Answer on Question #86018 – Math – Statistics and Probability
Question

Components are placed into bins containing 100. After inspection of a large number of bins the average number of defective parts was found to be 10 with a standard deviation of 3. Assuming that the same production conditions continue, except that bins containing 300 were used:

1.2.1 what would be the average number of defective components per larger bin?

1.2.2 what would be the standard deviation of the number of defectives per larger bin?

1.2.3 how many components must each bin hold so that the standard deviation of the number of defective components is equal to 1% of the total number of components in the bin?

Solution

Proportion defective is $p = 0.1$ (from the inspection phase). So, proportion good is $q = 1 - p = 0.9$. $Mean = E(X) = np = 100 \cdot 0.1 = 10$,
10 components are defective on average
S. D. $(X) = \sqrt{npq} = \sqrt{100(0.1)(0.9)} = 3$

1.2.1 Now we have the sample size $N = 300$.
Production is assumed to be continuing as before, so proportion defective is $p = 0.1$. Hence $E(X)$ for larger bin size
$E(X) = Np = 300 \cdot 0.1 = 30$

1.2.2
S. D. $(X) = \sqrt{Npq} = \sqrt{300(0.1)(0.9)} = 3\sqrt{3} \approx 5.2$

1.2.3 For the S.D. (standard deviation) to be 1% of Total No.,

$$\sqrt{npq} = 0.01n$$
$$n(0.1)(0.9) = 0.0001n^2$$
$$n = \frac{0.09}{0.0001}$$
$$n = 900$$

Each bin must hold 900 components.