Bivariate Correlation

Pearson Correlation Coefficient $r = \frac{\sum_{i=1}^{n}(xi-xbar)(yi-ybar)}{\sqrt{\sum_{i=1}^{n}(xi-xbar)^2 \sum_{i=1}^{n}(yi-ybar)^2}}$

xbar = mean of variable X = $\frac{\sum x}{n}$

ybar = mean of variable Y = $\frac{\sum y}{n}$

Example 1:

The following table shows the student degree in statistics and science. Find out the correlation factor among them.

Student	1	2	3	4	5	6	7	8	9	10
Statistics	20	23	8	29	14	12	11	20	17	18
Science	20	25	11	24	23	16	12	21	22	26

	A	B	C	D	E	F	G	H
1	Student	**statistics**	**science**	**x-xbar**	**(x-xbar)^2**	**y-ybar**	**(y-ybar)^2**	**(x-xbar)(y-ybar)**
2	1	20	20	2.8	7.84	0	0	0
3	2	23	25	5.8	33.64	5	25	29
4	3	8	11	-9.2	84.64	-9	81	82.8
5	4	29	24	11.8	139.24	4	16	47.2
6	5	14	23	-3.2	10.24	3	9	-9.6
7	6	12	16	-5.2	27.04	-4	16	20.8
8	7	11	12	-6.2	38.44	-8	64	49.6
9	8	20	21	2.8	7.84	1	1	2.8
10	9	17	22	-0.2	0.04	2	4	-0.4
11	10	18	26	0.8	0.64	6	36	4.8
12	Mean=	**17.2**	**20**		**349.6**		**252**	**227**
13				SQRT=	18.69759343	SQRT=	15.874508	
14						**296.815094**		
15					Coefficient r=	0.7647859		

Example 2:

Find the coefficient of correlation between the Intelligence Ratio (IT) and Emotional Ration (ER) from the following data.

Student	1	2	3	4	5	6	7	8	9	10
IR	105	104	102	101	100	99	98	96	93	32
ER	101	103	100	98	95	96	104	98	97	94

	A	B	C	D	E	F	G	H
1	Student	IR	ER	x-xbar	(x-xbar)^2	y-ybar	(y-ybar)^2	(x-xbar)(y-ybar)
2	1	105	101	6	36	2.4	5.76	14.4
3	2	104	103	5	25	4.4	19.36	22
4	3	102	100	3	9	1.4	1.96	4.2
5	4	101	98	2	4	-0.6	0.36	-1.2
6	5	100	95	1	1	-3.6	12.96	-3.6
7	6	99	96	0	0	-2.6	6.76	0
8	7	98	104	-1	1	5.4	29.16	-5.4
9	8	96	98	-3	9	-0.6	0.36	1.8
10	9	93	97	-6	36	-1.6	2.56	9.6
11	10	92	94	-7	49	-4.6	21.16	32.2
12	Mean=	**99**	**98.6**		**170**		**100.4**	**74**
13				SQRT=	13.03840481	SQRT=	10.01998	
14						**130.644556**		
15					Coefficient r=	0.56642238		

Example 3:

Calculate the correlation coefficient x and y using the following data.

