Also, we can assume that $\sigma = 15$ (see the discussion that immediately precedes this example). Using Formula 7-4, we get

$$n = \left[\frac{z_{\alpha/2}\sigma}{E}\right]^2 = \left[\frac{1.96 \cdot 15}{3}\right]^2 = 96.04 = 97 \quad \text{(rounded } up\text{)}$$

Interpretation

Among the thousands of statistics students, we need to obtain a simple random sample of at least 97 of their IQ scores. With a simple random sample of only 97 statistics students, we will be 95% confident that the sample mean $\bar{x}$ is within 3 IQ points of the true population mean μ.

Part 2: Estimating a Population Mean When σ is Known

In the real world of professional statisticians and professional journals and reports, it is extremely rare that we want to estimate an unknown value of a population mean but we somehow know the value of the population standard deviation σ. If we somehow do know the value of σ, the confidence interval is constructed using the standard normal distribution instead of the Student t distribution, as shown in the following box.

Confidence Interval for Estimating a Population Mean with σ Known

Requirements

1. The sample is a simple random sample.

2. Either or both of these conditions is satisfied: The population is normally distributed or $n > 30$.

Confidence Interval

$$\bar{x} - E < \mu < \bar{x} + E$$

or

$$\bar{x} \pm E$$

or

$$(\bar{x} - E, \bar{x} + E)$$

where the margin of error E is found from the following:

$$E = z_{\alpha/2} \cdot \frac{\sigma}{\sqrt{n}}$$

where $z_{\alpha/2}$ = critical z score separating an area of $\alpha/2$ in the right tail of the standard normal distribution. (Find $z_{\alpha/2}$ using technology or Table A-2.)

Example 7 **Confidence Interval Estimate of μ with Known σ**

Use the same sample of 12 highway speeds given in Example 2 and construct a 95% confidence interval estimate of the population mean by assuming that σ is known to be 4.1.

Solution

Requirement check The requirements were checked with the help of a dotplot in Example 2. The requirements are satisfied. ✔

continued