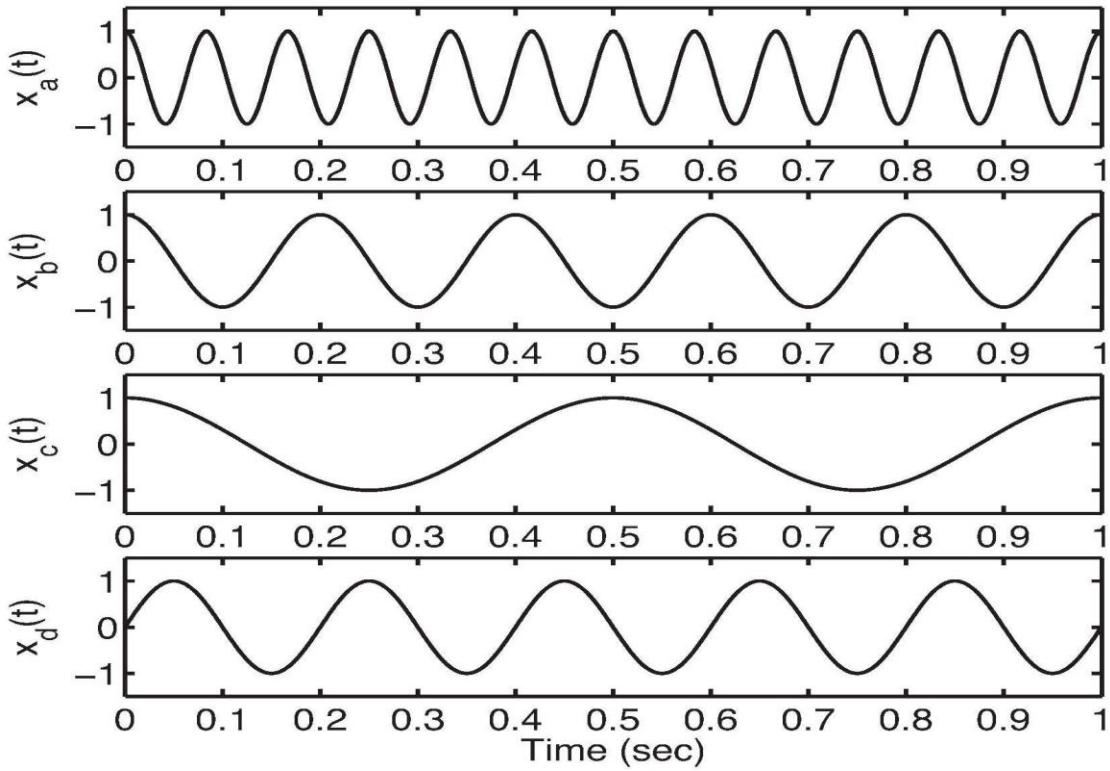
Quiz 1 – Digital Signal Processing

Name:

1. Which of the continuous time sinusoids shown in the figure below can be sampled at 5 Hz without aliasing (the units of the horizontal axis is seconds)?



(A) $x_a(t)$

(B) $x_b(t)$

(C) $x_c(t)$

(D) $x_d(t)$

For questions 2 and 3, consider the continuous time signal $x(t) = 2\cos(2\pi t + \pi/4)$

2. If x(t) is sampled uniformly at T_s seconds/sample, which value of T_s will cause aliasing and not allow x(t) to be reconstructed from its samples?
   (A) $T_s = 0.1$
   (B) $T_s = 0.2$
   (C) $T_s = 0.3$
   (D) $T_s = 0.4$
   (E) $T_s = 0.6$

3. If x(t) is sampled uniformly at $T_s = 0.1$ seconds/sample, what is the value of $x(T_s)$?
   (A) $2\cos(0.01\pi + \pi/4)$
   (B) $2\cos(0.1\pi + \pi/4)$
   (C) $2\cos(0.2\pi + \pi/4)$
   (D) $2\cos(0.5\pi + \pi/4)$
   (E) $2\cos(\pi + \pi/4)$
   (F) $2\cos(2\pi + \pi/4)$

4. Suppose x(n) = [10 11 12 13 -14] for $0 \le n \le 4$. The signal $x(<-n>_5)$ ($<-n>_5$ is –n modulo 5) is equal to
   (A) [10 11 12 13 -14] for $0 \le n \le 4$
   (B) [-14 13 12 11 10] for $0 \le n \le 4$
   (C) [10 -14 13 12 11] for $0 \le n \le 4$
   (D) [11 10 -14 13 12] for $0 \le n \le 4$
   (E) [11 12 13 -14 10] for $0 \le n \le 4$
   (F) [-14 10 11 12 13] for $0 \le n \le 4$

5. The period (in samples) of $\cos(\pi n/8) + \cos(\pi n/5)$ is equal to
   (A) 5
   (B) 8
   (C) 10
   (D) 16
   (E) 20
   (F) 30
   (G) 40
   (H) 80
   (I) 100
   (J) 120

For questions 6 and 7, consider a signal $x(n) = (n - 2)\, a^n\, [u(n) - u(n - 4)]$ where u(n) is a unit-step function. Note that "a" is an arbitrary constant.

6. Which if the following statements about x(n) is/are true?
   1) x(n) is a causal signal.
   2) x(n) is a bounded signal.
   3) x(n) is of infinite duration.

   (A) Statement 1 only
   (B) Statement 2 only
   (C) Statement 3 only
   (D) Statements 1 and 2 only
   (E) Statements 1 and 3 only
   (F) Statements 2 and 3 only
   (G) Statements 1, 2 and 3 are true.

7. When a = 2, the L_∞ norm of x(n) is

   (A) 0
   (B) 1
   (C) 2
   (D) 4
   (E) 8

8. Consider the signal $x(n) = a^n u(n)$ where u(n) is a unit-step function. Find an expression for g(n) = x(n) – ax(n - 1). Note that δ(n) denotes the impulse signal and "a" is an arbitrary constant.

   (A) g(n) = δ(n)
   (B) g(n) = δ(n - 1)
   (C) g(n) = aδ(n)
   (D) g(n) = aδ(n - 1)
   (E) g(n) = δ(n - a)
   (F) g(n) = aδ(n - a)

Questions 9 and 10 are about the signal $x(n) = 5\, e^{j2n}$.

9. Which of the following statements about x(n) is true?
   (A) x(n) is periodic
   (B) x(n) is aperiodic

10. Which of the following statements about x(n) is true?
   (A) x(n) has finite energy and finite power
   (B) x(n) has finite energy and infinite power
   (C) x(n) has infinite energy and finite power
   (D) x(n) has infinite energy and infinite power