ENGINEERING MATHEMATICS

UNIT-3 : *Statistical Techniques – I*

Lec-10

Today's Target

- Rank Correlation
- PYQ
- DPP

GW
GATEWAY CLASSES

Rank Correlation

- Non Repeated Rank
- Repeated Rank

Rank Correlation (Non Repeated Rank)

$$r = 1 - \frac{6\sum D^2}{n(n^2-1)}$$

Spearman's Formula

Where n = number of observation

$$D = R_1 - R_2$$

r = Rank Correlation coefficient

GW
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Rank Correlation (Repeated Rank)

$$r = 1 - \frac{6[\sum D^2 + F]}{n(n^2-1)}$$

$$Where\ F = \frac{m_1(m_1^2-1)}{12} + \frac{m_2(m_2^2-1)}{12} + \cdots \ldots .$$

Type – 1 : Where Rank is given

Q. 1 Compute the rank correlation coefficient for the following data:

Person:	A	B	C	D	E	F	G	H	I	J
Rank in Maths: (R_1)	9	10	6	5	7	2	4	8	1	3
Rank in Physics: (R_2)	1	2	3	4	5	6	7	8	9	10

Person	R_1	R_2	$D = R_1 - R_2$	D^2
A	9	1	8	64
B	10	2	8	64
C	6	3	3	9
D	5	4	1	1
E	7	5	2	4
F	2	6	-4	16
G	4	7	-3	9
H	8	8	0	0
I	1	9	-8	64
J	3	10	-7	49
				$\Sigma D^2 = 280$

Coefficient of Rank correlation

$$\gamma = 1 - \frac{6\Sigma D^2}{n(n^2-1)}$$

$$= 1 - \frac{6 \times 280}{10 \times 99}$$

$$\gamma = -0.6969$$

Q. 2 *Ten competitors in a beauty contest were ranked by three judges in the following orders:*

	A	B	C	D	E	F	G	H	I	J
First Judge:	1	6	5	10	3	2	4	9	7	8
Second Judge:	3	5	8	4	7	10	2	1	6	9
Third Judge:	6	4	9	8	1	2	3	10	5	7

Use the method of rank correlation to determine which pair of judges has the nearest approach to common taste in beauty ?

$$\gamma_{12} = 1 - \frac{6\sum D_{12}^2}{n(n^2-1)}$$

$$\gamma_{12} = 1 - \frac{6 \times 20}{10 \times 99}$$

$$\gamma_{12} = -0.212$$

$$\gamma_{13} = 1 - \frac{6\sum D_{13}^2}{n(n^2-1)}$$

$$= 1 - \frac{6 \times 60}{10 \times 99}$$

$$\gamma_{13} = 0.636$$

$$\gamma_{23} = 1 - \frac{6\sum D_{23}^2}{n(n^2-1)}$$

$$= 1 - \frac{6 \times 214}{10 \times 99}$$

$$\gamma_{23} = -0.296$$

Hence, First and third judges has the nearest approach.

competitors	R_1	R_2	R_3	$D_{12} = R_1 - R_2$	$D_{13} = R_1 - R_3$	$D_{23} = R_2 - R_3$	D_{12}^2	D_{13}^2	D_{23}^2
A	1	3	6	−2	−5	−3	4	25	9
B	6	5	4	1	2	1	1	4	1
C	5	8	9	−3	−4	−1	9	16	1
D	10	4	8	6	2	−4	36	4	16
E	3	7	1	−4	2	6	16	4	36
F	2	10	2	−8	0	8	64	0	64
G	4	2	3	2	1	−1	4	1	1
H	9	1	10	8	−1	−9	64	1	81
I	7	6	5	1	2	1	1	4	1
J	8	9	7	−1	1	2	1	1	4
							$\Sigma D_{12}^2 = 200$	$\Sigma D_{13}^2 = 60$	$\Sigma D_{23}^2 = 214$

Type – 2 : Where Rank is not given

Q.3 Ten students got the following perentage of marks in Chemistry and Physics :

Students:	1	2	3	4	5	6	7	8	9	10
Marks in Chemistry	78	36	98	25	75	82	90	62	65	39
Marks in Physics	84	51	91	60	68	62	86	58	63	47

Calculate the rank correlation co-efficient.

$n = 10$

$\Sigma D^2 = 26$

$$\gamma = 1 - \frac{6\Sigma D^2}{n(n^2-1)}$$

$$\gamma = 1 - \frac{6 \times 26}{10 \times 99}$$

$$\gamma = 0.84$$

Students	MARKS (chem)	R_1	MARKS (Phy)	R_2	$D = R_1 - R_2$	D^2
1	78	4	84	3	1	1
2	36	9	51	9	0	0
3	98	1	91	1	0	0
4	25	10	60	7	3	9
5	75	5	68	4	1	1
6	82	3	62	6	-3	9
7	90	2	86	2	0	0
8	62	7	58	8	-1	1
9	65	6	63	5	1	1
10	39	8	47	10	-2	4
						$\Sigma D^2 = 26$

Q.4 ***Find the rank correlation coefficient of marks of A and B from the following data:*** **(AKTU-2016)**

Marks A:	15	20	27	13	45	60	20	75
Marks B:	50	30	55	30	25	10	30	70

Students	MARKS A	R_1	MARKS B	R_2	$D = R_1 - R_2$	D^2
1	15	7	50	3	4	16
2	20(5)	5.5	30(4)	5	0.5	0.25
3	27	4	55	2	2	4
4	13	8	30(5)	5	3	9
5	45	3	25	7	−4	16
6	60	2	10	8	−6	36
7	20(6)	5.5	30(6)	5	0.5	0.25
8	75	1	70	1	0	0
						$\Sigma D^2 = 81.5$

$$\frac{5+6}{2} = \frac{11}{2} = 5.5$$

$$\frac{4+5+6}{3} = \frac{15}{3} = 5$$

$20 \longrightarrow 2$

$m_1 = 2$

$30 \longrightarrow 3$

$m_2 = 3$

coefficient of rank correlation

$$\gamma = 1 - \frac{6(\Sigma D^2 + F)}{n(n^2-1)} \quad \text{---- (1)}$$

$$F = \frac{m_1(m_1^2-1)}{12} + \frac{m_2(m_2^2-1)}{12}$$

$$F = \frac{2(4-1)}{12} + \frac{3(9-1)}{12}$$

$$F = \frac{\cancel{6}}{\cancel{12}_2} + \frac{\cancel{24}^2}{\cancel{12}}$$

$$F = 2.5$$

From (1)

$$\gamma = 1 - \frac{6(81.5+2.5)}{8(64-1)}$$

$$\gamma = 1 - \frac{6 \times 84}{8 \times 63}$$

$$\gamma = 1 - 1 = 0$$

$$\boxed{\gamma = 0}$$

Engineering Mathematics by Gulshan Sir

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Topic : Rank Correlation

Q.1 *Obtain the rank correlation co – efficient for the following data*

X	68	64	75	50	64	80	75	40	55	64
Y	62	58	68	45	81	60	68	48	50	70

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Thank You

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