Q6. The mean and standard deviation of some data for the time taken to complete . a test are calculated with the following results:

Number of observations = 25, mean = 18.2 seconds, standard deviation = 3.25 s.

Further, another set of 15 observations $x_1, x_2, ..., x_{15}$, also in seconds, is now available and we have $\sum_{i=1}^{15} x_i = 279$ and $\sum_{i=1}^{15} x_i^2 = 5524$. Calculate the standard deviation based on all 40 observations.

Sol. Given, $n_1 = 25$, $\bar{x}_i = 18.2$, $\sigma_1 = 3.25$,

$$n_2 = 15, \sum_{i=1}^{15} x_i = 279 \text{ and } \sum_{i=1}^{15} x_i^2 = 5524$$

For first set $\Sigma x_i = 25 \times 18.2 = 455$

$$\therefore \quad \sigma_1^2 = \frac{\Sigma x_i^2}{25} - (18.2)^2$$

$$\Rightarrow \quad (3.25)^2 = \frac{\Sigma x_i^2}{25} - (18.2)^2 \quad \Rightarrow \quad 10.5625 + 331.24 = \frac{\Sigma x_i^2}{25}$$

$$\Rightarrow \quad \Sigma x_i^2 = 25 \times (10.5625 + 331.24) = 25 \times 341.8025 = 8545.0625$$

For combined SD of the 40 observations, $n = 40$.

Now $\sum_{i=1}^{40} x_i^2 = 5524 + 8545.0625 = 14069.0625$

and $\sum_{i=1}^{40} x_i = 455 + 279 = 734$

$$\therefore \quad SD = \sqrt{\frac{14069.0625}{40} - \left(\frac{734}{40}\right)^2} = \sqrt{351.1726 - (18.35)^2}$$

$$= \sqrt{351.726 - 336.7225} = \sqrt{15.0035} = 3.87$$