PEARSON - R

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Correlated or not correlated?!

The number of sleeping hours and academic rank

NOT CORRELATED

Correlated or not correlated?!

The mental ability and general grade average

CORRELATED

Correlated or not correlated?!

Weight in pounds and reading ability

NOT CORRELATED

Correlated or not correlated?!

Amount of force and acceleration

CORRELATED

Correlated or not correlated?!

Height in feet and academic rank

NOT CORRELATED

Correlated or not correlated?!

Reading comprehension and economic status

NOT CORRELATED

Correlated or not correlated?!

Weight in kilograms and body mass index

CORRELATED

Correlated or not correlated?!

Temperature and altitude of a place

CORRELATED

The following are examples of correlated variables:

1. The students' mental ability and academic performance in school are related.
2. There is a close relationship between reading comprehension and mathematical ability.
3. In physics, the larger the force exerted to push a body, the faster the acceleration of the body will be.

The Pearson Product Moment Coefficient of Correlation (r)

Proponent

Karl Pearson

Karl Pearson (1857-1936)

- "Pearson Product-Moment Correlation Coefficient"
- mathematical statistics
- Eugenics
- A protégé and biographer of Sir Francis Galton.
- *Biometrika* with Galton

hat is ?

- the most common
- an index of relationship between two variables
- symbol *r*
- reflects the degree of linear relationship between two variables

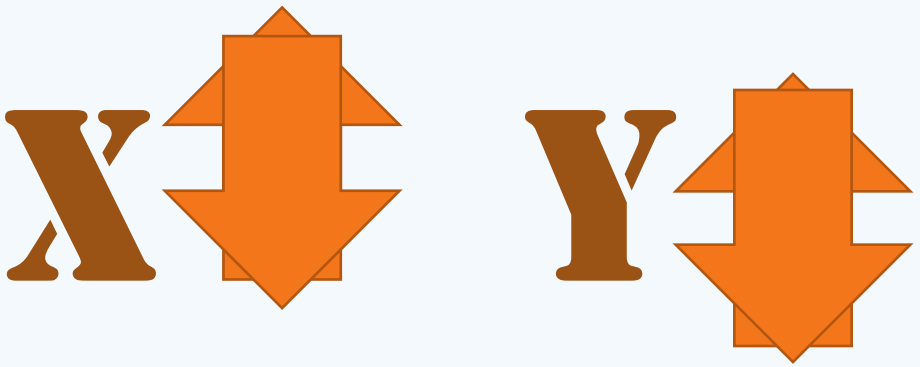
- It is symmetric. The correlation between x and y is the same as the correlation between y and x.
- It ranges from +1 to -1.

Three degrees of relationship or correlation between two variables.

