Simple Correlation

For

M.Ed. And M.A. (Education) Classes

Dr. Arun Kumar
Associate Professor – Education
Email: drarunlu@gmail.com

Definition of Correlation

According to Ferguson:

Correlation is connected with describing the degree of relation between variables.

Correlation is used to examine the relationship between of one variables to another than to measure performance in either alone.

Simple correlation: Linear- Represented by straight line
Expressed by- "Product moment" Coefficient of correlation
Designated by- "r" letter

Type of correlation

1. **Positive Correlation** : positive correlation indicates that large amount of one variables tends to accompany large amount of the others.
2. **Negative Correlation**: Negative correlation indicates that the small amount of one variables tend to accompany large amount of the other
3. **Zero Correlation**: It indicate no consistent relationship

Degree of coefficient of correlation

S.N.	Correlation (r)	Positive	Negative
1.	Perfect	+1.00	-1.00
2.	Very high	+.81 to .99	-.81 to -.99
3.	Moderate	+.61 to .80	-.61 to -.80
4.	Average	+.41 to .60	-.41 to -.60
5.	Low	+.21 to .40	-.21 to -.40
6.	Negligible	+.01 to .20	-.01 to -.20
7.	No Co relation	0.00	0.00

If the number of cases is small the nature of Correlation can be estimated on the basis of observation

- Case-1
- r=+1

A	B
25	73
24	66
23	52
22	40
21	35
20	30

Case-2
r=-1

A	B
25	30
24	35
23	40
22	52
21	66
20	73

Case-3
r=-1 to +1

A	B
25	66
24	40
23	73
22	52
21	30
20	35

Rank difference/ Spearman's method of correlations

S.N.	Student	Math (X)	Science (Y)	Rx	Ry	D	D^2
1.	A.	30	25	2	1	1	1
2.	B	26	23	4	3.5	.5	.25
3.	C	33	24	1	2	1	1
4.	D	24	20	5	5	0	0
5.	E	20	13	6	7	1	1
6.	F	18	16	7	6	1	1
7.	G	28	23	3	3.5	.5	.25
N	7					ΣD^2= 4.50	

$$\mu = \text{Rho} = 1 - \frac{\Sigma 6d^2}{N(N^2-1)}$$

$$\mu = \text{Rho} = 1 - \frac{6 \times 4.5}{7(7^2-1)}$$

$$\mu = \text{Rho} = 1 - \frac{6 \times 4.5}{7 \times 48}$$

$$\mu = 1 - \frac{4.5}{56}$$

$$\mu = 1 - 0.08$$

$$\mu = 0.92$$

Highly Positive Correlation

Fixed relations/ Perfect relation

- Example 1.
- Circle = 2pi.r
- r=1

Coefficient of correlation

Product moment correlation may be-

As ratio : which express the extent to which changes in one variable is accompanied by- or are dependent upon - changes in a second variables.

Coefficient of correlation as ratio
Example: Between Height and Weight

Student	Ht. in Inches (X)	Wt. in Kg. (Y)	x	y	xy	x/σx	y/σy	x/σx * y/σy
A	75	172	3	0	0	1.5	0.00	0.00
B	72	168	0	-4	0	0	-0.33	0.00
C	69	152	-3	-20	60	-1.5	-1.67	2.50
D	73	182	1	10	10	.5	0.83	0.42
E	71	186	-1	14	-14	-.5	1.17	-0.59
	Mx=72	My=172			56			2.33

$\sigma x = \sqrt{\Sigma x^2 / N} = 2$
$\sigma y = \sqrt{\Sigma y^2 / N} = 11.93$

r=2.33/5=.466

- Mx= 72
- My=172
- σx= 2
- σy=11.93

$$\text{Correlation} = \frac{\Sigma\left[\frac{x}{\sigma x} \times \frac{y}{\sigma y}\right]}{N}$$

$$r = \frac{2.33}{5} = .466$$

Average positive correlation

Calculation of (r) from ungrouped data by the difference formula(Deviation from the means)

