Medidas e Conceitos Estatísticos

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Níveis de Mensuração

	Exemplo
Nominal	**n.º de identidade**
Ordinal	**ordem de chegada**
de Intervalo	**temperatura (Celsius)**
de Razão	**temperatura (Kelvin)**

Modelo de Mensuração

Nível — **Variável**

- **Nominal**
- **Ordinal**

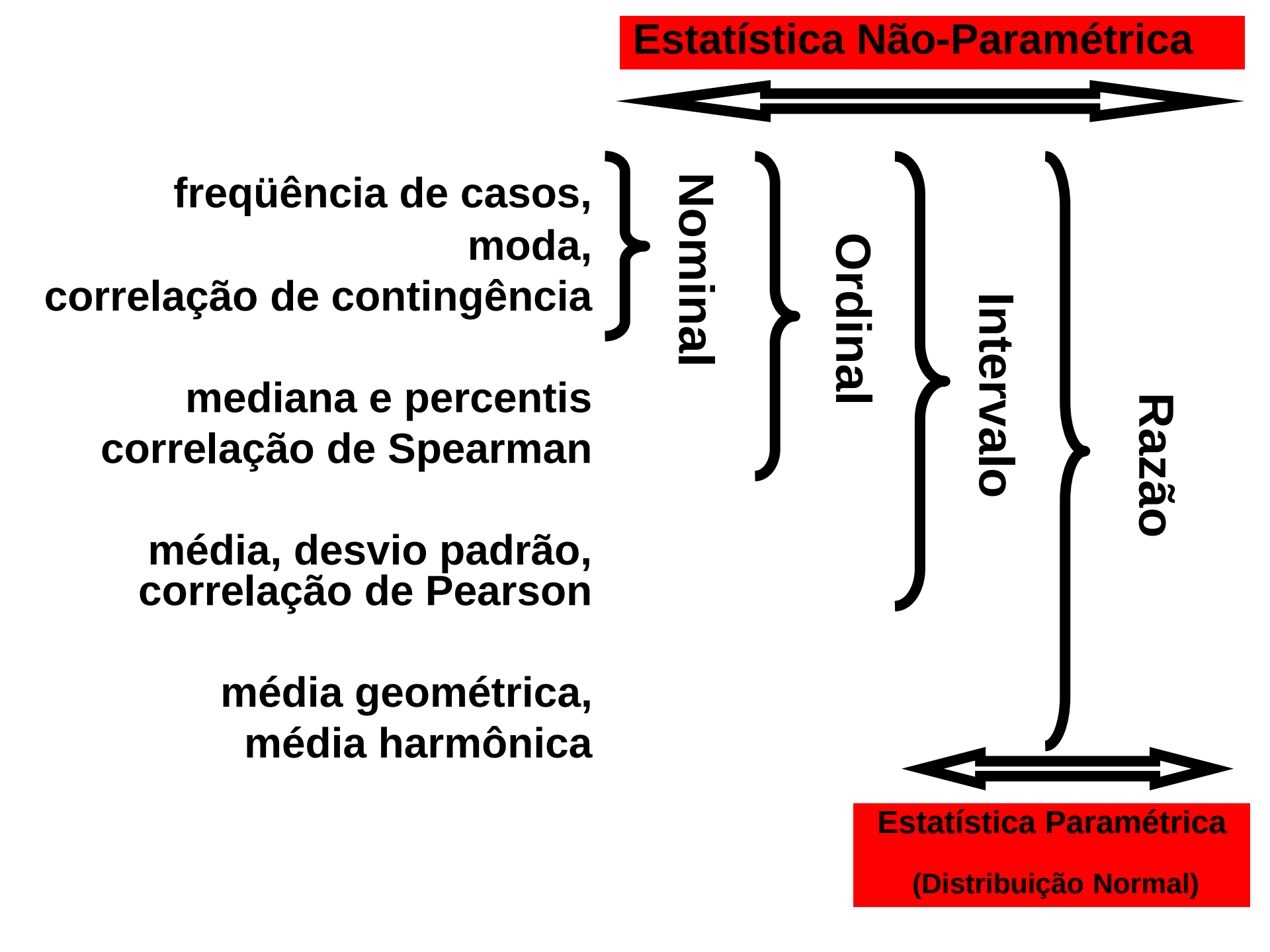
} **Discreta**

- **Intervalo**
- **Razão**

} **Contínua**

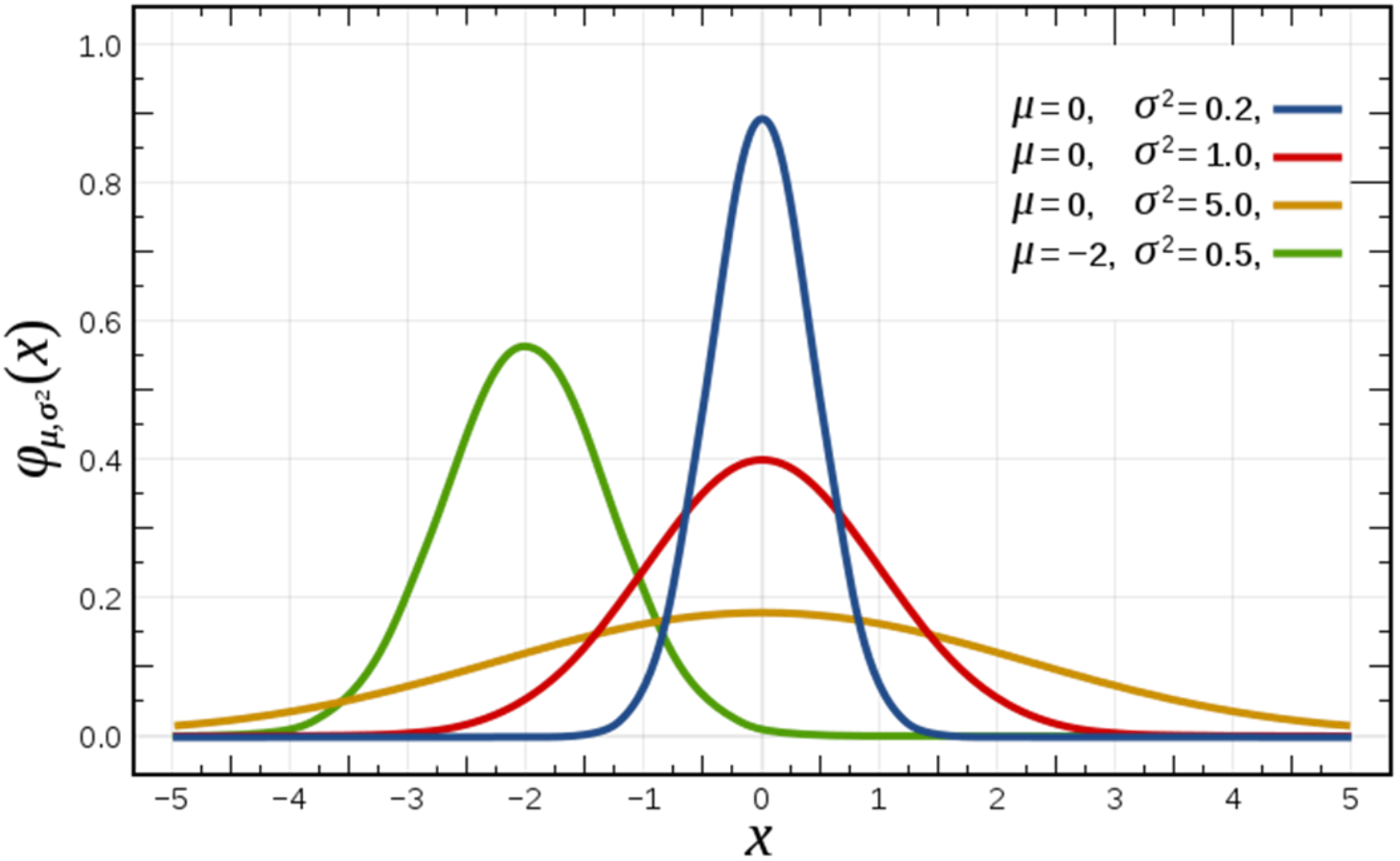
Stanley Smith Stevens (1906-1973)
Psicólogo – Havard University

Stevens, S.S. (1946). On the theory of scales of measurement. *Science*, 103, 677-680.

