Statistics and Probability
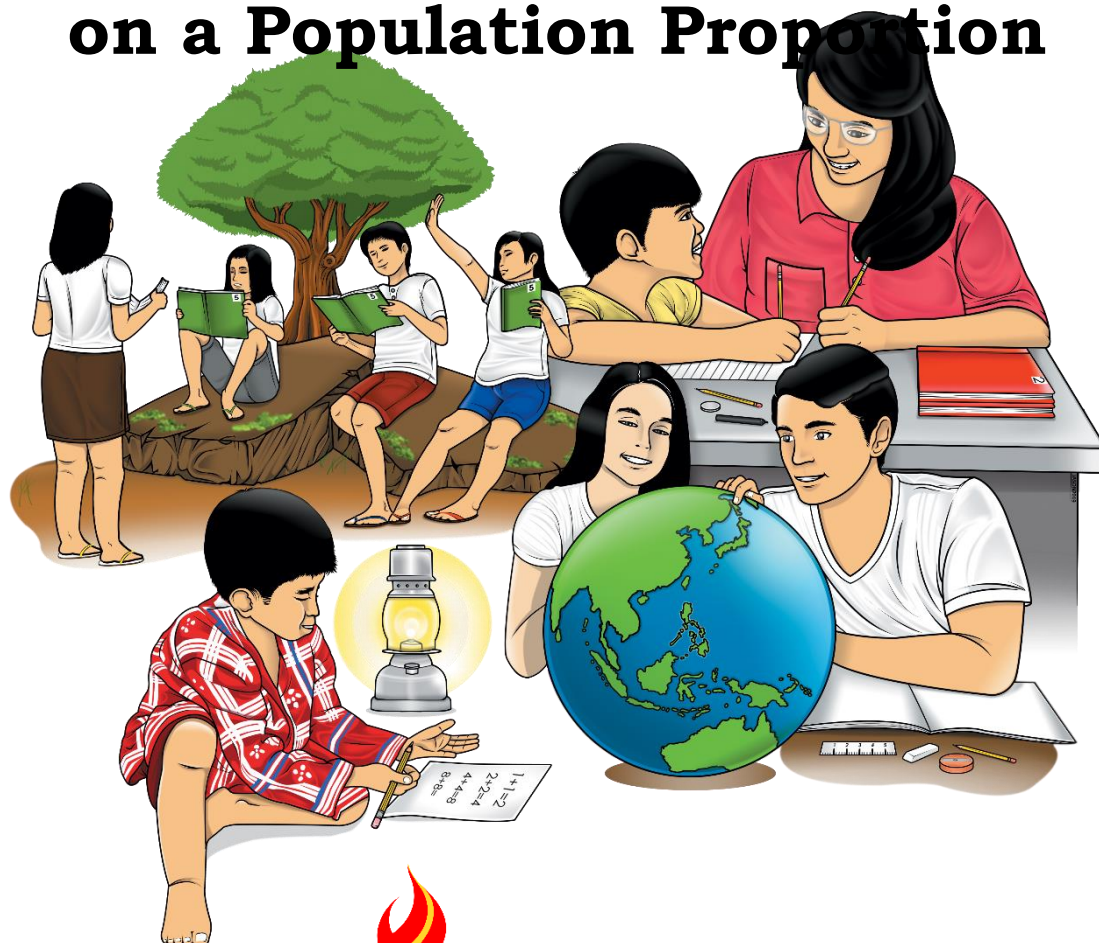
Quarter 4 – Module 9:
Formulating Appropriate
Null and Alternative Hypotheses
on a Population Proportion

ALTERNATIVE DELIVERY MODE

ADM

Statistics and Probability – Grade 11
Alternative Delivery Mode
Quarter 4 – Module 9: Formulating Appropriate Null and Alternative Hypotheses on a Population Proportion
First Edition, 2021

Statistics and Probability

Quarter 4 – Module 9: Formulating Appropriate Null and Alternative Hypotheses on a Population Proportion

DepED

DEPARTMENT OF EDUCATION

Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.

What I Need to Know

In the previous lessons, you have studied how to formulate appropriate null and alternative hypotheses concerning population means. Also, you've learned how to draw correct conclusions after solving given problems based on the test statistic and the rejection region.

In this module, you will have a short recall about population proportions and all other related concepts with their equivalent symbols like test statistic, rejection region, p-value, level of significance, etc.

