Candidate - Rank by Prof A - Rank by Prof B

1	6	5
2	10	11
3	2	6
4	1	3
5	5	4
6	11	12
7	4	2
8	3	1
9	7	7
10	12	10
11	9	8
12	8	9

Candidate	Rank by Prof A	Rank by Prof B	d_i	d_i^2
1	6	5	1	1
2	10	11	-1	1
3	2	6	-4	16
4	1	3	-2	4
5	5	4	1	1
6	11	12	-1	1
7	4	2	2	4
8	3	1	2	4
9	7	7	0	0
10	12	10	2	4
11	9	8	1	1
12	8	9	-1	1

$$n = 12;$$

$d_i = x_i - y_i$ is the difference between ranks;

$$\sum d_i^2 = 1 + 1 + 16 + 4 + 1 + 1 + 4 + 4 + 0 + 4 + 1 + 1 = 38$$

Question

What is the Spearman rank-correlation coefficient (rs)?

Solution

$$r_s = 1 - \frac{6 \sum d_i^2}{n(n^2 - 1)} = 1 - \frac{6 \cdot 38}{12(12^2 - 1)} = 0.8671.$$

Answer: 0.8671.

Question

What is σrs?

Solution

$$\sigma_{rs} = \frac{1}{\sqrt{12 - 1}} = 0.3015$$

Answer: 0.3015.

Question

What is the value of the test statistic z?

Solution

$$z = \frac{0.8671 - 0}{0.3015} = 2.88$$

Answer: 2.88.

Question

What is the p-value?

Solution

$$p - value = 2\big(1 - P(z < 2.88)\big) = 2(1 - 0.9980) = 0.004$$

Answer: 0.004.

Question

Using α = .02 what is your conclusion about how Professor A and Professor B rank the twelve students?

Solution

The null hypothesis: there is no association between the two variables.

P-value is less than α = .02, thus we reject the null hypothesis that population rank-correlation coefficient is zero. There is significant rank-correlation between rank of the twelve students by Professor A and Professor B. If we set $\alpha = 0.02$, achieving a statistically significant Spearman rank-order correlation means that we can be sure that there is less than a 2% chance that the strength of the relationship we found (our coefficient) happened by chance if the null hypothesis were true.