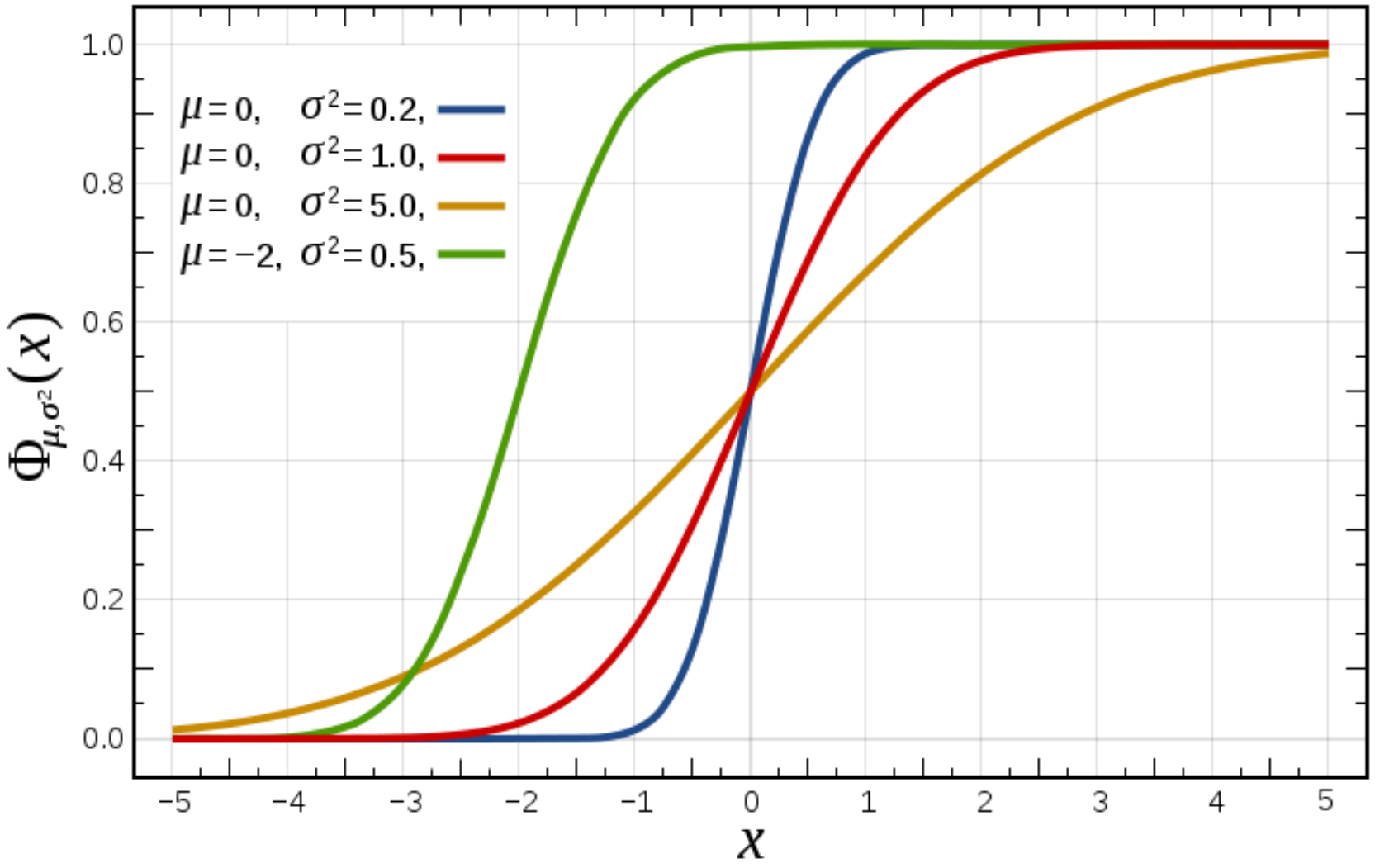

Estatística Não-Paramétrica
freqüência de casos,
moda,
correlação de contingência
mediana e percentis
correlação de Spearman
média, desvio padrão,
correlação de Pearson
média geométrica,
média harmônica
Nominal
Ordinal
Intervalo
Razão
Estatística Paramétrica
(Distribuição Normal)

Curva da Distribuição Normal

$$f(x, \mu, \sigma) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{\left(-\frac{(x-\mu)^2}{2\sigma^2}\right)}, -\infty < x < \infty, \sigma > 0.$$