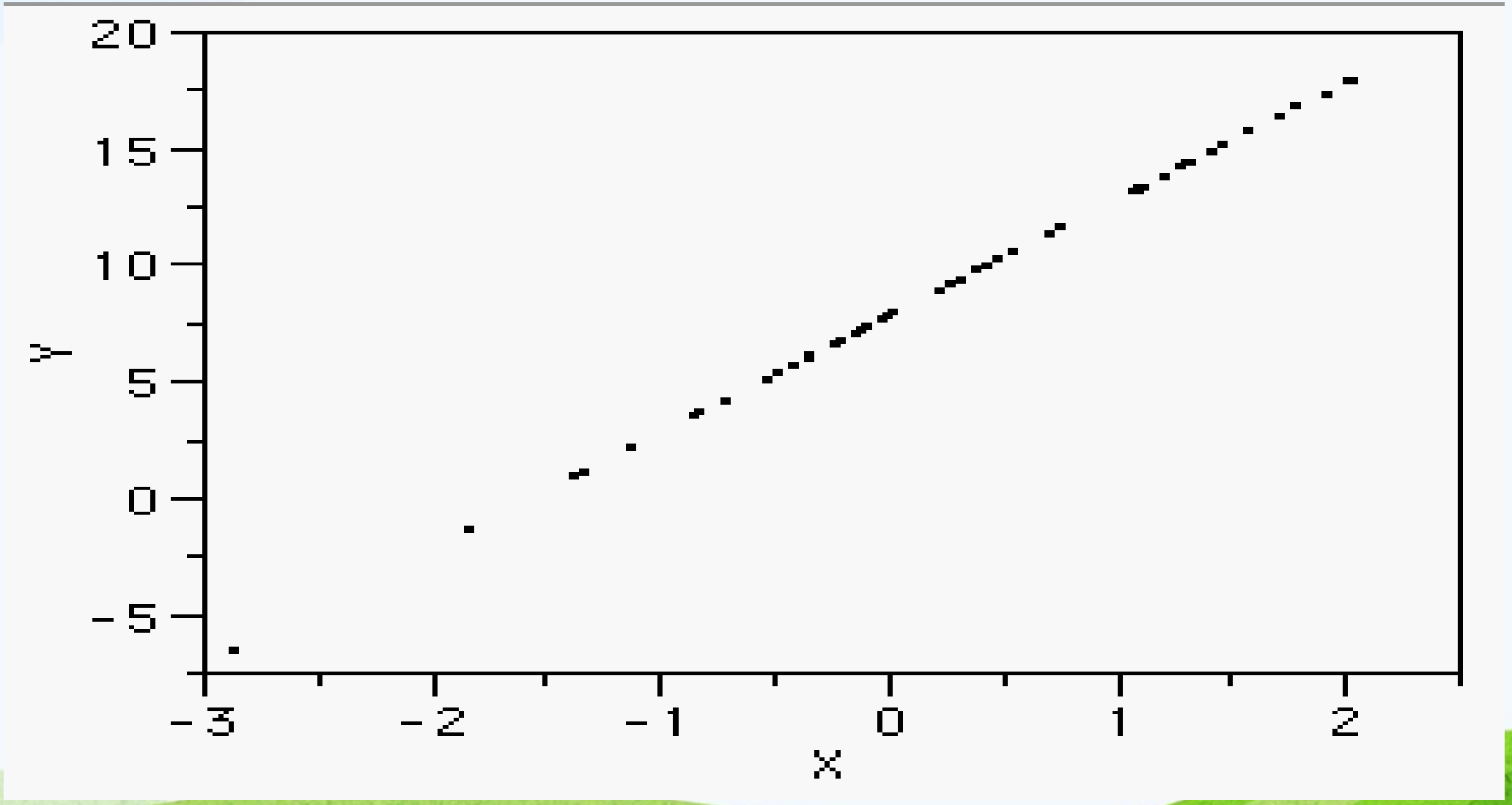
1. Perfect correlation (positive and negative)
2. Some degrees of correlation (positive and negative)
3. No correlation

correlation of +1

- there is a perfect positive linear relationship between variables

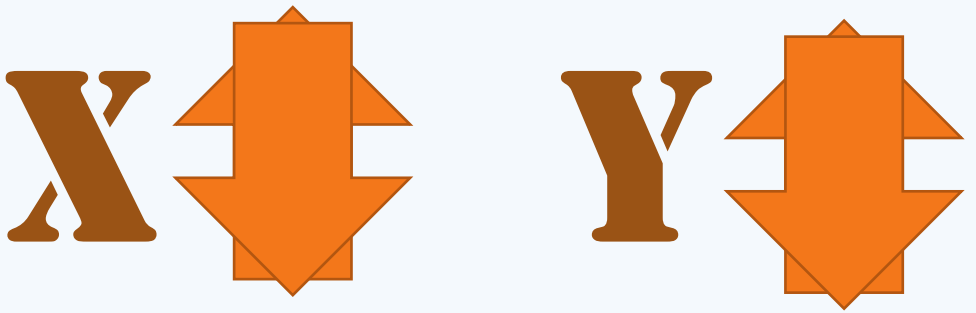


A perfect linear relationship, r = 1.

