Text Exercise Set 19

19-1 In the previous election for governor, 36% of the registered voters in a large state did not vote. A pollster is going to perform a hypothesis test to see if there is any evidence that the proportion of voters who do not vote in the upcoming election for governor is different from 36%.

(a) State each hypotheses.

Null Hypothesis:

Alternative Hypothesis:

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

(i) concluding that the proportion of voters who do not vote in the upcoming election is different from 0.36, when in reality the proportion of voters who do not vote is 0.36

(ii) concluding that the proportion of voters who do not vote in the upcoming election is different from 0.36, when in reality the proportion of voters who do not vote is different from 0.36

(iii) concluding that the proportion of voters who do not vote in the upcoming election is 0.36, when in reality the proportion of voters who do not vote is different from 0.36

(iv) concluding that the proportion of voters who do not vote in the upcoming election is 0.36, when in reality the proportion of voters who do not vote is 0.36

(c) Suppose that a simple random sample of 225 registered voters is selected, and the sample proportion \( \hat{p} \) of voters not intending to vote is obtained. Why can we treat the sampling distribution of \( \hat{p} \) as a normal distribution, under the assumption that the hypothesized \( \lambda = 0.36 \) is correct?

(d) Do each of the following under the assumption that the hypothesized \( \lambda = 0.36 \) is correct:

(i) Find the mean and standard deviation for the sampling distribution of \( \hat{p} \) with simple random samples of size 225.

(ii) Suppose that in a simple random sample of 225 registered voters, 72 are found not intending to vote. Find the sample proportion \( \hat{p} \) of voters not intending to vote, and find the z-score for this sample proportion.
19-1(d) - continued

(iii) Find the probability of obtaining a sample proportion farther away from (below or above) the hypothesized \( \lambda = 0.36 \) than the one calculated in (ii).

(iv) Decide whether the random sample of 225 registered voters with 72 not intending to vote provides sufficient evidence against the hypothesized \( \lambda = 0.36 \) for us to believe that the population proportion \( \lambda \) is different from 0.36, with each of the following significance levels:
\[ \alpha = 0.10 \]
\[ \alpha = 0.05 \]
\[ \alpha = 0.01 \]

(e) Do each of the following under the assumption that the hypothesized \( \lambda = 0.36 \) is correct:

(i) Find the mean and standard deviation for the sampling distribution of \( \bar{p} \) with simple random samples of size 900.

(ii) Suppose that in a simple random sample of 900 registered voters, 288 are found not intending to vote. Find the sample proportion \( p \) of voters not intending to vote, and find the z-score for this sample proportion.

(iii) Find the probability of obtaining a sample proportion farther away from (below or above) the hypothesized \( \lambda = 0.36 \) than the one calculated in (ii).

(iv) Decide whether the random sample of 900 registered voters with 288 not intending to vote provides sufficient evidence against the hypothesized \( \lambda = 0.36 \) for us to believe that the population proportion \( \lambda \) is different from 0.36, with each of the following significance levels:
\[ \alpha = 0.10 \]
\[ \alpha = 0.05 \]
\[ \alpha = 0.01 \]
A standard medication will completely cure a certain ailment 75% of the time. A researcher is going to perform a hypothesis test to see if there is any evidence that the proportion of complete cures with a new treatment is different from 75%.

(a) State each hypotheses.

Null Hypothesis:

Alternative Hypothesis:

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

(i) concluding that the proportion of complete cures with the new treatment is different from 0.75, when in reality the proportion of complete cures is different from 0.75

(ii) concluding that the proportion of complete cures with the new treatment is different from 0.75, when in reality the proportion of complete cures is 0.75

(iii) concluding that the proportion of concluding that the proportion of complete cures with the new treatment is 0.75, when in reality the proportion of complete cures is 0.75

(iv) concluding that the proportion of complete cures with the new treatment is 0.75, when in reality the proportion of complete cures is different from 0.75

(c) Suppose that a simple random sample of 48 treatments with the new medication is observed, and the sample proportion $\hat{p}$ of complete cures is obtained. Why can we treat the sampling distribution of $\hat{p}$ as a normal distribution, under the assumption that the hypothesized $\lambda = 0.75$ is correct?

