Text Exercise Set 21

21-1 A 0.05 significance level is chosen for a hypothesis test to see if there is any evidence that the mean weight of a certain variety of orange is different from 7 ounces. A simple random sample of these orange weights is recorded in ounces as follows:

7.4 7.1 6.4 5.6 6.3 6.5 6.0 7.7 6.1 6.8 7.8

(a) Complete the four steps of the hypothesis test by completing the following:

Step 1  
\[ H_0: \]
\[ H_1: \]
\[ \alpha = \]

Step 2

Step 3

Step 4

(b) Why would a box plot be an appropriate graphical display for the data used in this hypothesis test?

(c) Complete the construction of the box plot on the right, and comment on whether the t statistic appears to be appropriate.

(d) Considering the results of the hypothesis test, decide which of the Type I or Type II errors is possible, and describe this error.

(e) Decide whether \( H_0 \) would have been rejected or would not have been rejected with each of the following significance levels: (i) \( \alpha = 0.01 \), (ii) \( \alpha = 0.10 \).
A 0.01 significance level is chosen for a hypothesis test to see if there is any evidence that the mean weight of turkeys raised under experimental conditions is different from 14 lbs. A simple random sample of these turkey weights is recorded in pounds as follows:

12.4  13.8  15.4  11.6  10.9  12.1

(a) Complete the four steps of the hypothesis test by completing the following:

Step 1

H₀:

H₁:

α =

Step 2

Step 3

Step 4

(b) Why would a box plot be an appropriate graphical display for the data used in this hypothesis test?

(c) Complete the construction of the box plot below, and comment on whether the t statistic appears to be appropriate.

(d) Considering the results of the hypothesis test, decide which of the Type I or Type II errors is possible, and describe this error.

(e) Decide whether H₀ would have been rejected or would not have been rejected with each of the following significance levels: (i) α = 0.05, (ii) α = 0.10.
21-3 It is claimed that a cloud seeding technique produces a mean rainfall of 0.9 inches within 24 hours after seeding. A 0.01 significance level is chosen for a hypothesis test to see if there is any evidence that mean rainfall is different from the claimed 0.9 inches. In a simple random sample of 9 cloud seeding operations, the mean rainfall is 0.844 inches and the standard deviation is 0.045 inches.

(a) Complete the four steps of the hypothesis test by completing the following:

Step 1

$H_0$: 

$H_1$: 

$\alpha =$ 

Step 2

Step 3

Step 4

(b) In the list below, circle the best graphical display for this data and say why.

(i) bar or pie chart  (ii) scatter plot  (iii) box plot

(c) Considering the results of the hypothesis test, decide which of the Type I or Type II errors is possible, and describe this error.

(d) Decide whether $H_0$ would have been rejected or would not have been rejected with each of the following significance levels: (i) $\alpha = 0.05$, (ii) $\alpha = 0.10$.

(e) What would the presence of one or more outliers in the data suggest about using the $t$ statistic?
A 0.05 significance level is chosen for a hypothesis test to see if there is any evidence that the mean speed of cars between exits 2 and 3 on the expressway is different from 60 miles per hour. For a simple random sample of 15 cars traveling on the stretch of road, the mean speed is 63.8 miles per hour and the standard deviation of the speeds is 5.67 miles per hour.

(a) Complete the four steps of the hypothesis test by completing the following:

Step 1 
\[ H_0: \]
\[ H_1: \]
\[ \alpha = \]

Step 2

Step 3

Step 4

(b) In the list below, circle the best graphical display for this data and say why.

(i) bar or pie chart 
(ii) scatter plot 
(iii) box plot

(c) Considering the results of the hypothesis test, decide which of the Type I or Type II errors is possible, and describe this error.

(d) Decide whether \( H_0 \) would have been rejected or would not have been rejected with each of the following significance levels: (i) \( \alpha = 0.01 \), (ii) \( \alpha = 0.10 \).

(e) What would the presence of one or more outliers in the data suggest about using the \( t \) statistic?
The company which manufactures a substance called SureKill claims that this substance will kill roaches on contact 80% of the time. A 0.10 significance level is selected for a hypothesis test to see if there is any evidence that the proportion of roaches killed on contact is different from 0.8. When SureKill is used in a simple random sample of 600 roaches, 447 die on contact.

(a) Complete the four steps of the hypothesis test by completing the following:

Step 1

\[ H_0: \]

\[ H_1: \]

\[ \alpha = \]

Step 2

Step 3

Step 4

(b) Verify that the sample size is sufficiently large for the \( z \) statistic to be appropriate.

(c) Considering the results of the hypothesis test, decide which of the Type I or Type II errors is possible, and describe this error.