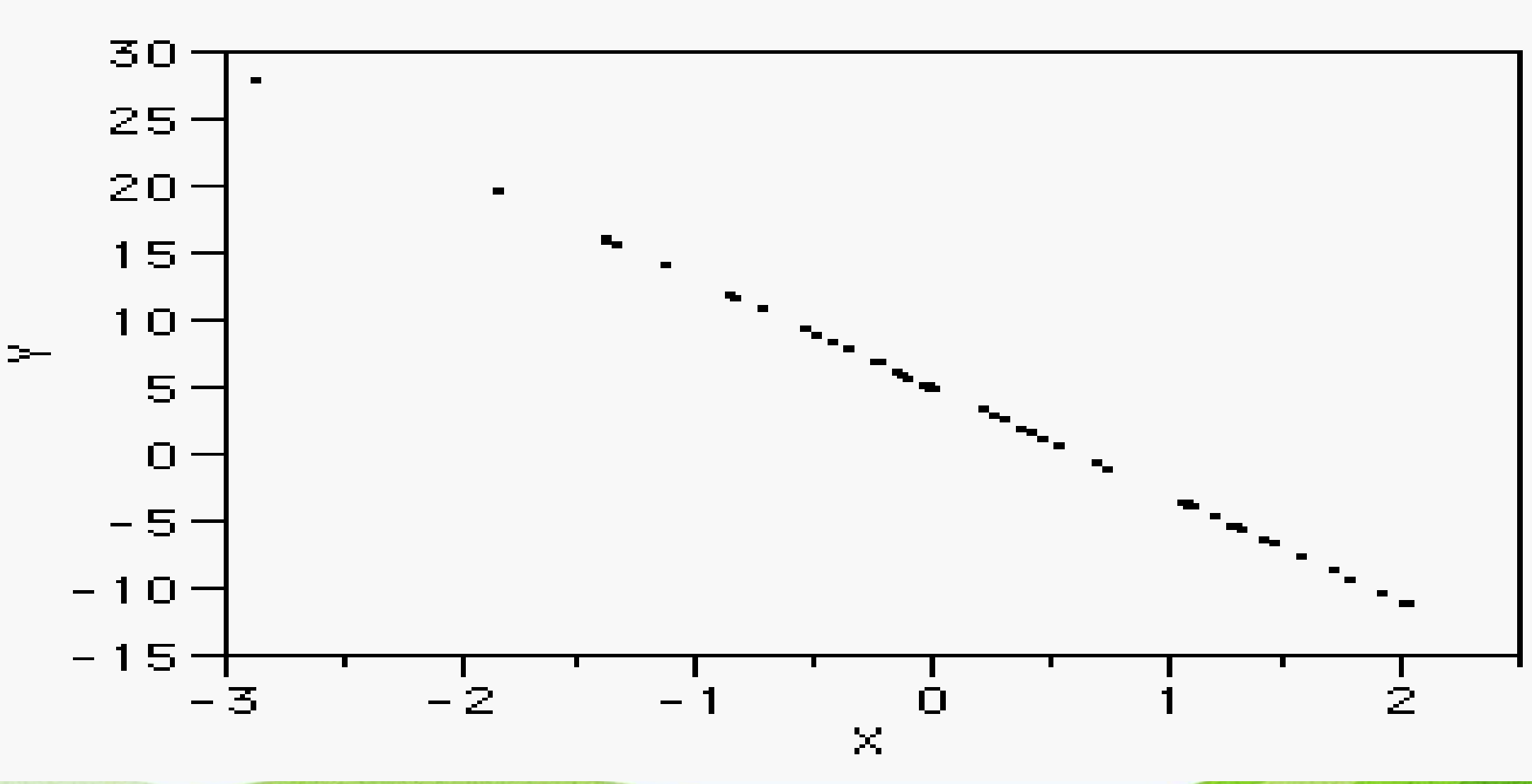


correlation of -1

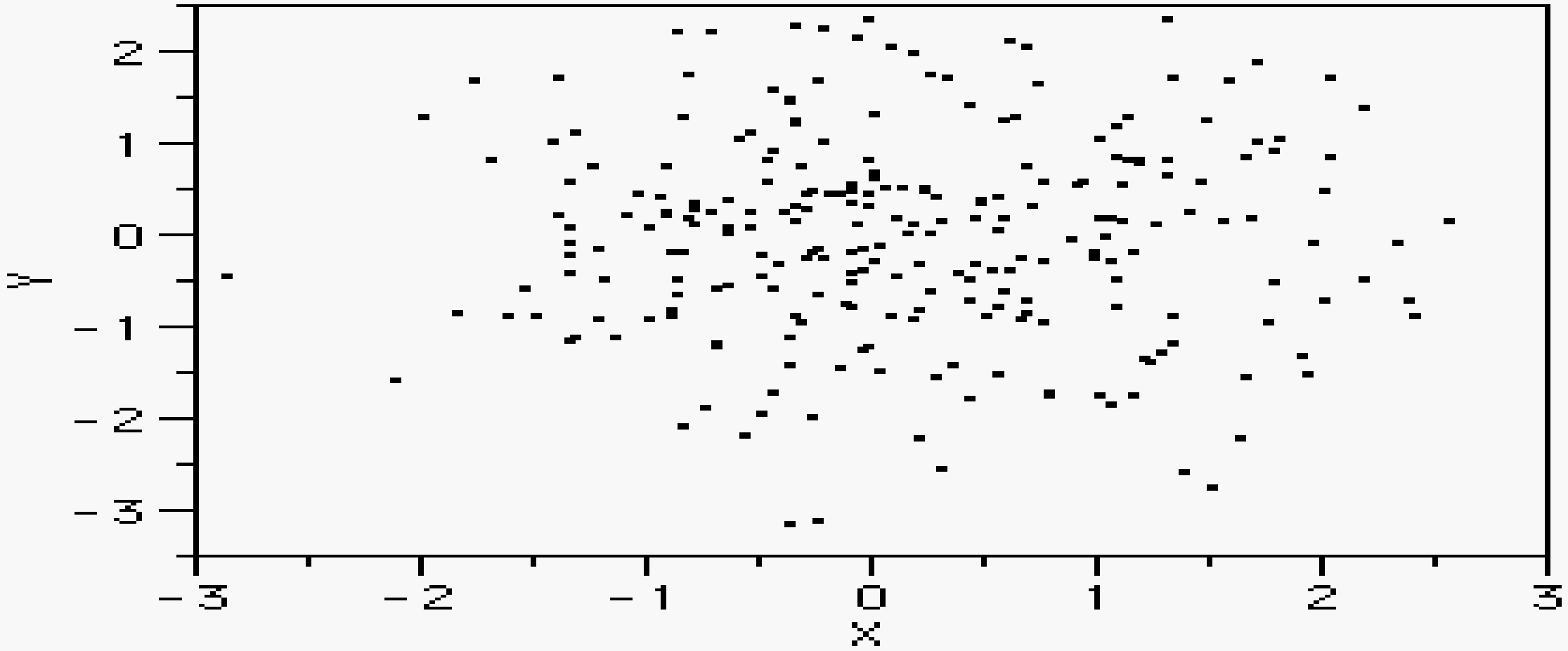
- there is a perfect negative linear relationship between variables



A perfect negative linear relationship, r = -1.



A correlation of 0 means there is no linear relationship between the two variables, r=0



- A correlation of .8 or .9 is regarded as a high correlation
  - there is a very close relationship between scores on one of the variables with the scores on the other

- A correlation of .2 or .3 is regarded as low correlation
  - there is some relationship between the two variables, but it's a weak one

-1 -.8 -.3 0 .3 .8 1

THE QUANTITATIVE INTERPRETATION OF R

r	Verbal Interpretation
0.00 - ±0.20	Slight correlation
±0.21 – ±0.40	Low correlation
±0.41 - ±0.60	Moderate correlation
±0.61 - ±0.80	High correlation
±0.81 - ±1.00	Very high correlation

Product-Moment Correlation Coefficient

Pearson r

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

Where:

N	=	number of pairs of scores
Σxy	=	sum of the products of paired scores
Σx	=	sum of x scores
Σy	=	sum of y scores
Σx^2	=	sum of squared x scores
Σy^2	=	sum of squared y scores

- The most common statistical tool in measuring the linear relationship between variables, x and y.
- This formula was developed and perfected by Karl Pearson

$$r = \frac{(N * \sum xy) - (\sum x * \sum y)}{\sqrt{[(N * \sum x^2) - (\sum x)^2][(N * \sum y^2) - (\sum y)^2]}}$$

EXAMPLE#1

Height and weight of 10 basketball players; find the Pearson r.

