

Q22. Mean and standard deviation of 100 observations were found to be 40 and 10, respectively. If at the time of calculation two observations were wrongly taken as 30 and 70 in place of 3 and 27 respectively, find the correct standard deviation.

Sol. Given, $n = 100$, $\bar{x} = 40$ and $\sigma = 10$

$$\therefore \frac{\sum x_i}{n} = 40$$

$$\Rightarrow \frac{\sum x_i}{100} = 40$$

$$\Rightarrow \sum x_i = 4000$$

Now, Corrected $\sum x_i = 4000 - 30 - 70 + 3 + 27 = 3930$

$$\text{Corrected mean} = \frac{3930}{100} = 39.3$$

Now,
$$\sigma^2 = \frac{\sum x_i^2}{n} - \left(\frac{\sum x_i}{n} \right)^2 = \frac{\sum x_i^2}{n} - (40)^2$$

$$\Rightarrow 100 = \frac{\sum x_i^2}{100} - 1600$$

$$\Rightarrow \sum x_i^2 = 170000$$

Now, Corrected $\sum x_i^2 = 170000 - (30)^2 - (70)^2 + 3^2 + (27)^2 = 164938$

$$\therefore \text{Corrected } \sigma = \sqrt{\frac{164938}{100} - (39.3)^2} = \sqrt{1649.38 - 1544.49} = \sqrt{104.9} = 10.24$$