(d) Decide whether \( H_0 \) would have been rejected or would not have been rejected with each of the following significance levels: (i) \( \alpha = 0.01 \), (ii) \( \alpha = 0.05 \).

(e) In the list below, circle the best graphical display for this data and say why.

(i) bar or pie chart    (ii) scatter plot    (iii) box plot
Last year in a certain metropolis, it was believed that 70% of the students attending a nearby university read the local newspaper regularly. A 0.10 significance level is selected for a hypothesis test to see if there is any evidence that the proportion of university students who read the paper regularly is different from 0.7. When a simple random sample of 400 university students are polled, 302 claimed to read the local newspaper regularly.

(a) Complete the four steps of the hypothesis test by completing the following:

Step 1  
$H_0$: 
$H_1$: 
$\alpha =$

Step 2

Step 3

Step 4

(b) Verify that the sample size is sufficiently large for the $z$ statistic to be appropriate.

(c) Considering the results of the hypothesis test, decide which of the Type I or Type II errors is possible, and describe this error.

(d) Decide whether $H_0$ would have been rejected or would not have been rejected with each of the following significance levels: (i) $\alpha = 0.01$, (ii) $\alpha = 0.05$.

(e) In the list below, circle the best graphical display for this data and say why.

(i) bar or pie chart     (ii) scatter plot     (iii) box plot
21-7 Weight loss resulting from a four-week diet is being studied. Suppose a hypothesis test is to be done to see if there is any evidence that the mean weight lost as a result of the diet is different from 10 lbs.

(a) State the null and alternative hypotheses.

\[ H_0: \]
\[ H_1: \]

(b) Identify which description is the Type I error and which is the Type II error.

(i) concluding that the mean weight lost as a result of the diet is different from 10 lbs., when in reality the mean weight lost is different from 10 lbs.

(ii) concluding that the mean weight lost as a result of the diet is different from 10 lbs., when in reality the mean weight lost is 10 lbs.

(iii) concluding that the mean weight lost as a result of the diet is 10 lbs., when in reality the mean weight lost is 10 lbs.

(iv) concluding that the mean weight lost as a result of the diet is 10 lbs., when in reality the mean weight lost is different from 10 lbs.

(c) Suppose you were told that \( \bar{x} = 12.4 \) lbs. and \( s = 4.5 \) lbs. were the mean and standard deviation of weight lost in a simple random sample used to perform the hypothesis test. Decide whether or not the null hypothesis would be rejected with a 0.05 significance level, for each of the following sample sizes:

(i) \( n = 10 \)

(ii) \( n = 100 \)

(d) Suppose you were told that the \( p \)-value of the hypothesis test was 0.0995. Indicate whether or not \( H_0 \) would be rejected with each of the following significance levels:

(i) \( \alpha = 0.01 \)

(ii) \( \alpha = 0.05 \)

(iii) \( \alpha = 0.10 \)
The amount of time Econo Airline flights arrive after their scheduled arrival times is being studied. Suppose a hypothesis test is to be done to see if there is any evidence that the mean time an Econo Airline flight arrives late is different from 15 minutes.

(a) State the null and alternative hypotheses.

\[ H_0: \]
\[ H_1: \]

(b) Identify which description is the Type I error and which is the Type II error.

(i) concluding that the mean time an Econo Airline flight arrives late is 15 minutes, when in reality the mean time an Econo Airline flight arrives late is different from 15 minutes

(ii) concluding that the mean time an Econo Airline flight arrives late is 15 minutes, when in reality the mean time an Econo Airline flight arrives late is 15 minutes

(iii) concluding that the mean time an Econo Airline flight arrives late is different from 15 minutes, when in reality the mean time an Econo Airline flight arrives late is 15 minutes

(iv) concluding that the mean time an Econo Airline flight arrives late is different from 15 minutes, when in reality the mean time an Econo Airline flight arrives late is different from 15 minutes

(c) Suppose you were told that \( \bar{x} = 17.8 \) minutes and \( s = 5.7 \) minutes were the mean and standard deviation of the time an Econo Airline flight arrives late in a simple random sample used to perform the hypothesis test. Decide whether or not the null hypothesis would be rejected with a 0.05 significance level, for each of the following sample sizes:

(i) \( n = 10 \)

(ii) \( n = 100 \)

(d) Suppose you were told that the \( p \)-value of the hypothesis test was 0.0119. Indicate whether or not \( H_0 \) would be rejected with each of the following significance levels:

(i) \( \alpha = 0.01 \)

(ii) \( \alpha = 0.05 \)

(iii) \( \alpha = 0.10 \)