x (height in inches)	y (weight in kilos)	xy	x^2	y^2
65	65			
64	64			
78	70			
72	71			
69	65			
66	66			
70	68			
71	69			
70	70			
67	71			
$\Sigma x =$	$\Sigma y =$	$\Sigma xy =$	$\Sigma x^2 =$	$\Sigma y^2 =$

x (height in inches)	y (weight in kilos)	xy	x^2	y^2
65	65	4225	4225	4225
64	64	4096	4096	4096
78	70	5460	6084	4900
72	71	5112	5184	5041
69	65	4485	4761	4225
66	66	4356	4356	4356
70	68	4760	4900	4624
71	69	4899	5041	4761
70	70	4900	4900	4900
67	71	4757	4489	5041
$\Sigma x = 692$	$\Sigma y = 679$	$\Sigma xy = 47050$	$\Sigma x^2 = 48036$	$\Sigma y^2 = 46169$

Step 1: Ho: There is no significant relationship between height and weight of 10 basketball players.

Step 2: $\alpha = 0.05$, $N = 10$

Step 3: Pearson r

Step 4: $df = N - 2 = 8$

$r_{tabular} = .6319$

Values of r for the .05 and .01 Levels of Significance

$df(N-2)$	.05	.01	$df(N-2)$	.05	.01
1	.997	1.000	31	.344	.442
2	.950	.990	32	.339	.436
3	.878	.959	33	.334	.430
4	.812	.917	34	.329	.424
5	.755	.875	35	.325	.418
6	.707	.834	36	.320	.413
7	.666	.798	37	.316	.408
8	.632	.765	38	.312	.403
9	.602	.735	39	.308	.398
10	.576	.708	40	.304	.393
11	.553	.684	41	.301	.389
12	.533	.661	42	.297	.384
13	.514	.641	43	.294	.380
14	.497	.623	44	.291	.376
15	.482	.606	45	.288	.372
16	.468	.590	46	.285	.368
17	.456	.575	47	.282	.365
18	.444	.562	48	.279	.361
19	.433	.549	49	.276	.358
20	.423	.537	50	.273	.354
21	.413	.526	60	.250	.325
22	.404	.515	70	.232	.302
23	.396	.505	80	.217	.283
24	.388	.496	90	.205	.267
25	.381	.487	100	.195	.254
26	.374	.479	200	.138	.181
27	.367	.471	300	.113	.148
28	.361	.463	400	.098	.128
29	.355	.456	500	.088	.115
30	.349	.449	1000	.062	.081

r	Verbal Interpretation
0.00 – ±0.20	Slight correlation
±0.21 – ±0.40	Low correlation
±0.41 – ±0.60	Moderate correlation
±0.61 – ±0.80	High correlation
±0.81 – ±1.00	Very high correlation

Step 5:

$$r = \frac{(N * \sum xy) - (\sum x * \sum y)}{\sqrt{[(N * \sum x^2) - (\sum x)^2][(N * \sum y^2) - (\sum y)^2]}}$$

$$r = \frac{(10 * 47050) - (692 * 679)}{\sqrt{[(10 * 48036) - (692)^2][(10 * 46169) - (679)^2]}}$$

$r = 0.64$ High Correlation

Step 6: Since 0.64 > .6319, therefore reject the null hypothesis.

Step 7: There is a significant relationship between height and weight of 10 basketball players.

EXAMPLE #2

I. PROBLEM:

Is there a relationship between the midterm and the final examinations of 10 students in Mathematics?

n = 10

II. Hypothesis

- Ho: There is NO relationship between the midterm grades and the final examination grades of 10 students in mathematics
- Ha: There is a relationship between the midterm grades and the final examination grades of 10 students in mathematics

Degrees of Freedom:

$$df = N - 2$$
$$= 10 - 2$$
$$= 8$$

Testing for Statistical Significance:

Based on *df* and level of significance, we can find the value of its statistical significance.