After going through this module, you are expected to:

1. recall and identify the symbols used in formulating hypotheses;
2. formulate the appropriate null and alternative hypotheses concerning population proportions; and
3. identify whether the given hypothesis test is a single-tailed or a two-tailed test.
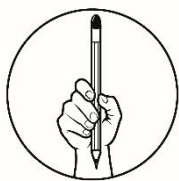
What I Know

Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. A certain telephone company with a target of 5,000 items found that 300 out of the 500 items they randomly chose and tested failed to meet the quality control guidelines. The company would like to test if more than 25% of the target might be out of assurance. What is the appropriate alternative hypothesis at α = 0.05 level?
   a. H_a: p < 0.25
   b. H_a: p > 0.25
   c. H_a: p = 0.25
   d. H_a: p ≠ 0.25

2. In problem no. 1, what is the correct null hypothesis?
   a. H_o: p < 0.25
   b. H_o: p > 0.25
   c. H_o: p = 0.25
   d. H_o: p ≠ 0.25

3. A survey conducted last year by the barangay health workers showed that 20% of the students smoked. This year, a new survey is conducted on 150 students selected randomly from the same school. It was found out that 35 of them smoke. Test if the claim has decreased at α = 0.01 level. Formulate the correct alternative hypothesis.
   a. H_o: p ≠ 0.20
   b. H_o: p < 0.20
   c. H_a: p = 0.20
   d. H_a: p < 0.20

4. In a public junior high school, a study found out that 40% of Grade 7 students are overweight. Is this lower for a grade level age if a sample of 100 students was randomly chosen at 0.05 level of significance? What is the appropriate alternative hypothesis?
   a. H_o: p = 0.40
   b. H_a: p ≠ 0.40
   c. H_a: p < 0.40
   d. H_o: p < 0.40

5. Ships arriving in Manila Port are inspected by Custom Officials for contaminated cargo. Assume that at a certain port, 15% of the ships arriving in the previous year contained cargo that was contaminated. A random selection of 50 ships in the current year included 5 that had contaminated cargo. Does the data suggest that the proportion of ships arriving in the port with contaminated cargoes has increased in the current year? Use α = 0.01 level. Formulate the alternative hypothesis in sentence form.

a. The proportion of ships arriving into the port this year with contaminated cargo is equal to 0.15.
b. The proportion of ships arriving into the port this year with contaminated cargo is less than 0.15.
c. The proportion of ships arriving into the port this year with contaminated cargo is not equal to 0.15.
d. The proportion of ships arriving into the port this year with contaminated cargo is greater than 0.15.

6. Which of the following words suggests a right-tailed test?
   a. smaller
   b. different
   c. increased
   d. unequal

7. A mayor is concerned about the percentage of city residents who express disapproval of his job performance. His political committee pays for a newspaper ad, hoping to keep his disapproval rating below 21%. They will use a follow-up poll to determine effectiveness. What is the correct null hypothesis?
   a. H_o: $\mu \geq 21$
   b. H_o: $p \geq 0.20$
   c. H_o: $p < 0.21$
   d. H_o: $p \geq 0.21$

8. In problem no. 7, what is the appropriate alternative hypothesis?
   a. H_a: $p < 0.21$
   b. H_a: $p \geq 0.21$
   c. H_a: $\mu < 0.21$
   d. H_a: $p < 0.20$

9. Which of the following alternative hypotheses in symbols involving population proportions illustrate a two-tailed test (non-directional)?
   a. H_a: $p < .35$
   b. H_a: $p \geq .35$
   c. H_a: $p \neq .35$
   d. H_a: $p = .35$

10. Which of the following alternative hypotheses in sentence form is NOT a one-tailed test (directional)?
    a. The proportion of female students who enrolled is greater than 10%.
    b. The proportion of male teachers who has master's degree is lower than 5%.
    c. The proportion of number of tourists who visited the park is not equal to 50%.
    d. The proportion of athlete students who joined the competition has increased by 25%.

11. The proportion of patients with heart diseases is higher among smokers than non-smokers. Which is true about this statement?
    a. It is a null hypothesis that is directional.
    b. It is a null hypothesis that is non-directional.
    c. It is an alternative hypothesis that is directional.
    d. It is an alternative hypothesis that is non-directional.