(d) Do each of the following under the assumption that the hypothesized $\lambda = 0.75$ is correct:

(i) Find the mean and standard deviation for the sampling distribution of $\hat{p}$ with simple random samples of size 48.

(ii) Suppose that in a simple random sample of 48 new treatments, 39 complete cures are found. Find the sample proportion $\hat{p}$ of complete cures, and find the z-score for this sample proportion.
(iii) Find the probability of obtaining a sample proportion farther away from (below or above) the hypothesized $\lambda = 0.75$ than the one calculated in (ii).

(iv) Decide whether the random sample of 48 new treatments with 39 complete cures provides sufficient evidence against the hypothesized $\lambda = 0.75$ for us to believe that the population proportion $\lambda$ is different from 0.75, with each of the following significance levels:

$\alpha = 0.10$

$\alpha = 0.05$

$\alpha = 0.01$

(e) Do each of the following under the assumption that the hypothesized $\lambda = 0.75$ is correct:

(i) Find the mean and standard deviation for the sampling distribution of $\bar{p}$ with simple random samples of size 192.

(ii) Suppose that in a simple random sample of 192 new treatments, 156 complete cures are found. Find the sample proportion $p$ of complete cures, and find the $z$-score for this sample proportion.

(iii) Find the probability of obtaining a sample proportion farther away from (below or above) the hypothesized $\lambda = 0.75$ than the one calculated in (ii).

(iv) Decide whether the random sample of 192 new treatments with 156 complete cures provides sufficient evidence against the hypothesized $\lambda = 0.75$ for us to believe that the population proportion $\lambda$ is different from 0.75, with each of the following significance levels:

$\alpha = 0.10$

$\alpha = 0.05$

$\alpha = 0.01$
19-3 Quality control personnel at a plant where a particular type of printed circuit is manufactured are going to perform a hypothesis test to see if there is any evidence that the percentage of defective printed circuits manufactured at this plant is different from 8%.

(a) State each hypothesis.
   Null Hypothesis:
   Alternative Hypothesis:

(b) Identify which description is the Type I error and which is the Type II error.
   (i) concluding that the proportion of defective circuits is 0.08, when in reality the proportion of defective circuits is different from 0.08

   (ii) concluding that the proportion of defective circuits is 0.08, when in reality the proportion of defective circuits is 0.08

   (iii) concluding that the proportion of defective circuits is different from 0.08, when in reality the proportion of defective circuits is 0.08

   (iv) concluding that the proportion of defective circuits is different from 0.08, when in reality the proportion of defective circuits is different from 0.08

(c) Suppose that a simple random sample of 184 printed circuits are selected, and the sample proportion $\hat{p}$ of defective circuits is obtained. Why can we treat the sampling distribution of $\hat{p}$ as a normal distribution, under the assumption that the hypothesized $\lambda = 0.08$ is correct?

(d) Do each of the following under the assumption that the hypothesized $\lambda = 0.08$ is correct:
   (i) Find the mean and standard deviation for the sampling distribution of $\hat{p}$ with simple random samples of size 184.

   (ii) Suppose that in a simple random sample of 184 printed circuits selected, 23 defective circuits are found. Find the sample proportion $\hat{p}$ of defective circuits, and find the z-score for this sample proportion.
19-3(d) - continued

(iii) Find the probability of obtaining a sample proportion farther away from (below or above) the hypothesized $\lambda = 0.08$ than the one calculated in (ii).

(iv) Decide whether the random sample of 184 printed circuits with 23 defective circuits provides sufficient evidence against the hypothesized $\lambda = 0.08$ for us to believe that the population proportion $\lambda$ is different from 0.08, with each of the following significance levels:

$\alpha = 0.10$

$\alpha = 0.05$

$\alpha = 0.01$

(e) Do each of the following under the assumption that the hypothesized $\lambda = 0.08$ is correct:

(i) Find the mean and standard deviation for the sampling distribution of $p$ with simple random samples of size 736.

(ii) Suppose that in a simple random sample of 736 printed circuits selected, 92 defective circuits are found. Find the sample proportion $\hat{p}$ of defective circuits, and find the $z$-score for this sample proportion.

(iii) Find the probability of obtaining a sample proportion farther away from (below or above) the hypothesized $\lambda = 0.08$ than the one calculated in (ii).

