

Homework 10 - Aidan Sharpe

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The titanium content in an aircraft-grade alloy is an important discriminant of strength. A sample of 10 test coupons reveals the following titanium content in percent:

Coupon	Titanium Content
1	8.30%
2	8.09%
3	8.99%
4	8.60%
5	8.40%
6	8.35%
7	8.36%
8	8.75%
9	8.91%
10	8.05%

Suppose that the distribution of titanium content is symmetric and continuous. Does the sample data suggest that the mean titanium content differs significantly from 8.5%? Use $\alpha = 0.05$

```
>>> coupons = [8.3, 8.09, 8.99, 8.60, 8.40, 8.35, 8.36, 8.75, 8.91, 8.05]
>>> mu0 = 8.5
```

```
# Find the difference between each sample and mu0
>>> differences = [xi - mu0 for xi in coupons]
```

```
# Find the absolute differences
>>> abs_diffs = [abs(x) for x in differences]
```

```
# Sort the differences in ascending order
>>> s_diffs = sorted(abs_diffs)
```

```
# Turn the sorted order into a ranked list
>>> ranks = [abs_diffs.index(x) + 1 for x in s_diffs]
```

```
# Find the ranks corresponding to positive differences
>>> p_ranks = [ranks[i] if differences[i] > 0 else 0 for i in range(len(differences))]
```

```
# Find the ranks corresponding to negative differences
>>> n_ranks = [ranks[i] if differences[i] < 0 else 0 for i in range(len(differences))]
```

```
# Find the positive and negative rank sums
>>> wp = sum(p_ranks)
>>> wn = sum(n_ranks)

# Find the test statistic
>>> w_observed = min(wp, wn)
>>> w_observed
22
```

For a two-sided signed rank test with $\alpha = 0.05$ and 10 samples, w_α^* is 8. Since 22 is greater than 8, we do not have enough evidence to suggest that the mean titanium content differs from 8.5%.