12. In the given statement below, what is the appropriate alternative hypothesis to be used in symbols?
    In a university, the proportion of graduates majoring in Mathematics is more than 10% of the entire population.
    a. H_a: p < .10   c. H_a: p ≠ .10
    b. H_a: p ≥ .10   d. H_a: p > .10

13. Which of the following statements is incorrect about alternative hypothesis on a population proportion?
    a. It is represented by H_a.
    b. It is used as a basis to determine the location of the p-value.
    c. It is the competing claim that the parameter is equal to a specific value.
    d. It is a claim that the proportion is less than, greater than, or not equal to the hypothesized proportion p_o.

14. What is the use of the value of **p** in formulating the null (hypotheses) hypothesis on a population proportion?
    a. It is the value only used for one-tailed test.
    b. It is the basis for the computation of z-test.
    c. It is the same as the hypothesized proportion.
    d. It is a probability that tells if the null hypothesis is true.

15. Which of the following null and alternative (hypothesis) hypotheses are correctly written in symbols?
    a. H_o: p = .10   c. H_o: p < .30
       H_a: p < .20 H_a: p = .30
    b. H_o: p ≤ .40   d. H_o: p ≥ .50
       H_a: p > .40 H_a: p > .50

Lesson 1	**Formulating Appropriate Null and Alternative Hypotheses on a Population Proportion**

In the previous modules, you have learned all the steps on how to test hypothesis concerning population mean and sample mean using the critical value approach. You also applied those concepts in solving real-life problems. Of course, the problems presented were limited to testing hypothesis concerning population mean.

This time, you will learn how to test hypothesis involving another parameter, the population proportion. Are the steps in testing hypothesis on population proportion the same as the steps you just have learned? Is it easier to test hypothesis concerning population proportion than population mean? These are some of the questions you may answer yourself as you go along with next modules.

As what you know, the first step in hypothesis testing is to formulate the null and the alternative hypothesis. This is also true if you are testing hypothesis concerning population proportion. But prior to that, you must fully understand the given situation and identify what values are given on the problem. It is important to correctly identify the different symbols involved and their corresponding values found in the given problem.

Recall the different symbols used in hypothesis testing by answering the following activity.

Review Activity: Match Them Up!

Match the given terms/phrases in Column A with the correct symbols in Column B. Write your chosen symbols on the boxes.

	A		B
1.	Alternative Hypothesis		n
2.	Sample Proportion		α
3.	Null Hypothesis		$\hat{p}$
4.	Population Proportion		H_a
5.	Sample Size		q
6.	Value of $1 - p$		H_0
7.	Level of Significance		p

Answer the following questions:

1. How did you find the activity?

2. Were you able to recall the different necessary symbols used in testing hypothesis correctly?

3. Did you encounter both familiar and unfamiliar symbols?

4. What is the importance of those symbols?

Activity 2: Synonyms Match

Classify the given words by grouping the relevant words together. Place them on the table below.

lesser	different	bigger
changed	increase	greater
higher	smaller	unequal
lower	more	decrease
fewer	larger	

In further discussions of this lesson, you will encounter some of the words listed above in formulating null and alternative hypotheses on a population proportion. They will be of great help to you in answering problems correctly.

What Is It

Once you already know that you are dealing with a population proportion, you can conduct the hypothesis test. You can start with the first step of a hypothesis test which is to determine the hypotheses. In order to formulate null and alternative hypotheses concerning population proportions, you can write them in sentence form or you can use different symbols. Here, you will use the symbol p for the population proportion.

Remember that the hypotheses are claims about the population proportion, p. The null hypothesis states that the proportion is equal to a specific value or the hypothesized proportion, p_o. On the other hand, the alternative hypothesis is the competing claim that the population proportion is less than, greater than, or not equal to p_o.

As a reminder, the null hypothesis is always a statement of equality. The alternative hypothesis is always a statement of inequality, using the symbols <, >, or ≠. Moreover, the hypotheses are stated in such a way that they are mutually exclusive. That is, if one is true, the other must be false; and vice versa.

If you are going to write the **null hypothesis** in sentence form, you will usually use "is" or "is equal to". In symbols, you are going to use:

$$H_O : p = p_o$$

Meanwhile, to formulate **alternative hypothesis** in sentence form or in symbols, you will just remember the following:

➢ When testing for population proportions, there are *three (3) possible alternative hypotheses. They are based on the wording of the question instructing you what to hypothesize. (See illustrative examples below.)*

Alternative Hypotheses (SYMBOLS TO BE USED)	CLUES/WORDS USED
a. $H_a : p < p_o$	smaller, less, decreased, fewer, lower
b. $H_a : p > p_o$	larger, greater, more, increased
c. $H_a : p \neq p_o$	different, not equal to, changed

where: p = population proportion
p_o = hypothesized proportion

In the given symbols as shown above, letters *a* and *b* are used in a one-tailed test or one-sided tests (directional) while letter *c* is used for a two-tailed test (non-directional).