Curva Acumulada da Distribuição Normal



Nota reduzida, Escore z

$$z = \frac{x - \mu}{\sigma}$$

$z \sim N(0,1)$

Transformação de escores com outras médias e desvios padrão

Nota padronizada = novo desvio padrão . z + nova média

ex.: z = 2

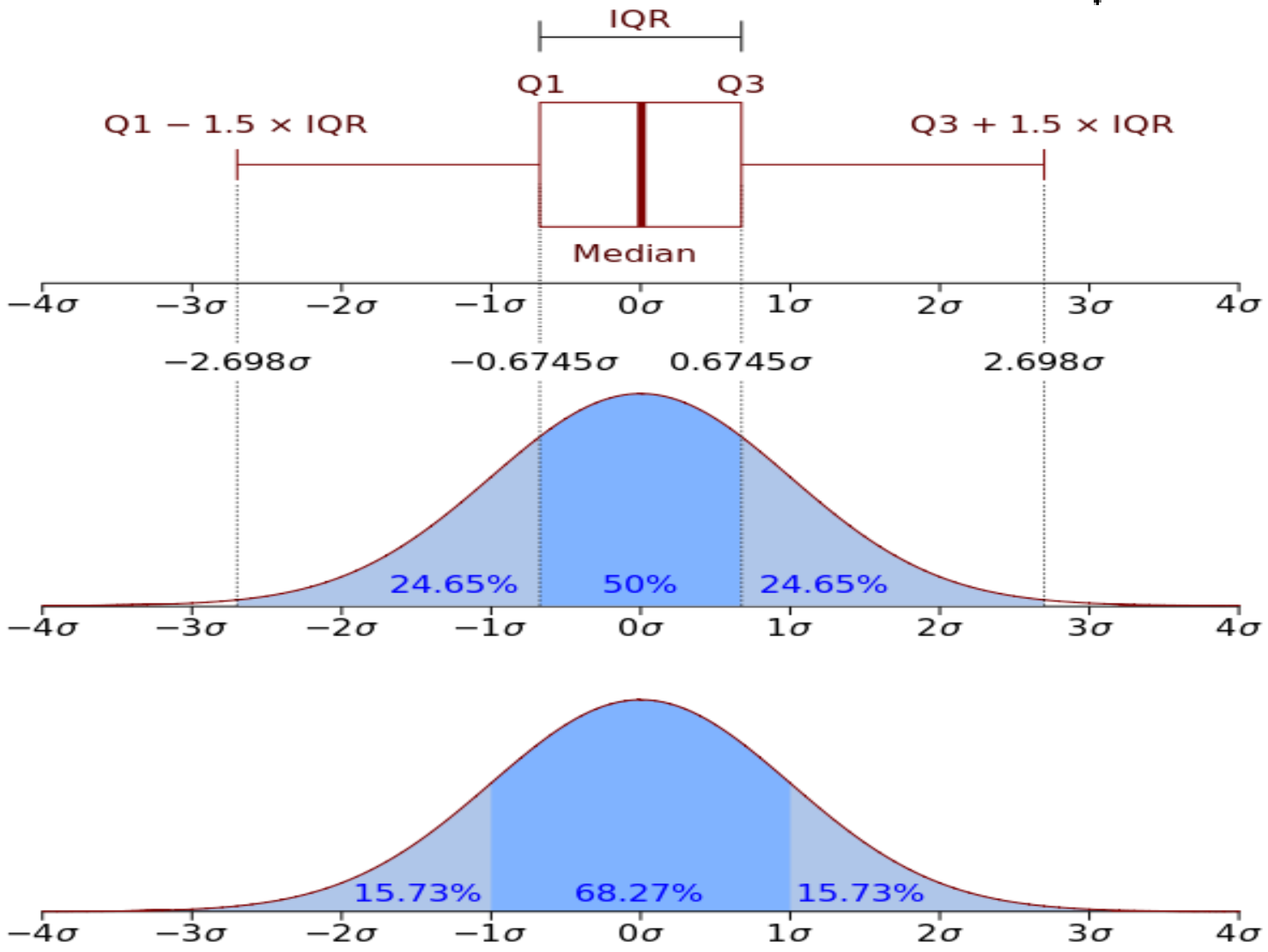
T = 10.z + 50 ~ N (50,10)