(iv) Decide whether the random sample of 736 printed circuits with 92 defective circuits provides sufficient evidence against the hypothesized $\lambda = 0.08$ for us to believe that the population proportion $\lambda$ is different from 0.08, with each of the following significance levels:

$\alpha = 0.10$

$\alpha = 0.05$

$\alpha = 0.01$
Ten years ago 43% of the homes in a large county were owned by an occupant. A state official is going to perform a hypothesis test to see if there is any evidence that the current percentage of homes owned by an occupant is different from 43%.

(a) State each hypotheses.
   Null Hypothesis:

   Alternative Hypothesis:

(b) Identify which description is the Type I error and which is the Type II error.
   (i) concluding that the proportion of homes owned by an occupant is 0.43,
       when in reality the proportion of homes owned by an occupant is different from 0.43

   (ii) concluding that the proportion of homes owned by an occupant is 0.43,
        when in reality the proportion of homes owned by an occupant is 0.43

   (iii) concluding that the proportion of homes owned by an occupant is different from 0.43,
        when in reality the proportion of homes owned by an occupant is 0.43

   (iv) concluding that the proportion of homes owned by an occupant is different from 0.43,
        when in reality the proportion of homes owned by an occupant is different from 0.43

(c) Suppose that a simple random sample of 245 homes are selected, and the sample proportion \( \hat{p} \) of homes owned by an occupant is obtained. Why can we treat the sampling distribution of \( \hat{p} \) as a normal distribution, under the assumption that the hypothesized \( \lambda = 0.43 \) is correct?

(d) Do each of the following under the assumption that the hypothesized \( \lambda = 0.43 \) is correct:
   (i) Find the mean and standard deviation for the sampling distribution of \( \hat{p} \)
       with simple random samples of size 245.

   (ii) Suppose that in a simple random sample of 245 homes, 98 are found to be owned by an occupant. Find the sample proportion \( \hat{p} \) of homes owned by an occupant, and find the z-score for this sample proportion.
19-4(d) - continued

(iii) Find the probability of obtaining a sample proportion farther away from (below or above) the hypothesized \( \lambda = 0.43 \) than the one calculated in (ii)

(iv) Decide whether the random sample of 245 homes with 98 owned by an occupant provides sufficient evidence against the hypothesized \( \lambda = 0.43 \) for us to believe that the population proportion \( \lambda \) is different from 0.43, with each of the following significance levels:
\[ \alpha = 0.10 \]
\[ \alpha = 0.05 \]
\[ \alpha = 0.01 \]

(e) Do each of the following under the assumption that the hypothesized \( \lambda = 0.43 \) is correct:

(i) Find the mean and standard deviation for the sampling distribution of \( \hat{p} \) with simple random samples of size 980.

(ii) Suppose that in a simple random sample of 980 homes, 392 are found to be owned by an occupant. Find the sample proportion \( \hat{p} \) of homes owned by an occupant, and find the \( z \)-score for this sample proportion.

(iii) Find the probability of obtaining a sample proportion farther away from (below or above) the hypothesized \( \lambda = 0.43 \) than the one calculated in (ii).

(iv) Decide whether the random sample of 390 homes with 392 owned by an occupant provides sufficient evidence against the hypothesized \( \lambda = 0.43 \) for us to believe that the population proportion \( \lambda \) is different from 0.43, with each of the following significance levels:
\[ \alpha = 0.10 \]
\[ \alpha = 0.05 \]
\[ \alpha = 0.01 \]
19-5 Forty-four percent of the voters in an upcoming election for mayor intend to vote for Randall. A simple random sample of \( n \) voters is to be polled, and the sample proportion voting for Randall \( \hat{p} \) is to be obtained. Circle either 0 (zero) or 1 (one) to correctly complete each statement.

