of the Client on whom the Consultant called, contacted or may have become acquainted with during the fulfillment of the terms of this Agreement, either for their own benefit or for the benefit of any other individual, firm, corporation or organization."
- Should be reasonable in time scope negotiate

#### Key Terms – Non-Recruit

- Terms that prevent the consultant recruiting employees of the client
- "The Consultant shall not throughout the duration of this Agreement and for a period of year(s) immediately following the termination of this Agreement, either directly or indirectly, recruit any of the Client's employees, customers, clients or management for the purpose of any outside business."

Should be reasonable in time scope - negotiate

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#### Key Terms – Return of Records

- Terms that govern handling of confidential/proprietary information
- "Upon the termination of this Agreement, the Consultant shall deliver any and all records, notes and data of any nature which may be in the possession of the Consultant or may be under the control of the Consultant and of which are and shall remain the property of and relate to the Client's business."

Should be reasonable and practical - negotiate

Slide / 34 FISHERBROYLES.COM

#### THE BOTTOM LINE

#### READ, READ, READ....

- AGREEMENT TERMS ARE COMMITMENTS
- NOT BOILERPLATE NOT STANDARD
- NEGOTIATE IF NEEDED
- UNDERSTAND AND KEEP TRACK OF YOUR OBLIGATIONS



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Thank You Questions?

Slide / 36

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