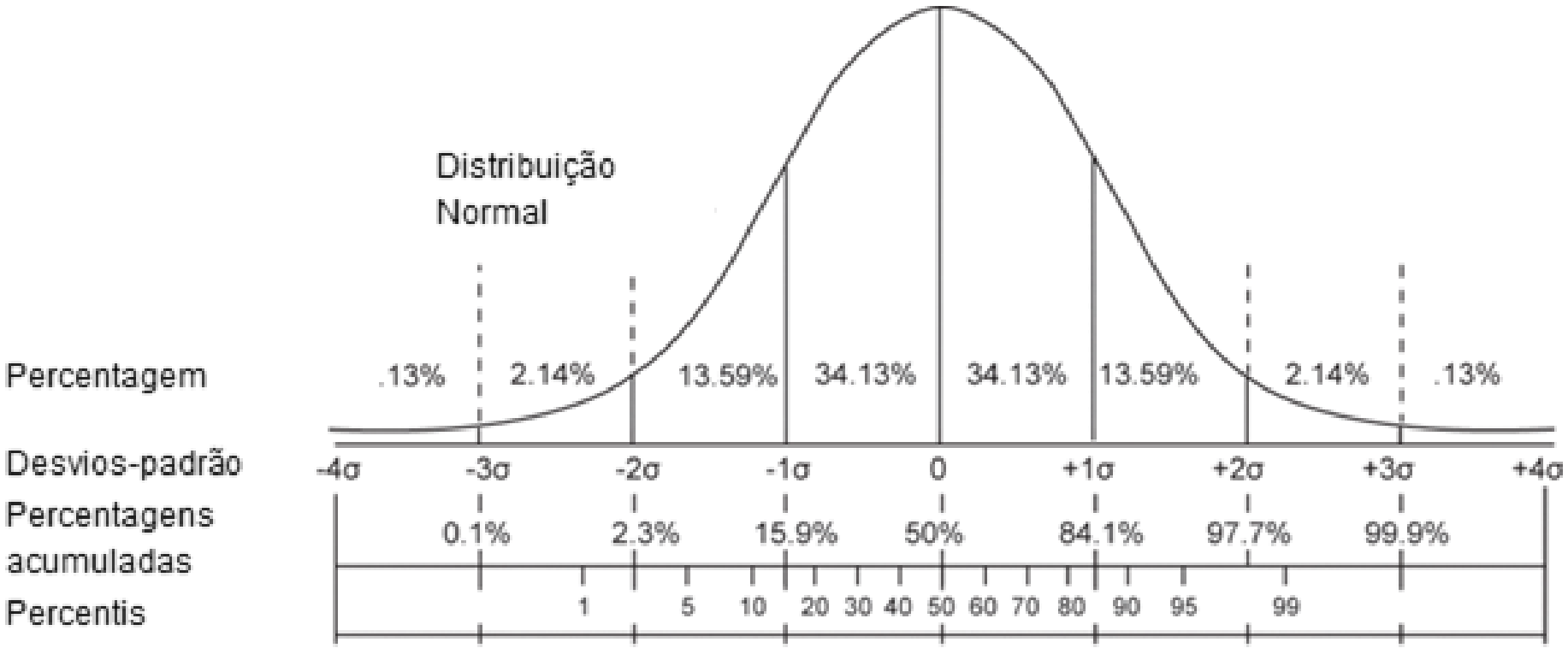
T = 20+50 = 70

Curva da Distribuição Normal Reduzida

N (0 , 1)

$$f(x) = \frac{1}{\sqrt{2\pi}} e^{\left(-\frac{x^2}{2}\right)}$$




Distribuição
Normal
Percentagem
.13%
2.14%
13.59%
34.13%
34.13%
13.59%
2.14%
.13%
Desvios-padrão
-4σ
-3σ
-2σ
-1σ
0
+1σ
+2σ
+3σ
+4σ
Percentagens
acumuladas
0.1%
2.3%
15.9%
50%
84.1%
97.7%
99.9%
Percentis
1
5
10
20
30
40
50
60
70
80
90
95
99