(a) As \( n \) increases, the probability that \( \hat{p} \) is between 0.55 and 0.65 becomes closer to

\[
\begin{array}{c}
0 \quad 1
\end{array}
\]

(b) As \( n \) increases, the probability that \( \hat{p} \) is more than 0.03 away from (below or above) 0.44 becomes closer to

\[
\begin{array}{c}
0 \quad 1
\end{array}
\]

(c) As \( n \) increases, the probability that \( \hat{p} \) is between 0.40 and 0.48 becomes closer to

\[
\begin{array}{c}
0 \quad 1
\end{array}
\]

(d) As \( n \) increases, the probability that \( \hat{p} \) is less than 0.45 becomes closer to

\[
\begin{array}{c}
0 \quad 1
\end{array}
\]

(e) As \( n \) increases, the probability that \( \hat{p} \) is less than 0.43 becomes closer to

\[
\begin{array}{c}
0 \quad 1
\end{array}
\]

19-6 Six percent of the firecrackers manufactured by the Exploso company are duds. A simple random sample of \( n \) firecrackers is to be selected, and the sample proportion of duds \( \hat{p} \) is to be obtained. Circle either 0 (zero) or 1 (one) to correctly complete each statement.

(a) As \( n \) increases, the probability that \( \hat{p} \) is between 0.055 and 0.065 becomes closer to

\[
\begin{array}{c}
0 \quad 1
\end{array}
\]

(b) As \( n \) increases, the probability that \( \hat{p} \) is 0.01 away from (below or above) 0.06 becomes closer to

\[
\begin{array}{c}
0 \quad 1
\end{array}
\]

(c) As \( n \) increases, the probability that \( \hat{p} \) is between 0.065 and 0.075 becomes closer to

\[
\begin{array}{c}
0 \quad 1
\end{array}
\]

(d) As \( n \) increases, the probability that \( \hat{p} \) is greater than 0.07 becomes closer to

\[
\begin{array}{c}
0 \quad 1
\end{array}
\]

(e) As \( n \) increases, the probability that \( \hat{p} \) is greater than 0.05 becomes closer to

\[
\begin{array}{c}
0 \quad 1
\end{array}
\]
19-7 Each workday for 4 weeks, quality control personnel select 20 printed circuits from those manufactured at a plant in order to draw a conclusion about the proportion of defective circuits manufactured at this plant. Identify which description is the sample, which is the population of interest, which is the parameter of interest, and which is the statistic used to estimate the parameter:

(i) all defective circuits manufactured at the plant
(ii) all circuits manufactured at the plant
(iii) all circuits selected each workday for the 4 weeks
(iv) the defective circuits selected each workday for the 4 weeks
(v) the proportion of defective circuits among the circuits selected each workday for the 4 weeks
(vi) the proportion of defective circuits among all circuits manufactured at the plant

19-8 Using phone directories, state officials select 800 homes from those in a large county in order to draw a conclusion about the proportion of all homes in the county owned by an occupant. Identify which description is the sample, which is the population of interest, which is the parameter of interest, and which is the statistic used to estimate the parameter:

(i) the proportion of homes in the county owned by an occupant
(ii) the proportion of 800 selected homes owned by an occupant
(iii) all homes in the county
(iv) all homes in the county owned by an occupant
(v) the 800 selected homes
(vi) the selected homes owned by an occupant
19-9 In order to draw a conclusion about the mean speed of cars which travel past exit 27 of the expressway, radar is used to measure the speed of a car which passes exit 27 every 5 minutes for 75 minutes one afternoon, and the mean speed for the observed cars is computed. Identify which description is the sample, which is the population of interest, which is the parameter of interest, and which is the statistic used to estimate the parameter:

(i) the mean speed of all cars which travel past exit 27
(ii) the cars observed traveling past exit 27 every 5 minutes
(iii) the proportion of all cars on the expressway which travel past exit 27
(iv) all cars which travel past exit 27
(v) all cars on the expressway which exceed the speed limit
(vi) the mean speed of the cars observed traveling past exit 27 every 5 minutes

19-10 In order to draw a conclusion about the mean nicotine content in Econo brand cigarettes, one pack of Econo cigarettes is purchased from each of 20 different stores, then one cigarette is chosen from each pack; the mean nicotine content per cigarette for the chosen cigarettes is computed. Identify which description is the sample, which is the population of interest, which is the parameter of interest, and which is the statistic used to estimate the parameter:

(i) the mean nicotine content in the 20 selected Econo brand cigarettes
(ii) all Econo brand cigarettes
(iii) the packs of cigarettes purchased
(iv) the proportion of Econo brand cigarettes sold in stores
(v) the mean nicotine content in Econo brand cigarettes
(vi) the 20 selected Econo brand cigarettes
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