

## Answer to Question #85578 - Math - Statistics and Probability

**Question:** The mean and the standard deviation of 20 items is found to be 10 and 2 respectively. At the time of checking it was found that one items with value 8 was incorrect. Calculate the mean and standard deviation if the wrong item is omitted.

**Solution:** Given that the mean is 10, standard deviation is 2, and there are 20 items. If the values are  $x_1, x_2, \dots, x_{20}$ , then we have,

$$\text{mean} = \bar{x} = \frac{1}{20} \sum_{i=1}^{20} x_i = 10 \quad (1)$$

$$\text{and standard deviation} = \sqrt{\frac{1}{20} \sum_{i=1}^{20} (x_i - \bar{x})^2} = 2 \quad (2)$$

From equation (1), we have,  $\sum_{i=1}^{20} x_i = 200$

and from equation (2),

$$\begin{aligned} \frac{1}{20} \sum_{i=1}^{20} (x_i - \bar{x})^2 &= 4 \\ \Rightarrow \frac{1}{20} \sum_{i=1}^{20} x_i^2 - \bar{x}^2 &= 4 \\ \Rightarrow \frac{1}{20} \sum_{i=1}^{20} x_i^2 &= 4 + 10^2 = 104 \\ \Rightarrow \sum_{i=1}^{20} x_i^2 &= 104 \times 20 = 2080 \end{aligned}$$

Let  $x_k$  denote the wrong entry for some  $k \in \{1, 2, \dots, 20\}$ . So,  $x_k = 8$

If we omit  $x_k$ , then there are 19 entries. So the new mean is,

$$\text{mean} = \frac{1}{19} \left( \sum_{i=1}^{20} x_i - x_k \right) = \frac{200 - 8}{19} = \frac{192}{19} \approx 10.105$$

Let's call this new mean  $\bar{x}' = \frac{192}{19}$

$$\begin{aligned} \text{Variance} &= \frac{1}{19} \left( \sum_{i=1}^{20} x_i^2 - x_k^2 \right) - \bar{x}'^2 \\ &= \frac{1}{19} (2080 - 8^2) - \left( \frac{192}{19} \right)^2 \\ &\approx 3.9889 \end{aligned}$$

Therefore, *standard deviation*  $\approx \sqrt{3.9889} \approx 1.997$

**Answer:**

- Mean = 10.105
- Standard deviation = 1.997