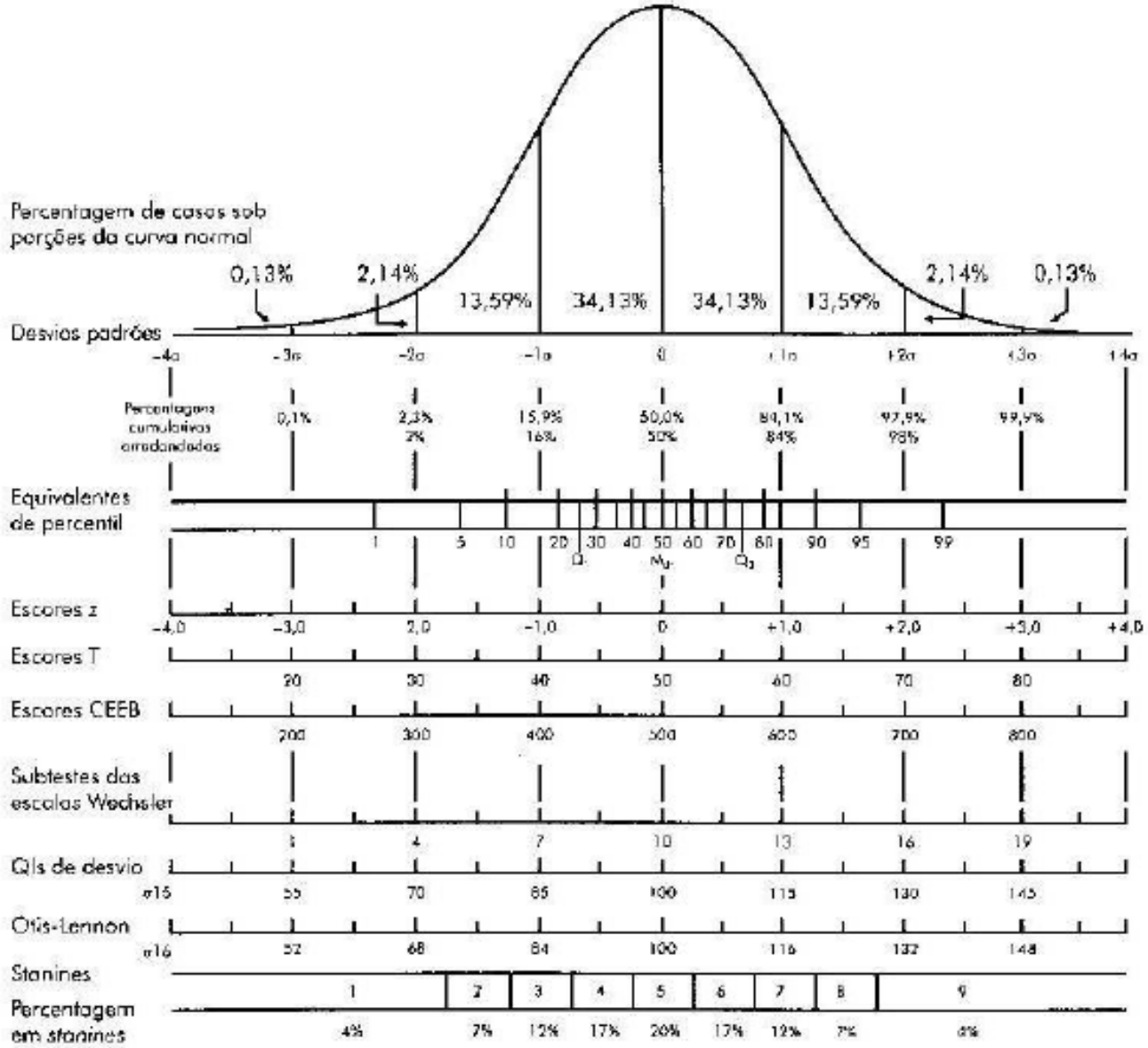


Figura 3.1 A curva normal, percentis e escores padrões selecionados.
Nota: Adaptado de *Test Service Notebook # 148* de The Psychological Corporation

