

Text Exercise Set 20

20-1 A foreman at a certain plant would like to see if there is any evidence that the proportion of defective printed circuits manufactured at this plant is different from 0.05. He chooses a 0.01 significance level to perform a hypothesis test. In a simple random sample of 400 printed circuits, 30 are found to be defective.

(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) $\alpha = 0.05$, (ii) $\alpha = 0.10$.
- (e) What would be an appropriate graphical display for the data used in this hypothesis test?

20-2 In a study concerning home ownership in a county, a 0.05 significance level is selected for a hypothesis test to see if there is any evidence that the percentage of the homes are owned by an occupant is different from 45%. In a simple random sample of 200 homes, 106 are found to be owned by an occupant.

(a)

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) $\alpha = 0.10$.
- (e) What would be an appropriate graphical display for the data used in this hypothesis test?

20-3 A state government official would like to see if there is any evidence that the percentage of the state's licensed drivers who are red-green color blind is different from 15%. He chooses a 0.05 significance level to perform a hypothesis test. In a simple random sample of 875 licensed drivers, 112 are found to be red-green color blind

(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) $\alpha = 0.10$.

(e) What would be an appropriate graphical display for the data used in this hypothesis test?

20-4 In a study being conducted at a university, a 0.01 significance level is selected for a hypothesis test to see if there is any evidence that the proportion of United States citizens who believe that UFOs exist is different from 0.3. In a simple random sample of 1032 United States citizens, 282 are found to believe that UFOs exist

(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) $\alpha = 0.05$, (ii) $\alpha = 0.10$.
- (e) What would be an appropriate graphical display for the data used in this hypothesis test?

20-5 Circle the number of the response which correctly completes each statement.

- (a) A null hypothesis is rejected when the value of the test statistic is
- (i) within the bounds we expect from sampling error if the null hypothesis were really true.
 - (ii) outside the bounds we expect from sampling error if the null hypothesis were really true.
 - (iii) within the bounds we expect from sampling error if the alternative hypothesis were really true.
 - (iv) outside the bounds we expect from sampling error if the alternative hypothesis were really true.
- (b) The p -value from a hypothesis test
- (i) is the significance level.
 - (ii) can be treated as a measure of how strongly the observed data supports the alternative hypothesis.
 - (iii) can be treated as a measure of how strongly the observed data supports the null hypothesis.
 - (iv) is the probability of making a type II error.
- (c) As the simple random sample size n is increased, then
- (i) the standard deviation of the sampling distribution of \bar{p} decreases.
 - (ii) the standard deviation of the sampling distribution of \bar{p} increases.
 - (iii) the standard deviation of the sampling distribution of \bar{p} does not change.
 - (iv) the probability of making a type I error decreases.
- (d) If you are told that the p -value in a hypothesis test is 0.002, then you
- (i) know that the null hypothesis would not be rejected with any of the most commonly chosen significance levels of 0.01, 0.05, and 0.10.
 - (ii) know that the null hypothesis would be rejected with any of the most commonly chosen significance levels of 0.01, 0.05, and 0.10.
 - (iii) do not have enough information to know whether or not the null hypothesis would be rejected with a significance level of 0.05.

20-6 Circle the number of the response which correctly completes each statement.

- (a) Sampling error refers to
- (i) errors made in recording data.
 - (ii) the selection of a sample which is not a simple random sample.
 - (iii) the variation in a sampling distribution.
 - (iv) bias in measuring a variable.
- (b) The standard deviation of the sampling distribution of \bar{p} is
- (i) a measure of the center of a distribution.
 - (ii) a measure of dispersion.
 - (iii) a measure of the shape of a distribution.
 - (iv) a measure of bias in sampling.
- (c) Once a significance level α is chosen, then the only way to decrease the
- (i) probability of a type I error is to increase the sample size n .
 - (ii) probability of a type II error is to increase the sample size n .
 - (iii) probability of a type I error is to decrease the sample size n .
 - (iv) probability of a type II error is to decrease the sample size n .
- (d) If you are told that the p -value in a hypothesis test is 0.369, then you
- (i) know that the null hypothesis would not be rejected with any of the most commonly chosen significance levels of 0.01, 0.05, and 0.10.
 - (ii) know that the null hypothesis would be rejected with any of the most commonly chosen significance levels of 0.01, 0.05, and 0.10.
 - (iii) do not have enough information to know whether or not the null hypothesis would be rejected with a significance level of 0.05.

20-7 Suppose the p -value in a hypothesis test is found to be 0.037. Circle TRUE OR FALSE as appropriate for each statement.

