Section 6.2

Confidence Intervals for Means

Let \( X \) equal the length of life of a 60-watt light bulb marketed by a certain manufacturer of light bulbs. Assume that the distribution of \( X \) is \( N(\mu, 1296) \).

If a random sample of \( n = 27 \) bulbs were tested until they burned out, yielding a sample mean of \( \bar{X} = 1478 \) hours, then a 95% confidence interval for \( \mu \) is

\[
\left[ \bar{X} - t_{n-1}\left( \frac{\sigma}{\sqrt{n}} \right), \bar{X} + t_{n-1}\left( \frac{\sigma}{\sqrt{n}} \right) \right]
\]

\[
= [1478 - 1.96\left( \frac{36}{\sqrt{27}} \right), 1478 + 1.96\left( \frac{36}{\sqrt{27}} \right)]
\]

Lake Macatawa, an inlet lake on the east side of Lake Michigan, is divided into an east basin and a west basin. To measure the effect on the lake of salting city streets in the winter, students took 32 samples of water from the west basin and measured the amount of sodium in parts per million in order to make a statistical inference about the unknown mean \( \mu \). They obtained the following data:

| 13.0 | 18.5 | 16.4 | 14.8 | 19.4 | 17.3 | 23.2 | 24.9 |
| 20.8 | 19.3 | 18.8 | 23.1 | 15.2 | 19.9 | 19.1 | 18.1 |
| 23.1 | 16.8 | 20.4 | 17.4 | 25.2 | 23.1 | 15.3 | 19.4 |
| 16.0 | 21.7 | 15.2 | 21.3 | 21.3 | 16.8 | 15.6 | 17.8 |

Section 6.4

Confidence Intervals for Means

For these data \( \bar{X} = 19.07 \) and \( s^2 = 10.60 \). Thus an approximate 95% confidence interval for \( \mu \) is

\[
\bar{X} \pm t_{n-1}\left( \frac{s}{\sqrt{n}} \right)
\]

or

\[
19.07 \pm 1.96\sqrt{\frac{10.60}{32}}
\]

or

\[
[17.94, 20.20]
\]

Example 6.2-4

\( \sigma^2 \) unknown

we replace \( \sigma^2 \) by its estimator \( s^2 \).

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