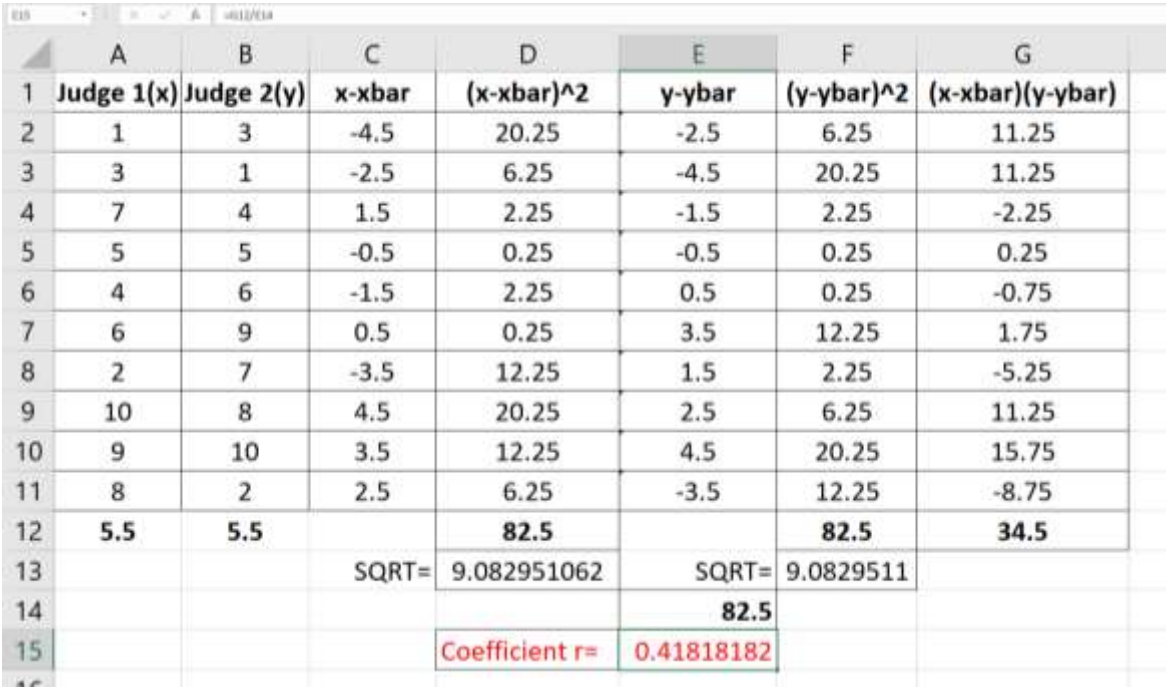
x	2	4	5	6	8	11
y	18	12	10	8	7	5

	A	B	C	D	E	F	G
1	**x**	**y**	**x-xbar**	**(x-xbar)^2**	**y-ybar**	**(y-ybar)^2**	**(x-xbar)(y-ybar)**
2	2	18	-4	16	8	64	-32
3	4	12	-2	4	2	4	-4
4	5	10	-1	1	0	0	0
5	6	8	0	0	-2	4	0
6	8	7	2	4	-3	9	-6
7	11	5	5	25	-5	25	-25
8	**6**	**10**		**50**		**106**	**-67**
9			SQRT=	7.071067812	SQRT=	10.29563	
10					**72.8010989**		
11				Coefficient r=	-0.9203158		

Example 4:

10 participants in a contest are ranked by two judges as follows.

x	1	3	7	5	4	6	2	10	9	8
y	3	1	4	5	6	9	7	8	10	2

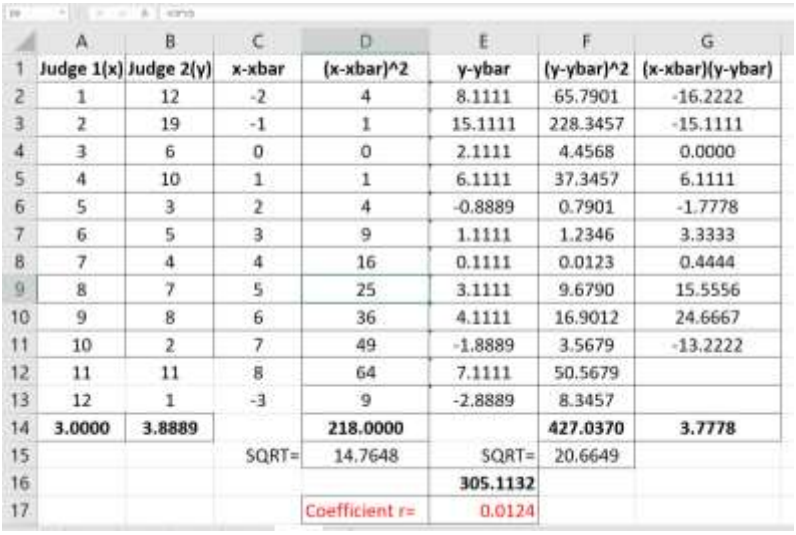


	A	B	C	D	E	F	G
1	**Judge 1(x)**	**Judge 2(y)**	**x-xbar**	**(x-xbar)^2**	**y-ybar**	**(y-ybar)^2**	**(x-xbar)(y-ybar)**
2	1	3	-4.5	20.25	-2.5	6.25	11.25
3	3	1	-2.5	6.25	-4.5	20.25	11.25
4	7	4	1.5	2.25	-1.5	2.25	-2.25
5	5	5	-0.5	0.25	-0.5	0.25	0.25
6	4	6	-1.5	2.25	0.5	0.25	-0.75
7	6	9	0.5	0.25	3.5	12.25	1.75
8	2	7	-3.5	12.25	1.5	2.25	-5.25
9	10	8	4.5	20.25	2.5	6.25	11.25
10	9	10	3.5	12.25	4.5	20.25	15.75
11	8	2	2.5	6.25	-3.5	12.25	-8.75
12	**5.5**	**5.5**		**82.5**		**82.5**	**34.5**
13			SQRT=	9.082951062	SQRT=	9.0829511	
14					**82.5**		
15				Coefficient r=	0.41818182		

Example 4:

Two judges in a beauty contest rank the 12 contestants as follows.

x	1	2	3	4	5	6	7	8	9	10	11	12
y	12	19	6	10	3	5	4	7	8	2	11	1



	A	B	C	D	E	F	G
1	**Judge 1(x)**	**Judge 2(y)**	**x-xbar**	**(x-xbar)^2**	**y-ybar**	**(y-ybar)^2**	**(x-xbar)(y-ybar)**
2	1	12	-2	4	8.1111	65.7901	-16.2222
3	2	19	-1	1	15.1111	228.3457	-15.1111
4	3	6	0	0	2.1111	4.4568	0.0000
5	4	10	1	1	6.1111	37.3457	6.1111
6	5	3	2	4	-0.8889	0.7901	-1.7778
7	6	5	3	9	1.1111	1.2346	3.3333
8	7	4	4	16	0.1111	0.0123	0.4444
9	8	7	5	25	3.1111	9.6790	15.5556
10	9	8	6	36	4.1111	16.9012	24.6667
11	10	2	7	49	-1.8889	3.5679	-13.2222
12	11	11	8	64	7.1111	50.5679	
13	12	1	-3	9	-2.8889	8.3457	
14	**3.0000**	**3.8889**		**218.0000**		**427.0370**	**3.7778**
15			SQRT=	14.7648	SQRT=	20.6649	
16					**305.1132**		
17				Coefficient r=	0.0124		