Q. Calculating Spearman's Coefficient Correlation using the Third Method.

{Allocating Ranks when numbers are repeating}.

S.No	X	R_1	Y	R_2	$D\{R_1-R_2\}$	D^2
1	20	8	28	3	5	25
2	22	7	24	7.5	-0.5	0.25
3	28	3	24	7.5	-4.5	20.25
4	23	5.5	25	6	-0.5	0.25
5	30	1.5	26	5	-3.5	12.25
6	30	1.5	27	4	-2.5	6.25
7	23	5.5	32	1	4.5	20.25
8	24	4	30	2	2	4

$\Sigma D^2 = 88.5$

$N = 8$

Step 1: Allocating ranks. In column X, 30 is at two places. So we use the following formula for ranking:

{We're going from highest to the lowest value}

$$\frac{1st + 2nd}{2} = 3/2 = 1.5$$

Next, 23 is also at two places:

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

Now we take the second column Y:
We will rank the values again from the highest value to the lowest value.

24 is at two places so we apply the formula:

$$\frac{7+8}{2} = \frac{15}{2} = 7.5$$

Step 2: Calculate $D\{R_1 - R_2\}$

Step 3: Calculate D^2, Obtain ΣD^2.

Step 4: Put values in the formula;

$$R = 1 - \frac{6\left\{\Sigma D^2 + \frac{1}{12}(n_1^3 - n_1) + \frac{1}{12}(n_2^3 - n_2) + \cdots\right\}}{N^3 - N}$$

Here n_1 = is the number of times the first value is repeating. In this example it is 30 {first value which is repeating} which is existing 2 times.
So, $n_1 = 2$ {In column X}.

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Similarly n_2 = is the second value is 23, which is existing at 2 places, so $n_2 = 2$ {In column X}

likewise, n_3 is the third number which is repeating 2 times and it is 24.

So $n_3 = 2$ {In column Y}.

$$R = 1 - \frac{6\left\{00.5 + \frac{1}{12}(2^3-2) + \frac{1}{12}(2^3-2) + \frac{1}{12}(2^3-2)\right\}}{8^3 - 8}$$

$$1 - \frac{6\left\{00.5 + \frac{1}{12}(6) + \frac{1}{12}(6) + \frac{1}{12}(6)\right\}}{512 - 8}$$

$$1 - \frac{6\left\{00.5 + \frac{1}{2} + \frac{1}{2} + \frac{1}{12}\right\}}{504}$$

$$= 1 - \frac{6 \times 90}{504}$$

$$= 1 - \frac{540}{504}$$

$$= 1 - 1.0714$$

$$R = -0.0714$$