As you might recall, the differences between one-tailed test (directional) and two-tailed test (non-directional) were already explained to you in the previous modules. And for the purpose of this lesson, the table below shows the differences between one-tailed test and two-tailed test.

One-Tailed	Two-Tailed
• Alternative hypothesis contains the greater than (>) or less than (<) symbols • It is directional (either right-tailed or left-tailed)	• Alternative contains the inequality (≠) symbol. • It has no direction.

The next table below shows the null and alternative hypotheses stated together with the types of hypothesis tests.

	Two-Tailed Test	Right-Tailed Test	Left-Tailed Test
Null Hypothesis	$H_o: p = p_o$	$H_o: p = p_o$ or $H_o: p \leq p_o$	$H_o: p = p_o$ or $H_o: p \geq p_o$
Alternative Hypothesis	$H_a: p \neq p_o$	$H_a: p > p_o$	$H_a: p < p_o$

Illustrative Examples:

Example 1. It has been claimed that *40%* of students in a particular senior high school dislike Mathematics. When a survey was conducted by a researcher, it showed that *145 of 800* students dislike Mathematics. Test if the claim was *different* at *a = 0.05 level.*

Null Hypothesis (H_o):

In this example, the hypothesized proportion is 40% or 0.40. Hence, the null hypothesis will be,

The proportion of students who dislike Mathematics is 40%.
In symbols, you can write,

<div align="center">

H_o: p = 0.40

</div>

Alternative Hypothesis (H_a):

Our cue word here is "*different*" which means "*not the same*" or "*not equal*". Therefore, the alternative hypothesis is,

The proportion of students who dislike Mathematics is not equal to 40%.
In symbols, you can write,

<div align="center">

H_a: p ≠ 0.40

</div>

> Since the word *"different"* is used in the given problem,
>
> the symbol to be used in alternative hypothesis is " ≠ ".

Note: This is a two-tailed test or non-directional.

Example 2. A certain senior high school plans to open STEM (Science and Technology, Engineering, and Mathematics) as an academic track only if *60% of the* students in their junior high school will enrol on the following academic year. A survey conducted among a random sample of students revealed that *450 out of 1000* students will enrol. Is the expected enrolment significantly *lower than* the desired enrolment? Test at *a = 0.05* level.

Null Hypothesis (H_o):

The hypothesized proportion here is 60%, therefore the null hypothesis will be,
    The proportion of students who will enroll on STEM track is 60%.
In symbols, it can be written as,

$$H_o: \ p = 0.60$$

Alternative Hypothesis (H_a):

Your hint in formulating the alternative hypothesis in this example is the phrase "lower than" which means "less than". So, your alternative hypothesis will be,
    The proportion of students who will enroll on STEM track is lower than 60%.
which can be written as,

$$H_a: \ p < 0.60$$

Since the word *"lower"* is used in the given problem, the symbol to be used in alternative hypothesis is "<".

Note: *This is a one-tailed test or directional.*

Example 3. It has been claimed that 40% of qualified applicants passed in a particular job interview. When a survey was conducted by a researcher of a certain company, it showed that 90 of 145 applicants passed the job interview. Test if the claim was *larger* at α = 0.05 level.

Null Hypothesis (H_o):

40% is the hypothesized proportion; hence you have the null hypothesis stated as
    The proportion of qualified applicants in a particular job interview is 40%.

And it can be written in symbols as
$$H_o: \ p = 0.40$$

Alternative Hypothesis (H_a):

The word "larger" is synonymous to "greater" hence your alternative hypothesis will be,
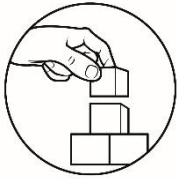   **The proportion of qualified applicants in a particular job interview was larger than 40%.**

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Or in symbols

$$H_a: \ p > \ 0.40$$

> Since the word *"larger"* is used in the given problem, the symbol to be used in alternative hypothesis is " > ".

Note: *This is a one-tailed test or directional.*

What's More

Activity 3: Please Correct Me If I'm Wrong!

On the first blank before each number, draw a happy face😊 *if the pair of hypotheses is correct* and a sad face ☹️ *if the pair is incorrect.* If incorrect, write the correct ALTERNATIVE hypothesis in symbols on the second blank.

