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DSCI 407 Assignment 3 (100 points)
Due 11:59 pm April 26, 2024

General instructions.

1. This is an individual assignment.
2. Your solution must be submitted through the Moodle site.

(a) Heart beats, in beats per minute, were measured for samples of 12 track athletes and 15 swimmers. The results are shown below. Cn you conclude that the median heart rate is greater for swimmers than for track athletes? Use the $\alpha = 0.05$ level of significance.
Track: 68, 62, 65, 72, 70, 68, 64, 77, 77, 66, 72, 76
Swim: 82, 81, 71, 69, 79, 65, 66, 70, 80, 78, 75, 82, 75, 63, 79

(b) Following are the prices of a gallon of a regular gas at two time points for 14 gas stations. Can you conclude that that the median prices are different? Use the $\alpha = 0.01$ level of significance.
Time 1: 3.85, 3.88, 3.81, 3.58, 3.48, 3.55, 3.59, 3.8, 4.11, 3.51, 3.86, 3.93, 3.64, 3.54
Time 2: 3.9, 3.79, 3.73, 3.55, 3.42, 3.54, 3.62, 3.78, 3.99, 3.52, 3.85, 3.93, 3.68, 3.5.

(c) Prices for a gallon of a regular gas were recorded for a sample of 12 gas stations. Can you conclude that the median price is less than \$3.00? Use the $\alpha = 0.05$ level of significance.
Prices: 2.93, 2.61, 2.95, 2.66, 2.76, 2.98, 2.89, 2.79, 2.57, 2.96, 3.06, 2.74.

(a)

M_1 Track: 68, 62, 65, 72, 70, 68, 64, 77, 77, 66, 72, 76
M_2 Swim: 82, 81, 71, 69, 79, 65, 66, 70, 80, 78, 75, 82, 75, 63, 79

1) $H_0: M_2 \not> M_1$ $H_1: M_2 > M_1$

2) $\alpha = 0.05$

3) = swim = track

62, 63, 64, 65, 65, 66, 66, 68, 68, 69, 70, 70, 71, 72,
Rank: 1 2 3 4.5 4.5 6.5 6.5 8.5 8.5 10 11 12 13 14.5

72, 75, 75, 76, 77, 77, 78, 79, 79, 80, 81, 82, 82
14.5 16.5 16.5 18 19.5 19.5 21 22.5 22.5 24 25 26.5 26.5

4) Smallest sample = track = n_1

S = sum of ranks from track = 129

$n_1 = 12$

$n_2 = 15$

$$\mu_S = \frac{n_1(n_1+n_2+1)}{2} = 168$$

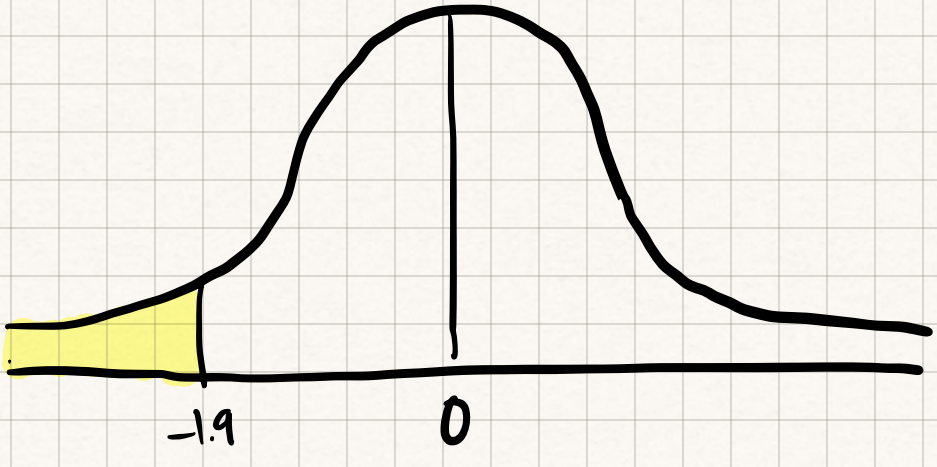
$$\sigma_S = \sqrt{\frac{n_1 \cdot n_2 (n_1+n_2+1)}{12}} = 20.4939$$

5) test statistic

$$Z = \frac{S - \mu_S}{\sigma_S} = \frac{129-168}{20.4939} = -1.903$$

6) P-value

*one-tailed



- probability from table = 0.0287

P-value = 0.0287

7) P-value $< 0.05 \Rightarrow$ reject H_0

8) Conclusion: We <u>can</u> conclude that the median heart rate is greater for swimmers than for track athletes.

(b) Following are the prices of a gallon of a regular gas at two time points for 14 gas stations. Can you conclude that that the median prices are different? Use the $\alpha = 0.01$ level of significance.
Time 1: 3.85, 3.88, 3.81, 3.58, 3.48, 3.55, 3.59, 3.8, 4.11, 3.51, 3.86, 3.93, 3.64, 3.54 M_1
Time 2: 3.9, 3.79, 3.73, 3.55, 3.42, 3.54, 3.62, 3.78, 3.99, 3.52, 3.85, 3.93, 3.68, 3.5. M_2

1) $H_0: M_1 = M_2$ $H_1: M_1 \neq M_2$

2) $\alpha = 0.01$

3) Rank = M_1 = M_2

3.42	3.48	3.5	3.51	3.52	3.54	3.54	3.55	3.55	3.58
1	2	3	4	5	6.5	6.5	8.5	8.5	10

3.59	3.62	3.64	3.68	3.73	3.78	3.79	3.80	3.81
11	12	13	14	15	16	17	18	19

3.85, 3.85, 3.86, 3.88, 3.90, 3.93, 3.93, 3.99, 4.11

20 21 22 23 24 25.5 25.5 27 28

4) Since the samples are the same size, let

$n_1 = M_2 = 14$

S = sum of M_2 ranks = 195.5

$\mu_S = 203$ $\sigma_S = 21.7639$

5) test-statistic

$$z = \frac{S - \mu_S}{\sigma_S} = \frac{195.5 - 203}{21.7639} = -0.3446$$

6) P-value

* two-tailed

- probability from table = 0.3669

Since it's 2 tailed, we multiply it by 2, so

P-value = 0.7338

7) P-value $>$ 0.01 $\Rightarrow$ do not reject H_0

8) Conclusion: We can not conclude that there is a difference in the median price of gas between the 2 times.

(c) Prices for a gallon of a regular gas were recorded for a sample of 12 gas stations. Can you conclude that the median price is less than \$3.00? Use the $\alpha = 0.05$ level of significance.
Prices: 2.93, 2.61, 2.95, 2.66, 2.76, 2.98, 2.89, 2.79, 2.57, 2.96, 3.06, 2.74.

1) $H_0: m = 3.00$ $H_1: m < 3.00$

2) $\alpha = 0.05$

3) $m_0 = 2.84$ $+ = 6$ $- = 6$

2.93	2.61	2.95	2.66	2.76	2.98
+	−	+	−	−	+

2.89	2.79	2.57	2.96	3.06	2.74
+	−	−	+	+	−

$x = 6$, $n = 12$

- since $n \leq 25$, then the test stat. is $\underline{x}$

4) since $n \leq 25$, critical value from table 1,

C.V. = 2

$x > C.V. \Rightarrow$ do not reject H_0

5) Conclusion: We can <u>not</u> conclude that the median price is ~~less~~ than \$3.00.