- (a) With significance level $\alpha = 0.01$, the null hypothesis is rejected. TRUE FALSE
- (b) With significance level $\alpha = 0.05$, the null hypothesis is rejected. TRUE FALSE
- (c) With significance level $\alpha = 0.10$, the null hypothesis is rejected. TRUE FALSE

20-8 Suppose the p -value in a hypothesis test is found to be 0.068. Circle TRUE OR FALSE as appropriate for each statement.

- (a) With significance level $\alpha = 0.01$, the null hypothesis is rejected. TRUE FALSE
- (b) With significance level $\alpha = 0.05$, the null hypothesis is rejected. TRUE FALSE
- (c) With significance level $\alpha = 0.10$, the null hypothesis is rejected. TRUE FALSE

20-9 Weight loss resulting from a four-week diet is being studied.

- (a) Suppose a hypothesis test is to be done to see if there is any evidence that the percentage of people who lose weight from the diet is different from 75%. 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 proportion of people who lose weight from the diet is 0.75, when in reality the proportion of people who lose weight is 0.75
 - (ii) concluding that the proportion of people who lose weight from the diet is 0.75, when in reality the proportion of people who lose weight is different from 0.75
 - (iii) concluding that the proportion of people who lose weight from the diet is different from 0.75, when in reality the proportion of people who lose weight is different from 0.75
 - (iv) concluding that the proportion of people who lose weight from the diet is different from 0.75, when in reality the proportion of people who lose weight is 0.75

- (c) If the null hypothesis in part (a) were true, find what would the standard deviation of the sampling distribution of \bar{p} be equal to, with each of the following random sample sizes:

(i) $n = 300$

(ii) $n = 1875$

- (d) Suppose you were told that the p -value of the hypothesis test in part (a) was 0.0531. 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) $\alpha = 0.10$

20-9 - *continued*

- (e) Suppose a hypothesis test is to be done to see if there is any evidence that the mean weight loss as a result of the diet is different from 10 lbs. State the null and alternative hypotheses.
- H_0 :
- H_1 :
- (f) Identify which description is the Type I error and which is the Type II error.
- (i) concluding that the mean weight loss as a result of the diet is different from 10 lbs., when in reality the mean weight loss is different from 10 lbs.
 - (ii) concluding that the mean weight loss as a result of the diet is different from 10 lbs., when in reality the mean weight loss is 10 lbs.
 - (iii) concluding that the mean weight loss as a result of the diet is 10 lbs., when in reality the mean weight loss is 10 lbs.
 - (iv) concluding that the mean weight loss as a result of the diet is 10 lbs., when in reality the mean weight loss is different from 10 lbs.
- (g) Suppose the weight lost from the diet was recorded for each person in a simple random sample of 25 people. How would you interpret a weight loss of - 6.1 lbs. recorded for one particular person?
- (h) Suppose you were told that a 0.05 significance level was being used for the hypothesis test in part (e). If you were also told that $\bar{x} = 12.4$ lbs. was the mean weight lost from the diet in a simple random sample of 25 people, what prevents us from calculating a z test statistic based on \bar{x} in the same way we calculate the z test statistic based on \bar{p} ?

20-10 The amount of time Econo Airline flights arrive after their scheduled arrival times is being studied.

- (a) Suppose a hypothesis test is to be done to see if there is any evidence that the percentage of flights which are on time or earlier is different from 60%. 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 proportion of flights on time or earlier is different from 0.60, when in reality the proportion of flights on time or earlier is different from 0.60
 - (ii) concluding that the proportion of flights on time or earlier is different from 0.60, when in reality the proportion of flights on time or earlier is 0.60
 - (iii) concluding that the proportion of flights on time or earlier is 0.60, when in reality the proportion of flights on time or earlier is 0.60
 - (iv) concluding that the proportion of flights on time or earlier is 0.60, when in reality the proportion of flights on time or earlier is different from 0.60
- (c) If the null hypothesis in part (a) were true, find what would the standard deviation of the sampling distribution of \bar{p} be equal to, with each of the following random sample sizes:
- (i) $n = 150$
 - (ii) $n = 1350$
- (d) Suppose you were told that the p -value of the hypothesis test in part (a) was 0.0351. 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) $\alpha = 0.10$

20-10 - *continued*

- (e) 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. State the null and alternative hypotheses.
- H_0 :
- H_1 :
- (f) 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
- (g) Suppose the number of minutes an Econo Airline flight arrived late was recorded for each flight in a simple random sample of 32 flights. How would you interpret a time of -4.5 minutes recorded for one of the flights?
- (h) Suppose you were told that a 0.05 significance level was being used for the hypothesis test in part (e). If you were also told that $\bar{x} = 13.8$ minutes was the mean time an Econo Airline flight arrived late in a simple random sample of 32 flights, what prevents us from calculating a z test statistic based on \bar{x} in the same way we calculate the z test statistic based on \bar{p} ?