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ASSIGNMENT-3

Q1. A computer while calculating correlation between two variables X and Y from 25 pairs of observations obtained the following results : $n=25$, $\Sigma X=125$, $\Sigma X^2=650$, $\Sigma Y=100$, $\Sigma Y^2=460$, $\Sigma XY=508$. If was, however, later discovered at the time of checking that he had copied down two pairs as $(x,y)=(16,14),(8,6)$ while the correct values were $(x,y)=(8,12),(6,8)$, obtain the correct value of correlation co-efficient.

Ans.

$$\Sigma x_i = 125 - 16 - 8 + 8 + 6 = 125$$

$$\Sigma y_i = 100 - 14 - 6 + 12 + 8 = 100$$

$$\Sigma x_i^2 = 650 - 16^2 + 8^2 + 6^2$$

$$= 650$$

$$\Sigma y_i^2 = 460 - 14^2 + 6^2 + 12^2 + 8^2$$

$$= 436$$

$$\Sigma x_i y_i = 508 - 6 \times 14 - 8 \times 6 + 8 \times 12 + 6 \times 8$$

$$= 520$$

$$r = \frac{n\Sigma xy - \Sigma x \Sigma y}{\sqrt{n\Sigma x^2 - (\Sigma x)^2}\sqrt{n\Sigma y^2 (\Sigma y)^2}}$$

$$= \frac{25 \times 520 - 125 \times 100}{\sqrt{25 \times 650 - (125)^2}\sqrt{25 \times 436 - (100)^2}}$$

$$= \frac{13000 - 12500}{\sqrt{625}\ \sqrt{900}} = \frac{500}{25 \times 30} = \frac{2}{3}$$

$$r = 0.667$$

Q2. Samples of sizes 10 and 14 were taken from two populations with SD 3.5 and 5.2. The sample means were found to be 20.3 and 18.6. Test whether the means of the two populations are the same at 5% level.

Ans. $H_0 : \mu_1 = \mu_2$. i.e. the means of the two populations are the same.

$H_1 : \mu_1 \neq \mu_2$

Given $\bar{x}_1 = 20.3$, $\bar{x}_2 = 18.6$, $n_1 = 10$, $n_2 = 14$,
$s_1 = 3.5$, $s_2 = 5.2$

$$s^2 = \frac{n_1 s_1^2 + n_2 s_2^2}{n_1 + n_2 - 2} = \frac{10(3.5)^2 + 14(5.2)^2}{10+14-2}$$

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s\left(\frac{1}{n_1} + \frac{1}{n_2}\right)} = \frac{20.3 - 18.6}{\left[\frac{1}{10} + \frac{1}{14}\right]} = 0.8604$$

$= 4.772$

The value of t at 5% level for 22 d.f. is $t_{0.05} = 2.0739$

Since $t = 0.8604 < t_{0.05}$ the hypothesis is accepted, i.e., there is no significant diff. between their means.

Q3. Compute the rank correlation co-efficient for the following data:

S.no.	1	2	3	4	5	6	7	8	9
x:	10	15	12	17	13	16	24	14	22
y:	30	42	45	46	33	34	40	35	39

Ans.

x	y	R_I	R_{II}	$D = R_I - R_{II}$	D^2
10	30	1	1	0	0
15	42	5	7	-2	4
12	45	2	8	-6	36
17	46	7	9	-2	4
13	33	3	2	1	1
16	34	6	3	3	9
24	40	9	6	3	9
14	35	4	4	0	0
22	39	8	5	3	9
					$\Sigma D^2 = 72$

$$\rho \Rightarrow 1 - \frac{6 \Sigma D^2}{n(n^2-1)}$$

$$\Rightarrow 1 - \frac{6 \times 72}{9(9^2-1)} \qquad \Rightarrow 1 - \frac{6 \times 72}{9(81-1)}$$

$$\Rightarrow 1 - \frac{432}{720}$$

$$\Rightarrow \frac{288}{720} = 0.4$$

Ans. $\boxed{\rho = 0.4}$

Q.4. 12 entries in a painting competition were ranked by two judges, judge I: 5, 2, 3, 4, 1, 6, 8, 7, 10, 9, 12, 11 and by judge II : 4, 5, 2, 1, 6, 7, 10, 9, 11, 12, 3, 8. Calculate Spearman's rank correlation coefficient.

Ans.

R_x	R_y	$d = R_x - R_y$	d^2
5	4	1	1
2	5	-3	9
3	2	1	1
4	1	3	9
1	6	-5	25
6	7	-1	1
8	10	-2	4
7	9	-2	4
10	11	-1	1
9	12	-3	9
12	3	9	81
11	8	3	9
			$\Sigma d^2 = 154$

$$r = 1 - \frac{6 \cdot \Sigma d^2}{n(n^2-1)}$$

$$\Rightarrow 1 - \frac{6 \times 154}{12(12^2-1)} \Rightarrow 1 - \frac{6 \times 154}{12 \cdot (144-1)}$$

$$\Rightarrow 1 - \frac{924}{1716} \Rightarrow 1 - 0.5385$$

$$\Rightarrow 0.4615$$

$$r = 0.4615$$

Qs. A die is thrown 276 times and the results of these throwns are given below.

No. appeared on die	1	2	3	4	5	6
Frequency	40	32	29	59	57	59

Frequency O_i	40	32	29	59	57	59
E_i	46	46	46	46	46	46
$(O_i - E_i)$	-6	-14	-17	13	11	13
$(O_i - E_i)^2$	36	196	289	169	121	169

$$\frac{(O_i - E_i)^2}{E_i} \Rightarrow \frac{36}{46} \quad \frac{196}{46} \quad \frac{289}{46} \quad \frac{169}{46} \quad \frac{121}{46} \quad \frac{169}{46}$$

$$\chi^2 = \left(\frac{[O_i - E_i]^2}{E_i} \right)$$

$$\chi^2 = \frac{36}{46} + \frac{196}{46} + \frac{289}{46} + \frac{169}{46} + \frac{121}{46} + \frac{129}{46}$$

$$= \frac{36 + 196 + 289 + 169 + 121 + 169}{46}$$

$$= 21.30$$

Ans.