

## Stat 145 Homework Solutions: Chapters 14 and 15

### Problem 14.5

The null hypothesis is  $H_0 : \mu = 26$  and the alternative hypothesis is  $H_A : \mu > 26$ . The parameter  $\mu$  represents average gas mileage using the new motor oil.

### Problem 14.6

The null hypothesis is  $H_0 : \mu = 5$  and the alternative hypothesis is  $H_A : \mu \neq 26$ . The parameter  $\mu$  is the mean diameter of all spindles, while the statistic  $\bar{x}$  is the mean of the sampled spindles.

### Problem 14.13

The value of the test statistic is:

$$\begin{aligned} z &= \frac{17 - 0}{60/\sqrt{75}} \\ &\doteq 2.45 \end{aligned}$$

The  $P$ -value is:

$$\begin{aligned} P &= P(Z \leq -2.45 \text{ or } Z \geq 2.45) \\ &= 2P(Z \leq -2.45) \\ &= 2(.0071) \\ &= .0142 \end{aligned}$$

This is good evidence that the population mean is not zero.

Problem 14.17

The hypotheses are:

$$\begin{aligned}H_0 : \mu &= 5 \\H_A : \mu &< 5\end{aligned}$$

The value of the test statistic is:

$$\begin{aligned}z &= \frac{4.62 - 5}{0.92/\sqrt{45}} \\&\doteq -2.77\end{aligned}$$

The  $P$ -value is:

$$\begin{aligned}P &= P(Z \leq -2.77) \\&= .0028\end{aligned}$$

This is very strong evidence that the stream has a mean oxygen content of less than 5 mg per liter.

Problem 14.19

The hypotheses are:

$$\begin{aligned}H_0 &: \mu = 224 \\H_A &: \mu \neq 224\end{aligned}$$

The value of the test statistic is:

$$\begin{aligned}z &= \frac{224.002 - 224}{0.060/\sqrt{16}} \\&\doteq 0.13\end{aligned}$$

The  $P$ -value is:

$$\begin{aligned}P &= P(Z \leq -0.13 \text{ or } Z \geq 0.13) \\&= 2P(Z \leq -0.13) \\&= 2(.4483) \\&= .8966\end{aligned}$$

The  $P$ -value does not provide convincing evidence that the process mean is not 224.

Problem 14.28

The hypotheses are:

$$H_0 : \mu = 25$$

$$H_A : \mu > 25$$

The value of the test statistic is:

$$\begin{aligned} z &= \frac{30.4 - 25}{7/\sqrt{10}} \\ &\doteq 2.44 \end{aligned}$$

The  $P$ -value is:

$$\begin{aligned} P &= P(Z \geq 2.44) \\ &= 1 - .9927 \\ &= .0073 \end{aligned}$$

This is very strong evidence that the mean threshold for untrained tasters is greater than 25  $\mu\text{g/l}$ .

Problem 14.35

(a) The  $P$ -value is:

$$\begin{aligned} P &= P(Z \geq 1.8) \\ &= 1 - .9641 \\ &= .0359 \end{aligned}$$

(b) The  $P$ -value is:

$$\begin{aligned} P &= P(Z \leq 1.8) \\ &= .9641 \end{aligned}$$

(c) The  $P$ -value is:

$$\begin{aligned} P &= P(Z \leq -1.8 \text{ or } Z \geq 1.8) \\ &= 2P(Z \leq -1.8) \\ &= 2(.0359) \\ &= .0718 \end{aligned}$$

Problem 15.1

(a) Yes, because:

$$\begin{aligned} 8740 \pm 1.96 \left( \frac{1125}{\sqrt{958}} \right) &\doteq 8740 \pm 71 \\ &= (8669, 8811) \end{aligned}$$

(b) No, because the sample is a voluntary response sample rather than a simple random sample. The methods discussed in Chapters 13 and 14 are only appropriate for data from a simple random sample.

Problem 15.5

(a) The value of the test statistic is:

$$\begin{aligned} z &= \frac{491.4 - 475}{100/\sqrt{100}} \\ &= 1.64 \end{aligned}$$

The  $P$ -value is:

$$\begin{aligned} P &= P(Z \geq 1.64) \\ &= 1 - .9495 \\ &= .0505 \end{aligned}$$

This result is not significant at the 5% level (i.e.,  $P > 0.05$ .)

(b) The value of the test statistic is:

$$\begin{aligned} z &= \frac{491.5 - 475}{100/\sqrt{100}} \\ &= 1.65 \end{aligned}$$

The  $P$ -value is:

$$\begin{aligned} P &= P(Z \geq 1.64) \\ &= 1 - .9505 \\ &= .0495 \end{aligned}$$

This result is significant at the 5% level (i.e.,  $P \leq 0.05$ .)