TABLE 2.3. Language Development/Vocabulary Test Scores for 100 Individuals

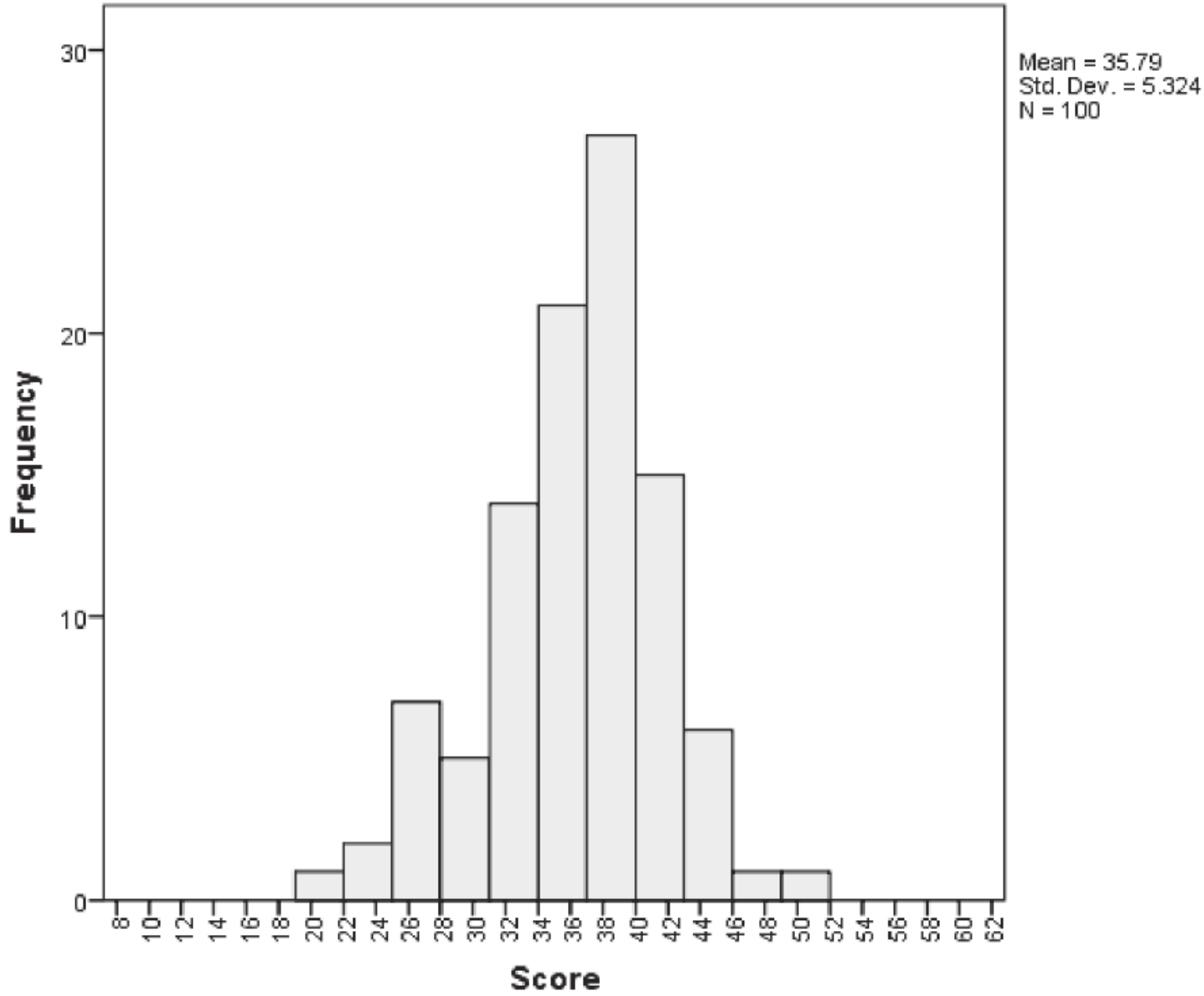
Person	Score	Person	Score	Person	Score	Person	Score	Person	Score
1	19	23	33	45	36	67	38	89	42
2	23	24	33	46	36	68	38	90	42
3	23	25	33	47	36	69	38	91	42
4	26	26	33	48	36	70	38	92	42
5	26	27	33	49	36	71	39	93	43
6	26	28	33	50	36	72	39	94	43
7	27	29	33	51	37	73	39	95	43
8	27	30	34	52	37	74	39	96	44
9	27	31	34	53	37	75	39	97	44
10	27	32	34	54	37	76	39	98	45
11	30	33	34	55	37	77	39	99	47
12	30	34	34	56	37	78	40	100	49
13	30	35	34	57	37	79	40	—	—
14	30	36	34	58	37	80	40	—	—
15	30	37	34	59	37	81	40	—	—
16	31	38	34	60	37	82	40	—	—
17	31	39	34	61	37	83	40	—	—
18	31	40	36	62	37	84	41	—	—
19	31	41	36	63	38	85	41	—	—
20	31	42	36	64	38	86	41	—	—
21	31	43	36	65	38	87	41	—	—
22	33	44	36	66	38	88	41	—	—

TABLE 2.4. Frequency Distribution for 100 Individuals

Score	Frequency	Relative frequency	Cumulative frequency	Cumulative relative frequency
X	$f(X)$	$p(X)$	$cf(X)$	$cp(X)$
19	1	0.01	1	0.01
23	2	0.02	3	0.03
26	3	0.03	6	0.06
27	4	0.04	10	0.10
30	5	0.05	15	0.15
31	6	0.06	21	0.21
33	8	0.08	29	0.29
34	10	0.10	39	0.39
36	11	0.11	50	0.50
37	12	0.12	62	0.62
38	8	0.08	70	0.70
39	7	0.07	77	0.77
40	6	0.06	83	0.83
41	5	0.05	88	0.88
42	4	0.04	92	0.92
43	3	0.03	95	0.95
44	2	0.02	97	0.97
45	1	0.01	98	0.98
47	1	0.01	99	0.99
49	1	0.01	100	1.00
	100	1.00		

TABLE 2.5. Grouped Frequency Distribution for 100 Individuals

Class interval	Frequency	Relative frequency	Cumulative frequency	Cumulative relative frequency
19–21	1	0.01	1	0.01
22–24	2	0.02	3	0.03
25–27	7	0.07	10	0.10
28–30	5	0.05	15	0.15
31–33	14	0.14	29	0.29
34–36	21	0.21	50	0.50
37–39	27	0.27	77	0.77
40–42	15	0.15	92	0.92
43–45	6	0.06	98	0.98
46–48	1	0.01	99	0.99
49–51	1	0.01	100	1.00
Total	100	1.00		


Mean = 35.79
Std. Dev. = 5.324
N = 100
Frequency
Score
0
10
20
30
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
52
54
56
58
60
62