_____, _____1. In a public market, 65% of the vendors preferred to use plastic over paper bags. After the local ordinance was signed, 92 out of 120 randomly selected vendors preferred plastic over paper bags. Does this indicate that vendors in that public market have *less* preference in using paper bags? Use 0.05 level of significance.

$$H_o : \ p = 0.65$$
$$H_a : \ p < 0.65$$

_____, _____2. The school principal in a certain private junior high school claimed that 35% of all students are in favor of the new PE uniform. A research teacher asked his students to verify the claim. With this, 271 out of 400 randomly selected students agreed to the new PE uniform.

Using $\alpha = 0.10$ level, is there enough evidence to conclude that the percentage of students who are in favor of the new PE uniform is *different* from 35%?

$$H_o : \ p = 0.35$$
$$H_a : \ p > 0.35$$

_____, _____3. A research found out that 5% of the senior high school students in a certain school are working students. A researcher randomly selected 35 out of 300 students who are working. Is there a percentage increase in the number of senior high school students who are working? Use $\alpha = 0.01$ level.

$$H_o : \ p = 0.05$$
$$H_a : \ p \neq 0.05$$

_____, _____4.   Before the national elections, 75% of the voters in a certain town said that they preferred older senatorial candidates running for senatorial positions than younger candidates. After a certain survey was conducted, 910 out of 1,300 randomly selected voters preferred older senatorial candidates. Does this claim indicate that voters in that town have a *greater* interest in older candidates than in younger ones? Use α = 0.05.

$$H_o : \quad p = 0.75$$
$$H_a : \quad p > 0.75$$

_____, _____5.   A researcher claimed that 55% of elementary students would rather play than read books during break time. Another researcher was assigned to verify the claim. He randomly selected 300 students. Two hundred seventy-four (274) of them said they would rather play during break time than read books.

At 0.10 level, is there enough evidence to conclude that the percentage of elementary students who would rather play than read books has *changed* to 55%?

$$H_o : \quad p = 0.55$$
$$H_a : \quad p < 0.55$$

Activity 4: Use It in a Sentence!

Using the given problems in Activity 3, write the appropriate null and alternative hypotheses in sentence form. Write your answers on the blank provided.

i. H_o _____

   H_a _____

ii. H_o _____

   H_a _____

iii. H_o _____

   H_a _____

iv. H_o _____

   H_a _____

v. H_o _____

   H_a _____

Activity 5: Tell me the Tail

In each problem below, give the null and alternative hypotheses and identify whether it is right-tailed, left-tailed or two-tailed test.

1. A sample of 800 items produced on a new machine showed that 48 of them are defective. The factory will get rid the machine if the data indicates that the proportion of defective items is significantly more than 5%. At a significance level of 10% does the factory get rid of the machine or not?

2. A drug manufacturer claims that fewer than 10% of patients who take its new drug for treating certain pneumonia will experience nausea. In a random sample of 250 patients, 23 experienced nausea. Perform a significance test at the 5% significance level to test this claim.

3. In a group of 375 Senior High School students, 40 were left-handed. Is this significantly different from the proportion of all Senior High School students who are left-handed, which is 12%?

4. In a random survey of 1000 households in Unlad Province, it is found that 29% of the households have at least one member with a college degree. Does this finding contradict the statement that the proportion of all such households in Unlad Province is 35 percent? Test at α = .05 significance level.

In a random sample of 400 electronic gadgets, 14 were found to be defective. The manufacturer wants to claim that less than 5% of all of their games are defective. Test this claim at the 0.01 significance level.

What I Have Learned

Complete the following statements.

1. Formulating the appropriate null hypothesis on a given population proportion in symbols is written as _____.

2. To formulate alternative hypothesis concerning population proportion, there are three possible alternative hypotheses and they are based on the wording of the question instructing you what to hypothesize.
   a. A problem with the expressions "smaller", "less", "decreased", "fewer", or "lower" is written in symbols as _____.
   b. A problem with the expressions "larger", "greater", "more", or "increased" is written in symbols as _____.
   c. A problem with the expressions "different", "not equal to", or "changed" is written in symbols as _____.

3. A hypothesis test can be directional or _____.

4. A directional or one-tailed test can be_____ or _____.

5. The null and alternative hypotheses are _____. That means, if one is true, the other must be false; and vice versa.
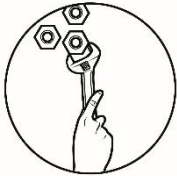
What I Can Do

Activity: Research, Create, Then Formulate!