X	Y	xy	x^2	y^2
75	80			
70	75			
65	65			
90	95			
85	90			
85	85			
80	90			
70	75			
65	70			
90	90			
□X =775	□Y =815			
X = 77.5	Y = 81.5			

V. Compare statistics

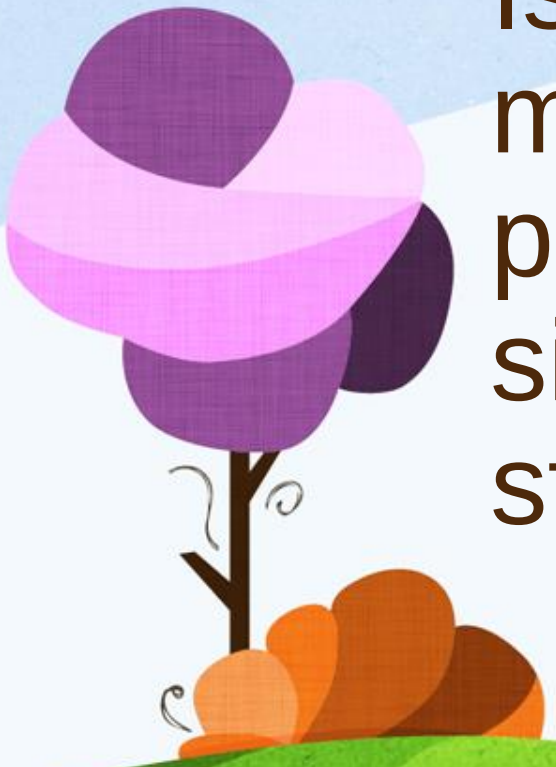
- **Decision rule: If the computed r value is greater than the r tabular value, reject Ho**

- In our example:
  - r.05 (critical value) = 0.632
  - Computed value of r =

VI. Conclusion / Implication

- There is a significant relationship between midterm grades of the students and their final examination.

PROBLEM:



Is there a relationship between mental ability and English proficiency at 5% level of significance among grade 7 students of HAU?

Please follow the stepwise method and show the following:

II. Hypothesis

- State the null hypothesis in words and in symbol
- State the alternative hypothesis in words and in symbol

III. Compute for the critical value

- use n = 17, $\alpha = 0.05$

IV. Compute the statistics

MENTAL ABILITY AND ENGLISH PROFICIENCY TEST SCORES:

MENTAL ABILITY (x)	ENGLISH PROFICIENCY (y)
50	200
54	198
50	200
51	203
49	186
46	205
48	185
47	197
44	183
44	171
46	179
45	185
48	184
53	190
54	191
33	170
34	168
$\Sigma x=$	$\Sigma y=$

Contd.

V. Compare the statistics

VI. State a conclusion

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MENTAL ABILITY (x)	ENGLISH PROFICIENCY (y)	xy	x^2	y^2
50	200	10 000	2 500	40 000
54	198	10 692	2 916	39 204
50	200	10 000	2 500	40 000
51	203	10 353	2 601	41 209
49	186	9 114	2 401	34 596
46	205	9 430	2 116	42 025
48	185	8 880	2 304	34 225
47	197	9 259	2 209	38 809
44	183	8 052	1 936	33 489
44	171	7 524	1 936	29 241
46	179	8 234	2 116	32 041
45	185	8 325	2 025	34 225
48	184	8 832	2 303	33 856
53	190	10 070	2 809	36 100
54	191	10 314	2 916	36 481
33	170	5 610	1 089	28 900
34	168	5 712	1 156	28 224
Σx=796	Σy=3, 195	Σxy = 150, 401	Σx2 = 37, 834	Σy2 = 602, 625

Answer key:

- *Ho:* **There is no significant relationship between mental ability and English proficiency among grade 7 students of HAU.** $H_o: r = 0$

- *Ha:* **There is a significant relationship between mental ability and English proficiency among grade 7 students of HAU.** $H_a: r \neq 0$

Answer key:

- Df = N – 2, 17 – 2 = 15
- tabular value: 0.482
- Computed r: 0.727 = 0.73
- 0.73 > 0.482, REJECT Ho
- There is a high correlation relationship between mental ability and English proficiency among grade 7 students of HAU .

References:

- Critical Values for Pearson's Correlation Coefficient

  Retrieved from: http://capone.mtsu.edu/dkfuller/tables/correlationtable.pdf

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