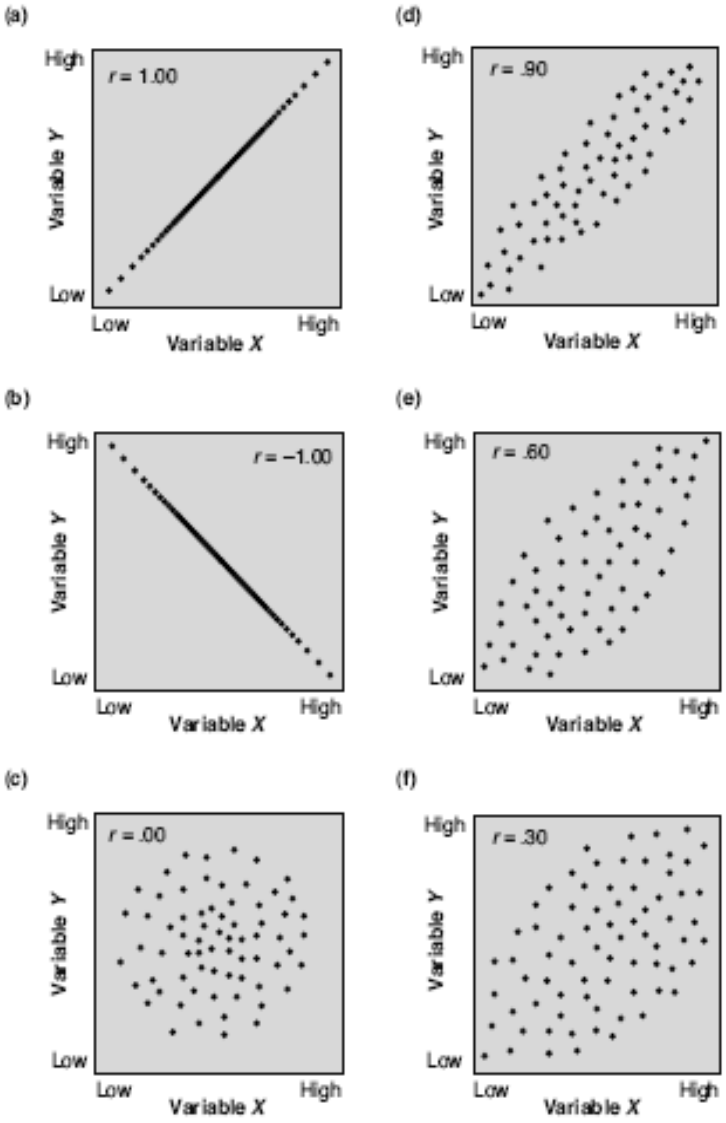


FIGURE 9 Scatterplot of Different Correlation Coefficients.

Source: Hopkins, Kenneth, *Educational and Psychological Measurement and Evalutation*, 8th ©1998. Printed and Electronically reproduced by permission of Pearson Education, Inc., Upper Saddle River, New Jersey.

TABLE 6 Calculating a Pearson Correlation Coefficient

There are different formulas for calculating a Pearson correlation coefficient and we will illustrate one of the simpler ones. For this illustration we will use the test scores we have used before as the *X* variable, and another set of 20 hypothetical scores as the *Y* variable. The formula is:

$$r_{xy} = \frac{N\Sigma XY - (\Sigma X)(\Sigma X)}{\sqrt{N\Sigma X^2 - (\Sigma X)^2}\sqrt{N\Sigma Y^2 - (\Sigma X)^2}}$$

XY = sum of the XY products
X = sum of X scores
Y = sum of Y scores
X^2 = sum of squared X scores
Y^2 = sum of squared Y scores

Test 1 (*X*)	X^2	Test 2 (*Y*)	Y^2	(*X*)(*Y*)
7	49	8	64	56
8	64	7	49	56
9	81	10	100	90
6	36	5	25	30
7	49	7	49	49
6	36	6	36	36
10	199	9	81	90
8	64	8	64	64
5	25	5	25	25
9	81	9	81	81
9	81	8	64	72
9	81	7	49	63
8	64	7	49	56
4	16	4	16	16
5	25	6	36	30
6	36	7	49	42
7	49	7	49	49
8	64	9	81	72
8	64	8	64	64
7	49	6	36	42
X = 146	X^2 = 1,114	Y = 143	Y^2 = 1,067	XY = 1,083

$$r_{xy} = \frac{20(1{,}083) - (140)(143)}{\sqrt{20(1{,}114) - (146)^2}\sqrt{20(1{,}067) - (143)^2}}$$

$$\frac{21{,}660 - 20{,}878}{\sqrt{22{,}280 - 21{,}316}\sqrt{21{,}340 - 20{,}449}} = \frac{782}{\sqrt{964}\sqrt{891}}$$

$$\frac{782}{(31.048)(29.849)} = 0.843$$