S.N.	X	Y	x	y	d(x–y)	x²	y²	d²
1	40	20	–12.5	–8.4	–4.1	156.25	70.56	16.81
2	44	23	–8.5	–5.4	–3.1	72.75	29.16	9.61
3	46	32	–6.5	3.6	10.1	42.25	12.96	102.01
4	49	26	–3.5	–2.4	–1.1	12.25	5.76	1.21
5	50	24	–2.5	–4.4	1.9	6.25	19.36	3.61
6	52	28	–.5	–.4	–.1	0.25	.16	.01
7	51	30	1.5	1.6	–3.1	2.25	2.56	9.61
8	55	28	2.5	–.4	2.9	6.25	.16	8.41
9	57	26	4.5	–2.4	6.9	20.25	5.76	47.61
10	61	32	8.5	3.6	4.9	72.25	12.96	24.01
11	61	34	8.5	5.6	2.9	72.25	31.36	8.41
12	64	38	11.5	9.6	1.9	132.25	92.16	3.61
	630	344				595.00	282.92	234.92

$$r = \frac{\Sigma x^2 + \Sigma y^2 + \Sigma d^2}{2\sqrt{\Sigma x^2 \times \Sigma y^2}}$$

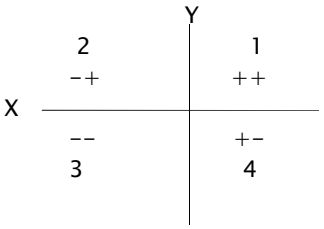
$$r = \frac{595 + 282.92 + 234.92}{2\sqrt{595 \times 282.92}}$$

$$r = \frac{877.92 + 234.92}{643}$$

r = 0.78 Moderate positive correction

The scatter diagram and correction table

- Use: When N is large, to save time and computational labour.



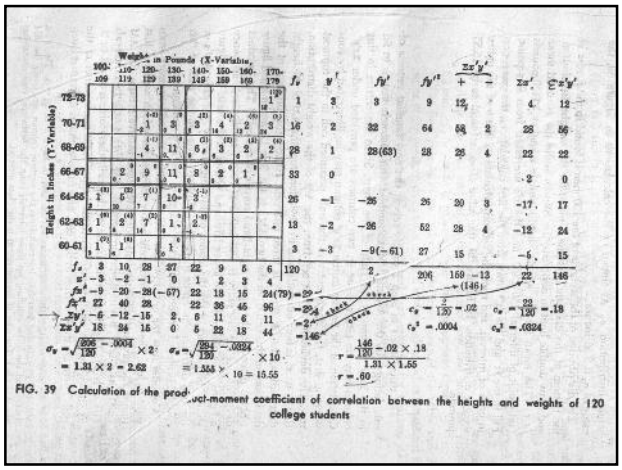


FIG. 39 Calculation of the product-moment coefficient of correlation between the heights and weights of 120 college students

Calculation of Coefficient of Correlation by Product Moment Correlation

Formula for Product moment correlation

$$r = \frac{N[\Sigma x^2 - \Sigma y^2 - \Sigma(x-y)^2] - 2(\Sigma x) \times (\Sigma y)}{2\sqrt{N[\Sigma x^2 - \Sigma x^2][N\Sigma y^2 - (\Sigma y)^2]}}$$

$$r = \frac{\Sigma x^2 + \Sigma y^2 + \Sigma d^2}{2\sqrt{\Sigma x^2 \times \Sigma y^2}}$$

$$r = \frac{595 + 282.92 + 234.92}{2\sqrt{595 \times 282.92}}$$

$$r = \frac{877.92 + 234.92}{643}$$

$$r = 0.78$$

r from ungrouped data calculation by assumed mean(AM)

S.N.	X	Y	x	y	x^2	y^2	xy
1	42	53	−20	−9	400	81	180
2	52	47	−10	−15	100	225	150
3	53	45	−9	−17	81	289	153
4	55	57	−7	−5	49	25	35
5	57	59	−5	−3	25	9	15
6	62	61	0	−1	0	1	0
7	65	62	3	0	9	0	0
8	70	67	5	5	25	25	25
9	72	71	10	9	100	81	90
10	77	79	15	17	225	289	255
			$\Sigma x = -18$	$\Sigma y = -19$	$\Sigma x^2 = 1014$	$\Sigma y^2 = 1025$	$\Sigma xy = 903$

AMx=62 AMy=62

$$r = \frac{N\ \Sigma xy^2 - 2x.2y}{\sqrt{[N\Sigma x^2 - (\Sigma x)^2]\,[N\Sigma y^2 - (\Sigma y)^2]}}$$

$$r = \frac{10 \times 903 - (-18) \times (-19)}{\sqrt{[10 \times 1014 - (-18)^2]\,[10 \times 1025 - (-19)^2]}}$$

$$r = \frac{9030 \times 342}{\sqrt{10140 - 324[10250 - 361]}}$$

$$r = \frac{8688}{\sqrt{9816 \times 9889}}$$

$$r = \frac{8688}{9852.43}$$

$$r = 0.88$$

Very high positive correlation

Thanks