1-INDICI01- media varianza correlazione

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7 The following table contains 10 scores of a variable. Obviously there is an outlier which is gray-colored. What will happen if the outlier is ignored?

25	25	26	24	2	29	25	22	27	25

(a) The mean and the median will increase notably.
(b) The mean will increase notably whereas the median remains the same.
(c) The median will increase notably whereas the mean remains the same.
(d) Both the mean and median remain unchanged.

MEDIANA

ORDINIAMO I DATI

POSIZIONE	1	2	3	4	5	6	7	8	9	10
VALORI	2	22	24	25	25	25	25	26	27	29

$n = 10$ (PARI) $\longrightarrow$ 2 POSIZIONI

$\frac{n}{2} = 5 \qquad \frac{n}{2} + 1 = 6$

POSIZIONE	1	2	3	4	5	6	7	8	9	10
VALORI	2	22	24	25	25	25	25	26	27	29

MEDIANA = 25

MEDIA

POSIZIONE	1	2	3	4	5	6	7	8	9	10
VALORI	2	22	24	25	25	25	25	26	27	29

$$\bar{x} = \frac{2 + 22 + 24 + 25 \cdot 4 + 26 + 27 + 29}{10} = 23$$

TOGLIAMO IL VALORE ANOMALO

MEDIANA

POSIZIONE	1	2	3	4	5	6	7	8	9
VALORI	22	24	25	25	25	25	26	27	29

$n = 9$ (DISPARI) $\longrightarrow$ 1 POSIZIONE $\frac{n+1}{2} = \frac{10}{2} = 5$

MEDIANA = 25 (rimane invariata)

MEDIA $\bar{x} = \dfrac{22+24+25\cdot 4+26+27+29}{9} = 25{,}33$ (AUMENTA)

18 A discrete random variable X has a mean $\mu = 15$ and a standard deviation $\sigma = 4$. The constant value 8 is added to X in order to create a new variable: $Y = X + 8$. What is the mean of Y?

(a) 4
(b) 15
(c) 23
(d) It is not possible to calculate the mean without knowing the probability distribution of X and Y.

$X: \quad \mu_x = 15 \qquad y = x + 8$

$\sigma_x = 4$

$\mu_y = \mu_{x+8} = \mu_x + 8 = 15 + 8 = 23$

RICORDA:

$X: \quad \mu_x \qquad y = ax + b$

$\mu_y = \mu_{ax+b} = a \cdot \mu_x + b$

Deviazione standard

$X: \quad \sigma_x \qquad y = ax + b: \quad \sigma_y = \sigma_{ax+b} = a\,\sigma_x$

$x: \quad \sigma_x = 4 \qquad y = x + 8 \qquad \sigma_y = \sigma_{x+8} = \sigma_x = 4$

(a) 4
(b) 15
$\boxed{\text{(c) 23}}$
(d) It is not possible to calculate the mean without knowing the probability distribution of X and Y.

24 Based on 254 observations $\bar{X} = 50$ and $s = 10$ have been calculated. Required is a scale with $\bar{X}_{new} = 50$ and $s_{new} = 5$. To this end, a linear transformation is used where $X_{new} = a + bX$ with $b > 0$. The first observation was 40. What are the coefficients a and b of the required linear transformation and what is the value of the first observation after applying this transformation?

(a) $a = -50$ and $b = 2$ and the transformed first observation is 30.
(b) $a = 0$ and $b = 0.5$ and the transformed first observation is 20.
(c) $a = 0$ and $b = 1$ and the transformed first observation is 40.
(d) $a = 25$ and $b = 0.5$ and the transformed first observation is 45.

$n = 254$

$\bar{x} = 50 \qquad s = 10 \qquad x_1 = 40$

$\bar{x}_N = 50 \qquad s_N = 5 \qquad x_N = a + b\,x$

$\bar{x}_N = a + b\,\bar{x}$

$s_N = b \cdot s$

$$\begin{cases} 50 = a + 50b \rightarrow a + 50 \cdot 0{,}5 = 50 \rightarrow a = 25 \\ 5 = b \cdot 10 \rightarrow b = 0{,}5 \end{cases}$$

$x_{1N} = a + b\,x_1$

$x_{1N} = 25 + 0{,}5 \cdot 40 = 45$

(a) $a = -50$ and $b = 2$ and the transformed first observation is 30.
(b) $a = 0$ and $b = 0.5$ and the transformed first observation is 20.
(c) $a = 0$ and $b = 1$ and the transformed first observation is 40.
(d) $a = 25$ and $b = 0.5$ and the transformed first observation is 45.

30 We collected scores of 60 test subjects and know that the variance of X is 4, the variance of Y is 9, and the correlation between X and Y is 0.8. What is the covariance between X and Y?

(a) 1.2
(b) 4.8
(c) 5.4
(d) 28.8

$n = 60$

$s^2_x = 4 \qquad s^2_y = 9 \qquad \rho_{xy} = 0{,}8 \qquad Cov_{xy} = ?$

$$\rho_{xy} = \frac{Cov_{xy}}{s_x \cdot s_y}$$

$$Cov_{xy} = \delta_x \cdot \delta_y \cdot \rho_{xy} =$$

$$= \sqrt{4} \cdot \sqrt{9} \cdot 0,80 = 4,8$$

32 It is important that the weight of a figure skater matches the weight of his skating partner. For male figure skaters (X) the average weight is 77 kg with a standard deviation of 4 kg. For female figure skaters (Y) is the average weight is 49 kg with a standard deviation of 3 kg. The correlation between X and Y is 0.77. What is the standard deviation of the random variable $W = X - Y$?

(a) 2.55
(b) 2.65
(c) 6.52
(d) 7.00

$\bar{x} = 77$ $\bar{y} = 49$ $\rho_{xy} = 0,77$

$\delta_x = 4$ $\delta = 3$

$W = x - y$ $\delta_w = ?$

Variabile somma

$$\delta^2_w = \delta^2_{x+y} = \delta^2_x + \delta^2_y + 2 \cdot Cov_{xy}$$

$$= \delta^2_x + \delta^2_y + 2 \cdot \rho_{xy} \cdot \delta_x \delta_y$$

Variabile differenza

$$\delta^2_w = \delta^2_{x-y} = \delta^2_x + \delta^2_y - 2 \cdot Cov_{xy}$$

$$= \delta^2_x + \delta^2_y - 2 \cdot \rho_{xy} \cdot \delta_x \delta_y$$

$$\delta_w = \sqrt{\delta^2_x + \delta^2_y - 2 \cdot \rho_{xy} \cdot \delta_x \delta_y}$$

$$= \sqrt{4^2 + 3^2 - 2 \cdot 0,77 \cdot 4 \cdot 3} = 2,553$$

$\boxed{\text{(a) } 2.55}$
(b) 2.65
(c) 6.52
(d) 7.00

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