Conduct a simple research to obtain some data in your community. You may do this through an interview. For example, your topic may be about population, health, number of households, accident rates, employment, etc. Using the given words below, choose only three and construct your own word problems. Then, formulate the appropriate null and alternative hypotheses.

|		
lesser	different	larger
changed	increase	greater
higher	smaller	unequal
lower	more	decrease

Assessment

Multiple Choice. Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. Which of the following is the correct symbol for hypothesized proportion?
   a. p_o b. p c. H_p d. H_o

2. What is the correct alternative hypothesis in sentence form of the statement: H_a: $p \neq 0.21$?
   a. The proportion of male in a certain barangay is 21%.
   b. The proportion of male in a certain barangay is fewer by 21%.
   c. The proportion of male in a certain barangay is different from 21%.
   d. The proportion of male in a certain barangay has increased by 21%.

3. Which of the following words is used in a null hypothesis written in sentence form?
   a. equal   b. fewer   c. higher   d. lower

4. A researcher will use a one-tailed test on his research study concerning population proportions. One-tailed test is also called _____.
   a. one-sided   c. directional
   b. one-region   d. non-directional

5. Which of the following statements is true about alternative hypothesis on a population proportion?
   a. It is represented by H_a.
   b. It is used as a basis to determine the location of the extreme values.
   c. It is the competing claim that the parameter is equal to a specific value.
   d. It is a claim that the proportion is equal to the hypothesized proportion.

6. Before the opening of classes, parents were asked to answer a survey. Those in favor of alternative learning mode were 1,900 out of 5,000 randomly selected parents. Using $\alpha = 0.10$ level, is there enough evidence to conclude that the percentage of parents who are in favor of alternative learning mode is *less than* 38%? What is the appropriate alternative hypothesis?
   a. H_a : $p > .38$ c. H_a : $p < .38$
   b. H_a : $p = .38$ d. H_a : $p \neq .38$

7. In problem no. 6, formulate the correct null hypothesis.
    a. The proportion of parents who are in favor of alternative learning mode is 38%.
    b. The proportion of parents who are in favor of alternative learning mode is not equal to 38%.
    c. The proportion of parents who are in favor of alternative learning mode has increased by 38%.
    d. The proportion of parents who are in favor of alternative learning mode is more than 38%.

8. A survey conducted last year by certain barangay officials showed that 40% of the residents owned a private car. This year a new survey is conducted on 375 residents selected randomly from the same barangay. It was found out that 190 of them own a car. Test if the claim is fewer at α = 0.01 level. Formulate the appropriate null hypothesis.
    a. $H_o:$ $p = .40$ c. $H_o:$ $p < .40$
    b. $H_a:$ $p = .40$ d. $H_a:$ $p < .40$

9. In problem #8, what is the correct alternative hypothesis in sentence form?
    a. The proportion of residents who owned a private car is 40%.
    b. The proportion of residents who owned a private car is higher than 40%.
    c. The proportion of residents who owned a private car has changed to 40%.
    d. The proportion of residents who owned a private car is fewer than 40%.

10. In a certain senior high school, a study found that 972 out that 1,100 Grade 12 students use smartphones. Using α = 0.10 level, is there enough evidence to conclude that the percentage of students who are using smartphones is *different from* 25%? What is the appropriate alternative hypothesis?
    a. $H_a: p > .25$ c. $H_a: p = .25$
    b. $H_a:$ $p < .25$ d. $H_a: p \neq .25$

11. In problem no. 10, what type of test is used?
    a. directional   c. one-tailed test
    b. one-sided test   d. non-directional

12. The president of a certain food chain claims that 70% of his 20,000 customers are very satisfied with the service they receive. In order to test the claim, a survey was conducted among 100 customers randomly chosen. Among them, 90% said that they are satisfied. Is there enough evidence to say that 70% of the customers are satisfied at 0.05 level of significance? Formulate the null hypothesis.
    a. $H_o: p \neq 0.70$ c. $H_o: p < 0.70$
    b. B. $H_o: p = 0.70$ d. $H_o: p > 0.70$

13. In problem no. 12, what is its alternative hypothesis?
    a. H_a: $p \neq 0.70$ c. H_a: $p = 0.70$
    b. H_a: $p < 0.70$ d. H_a: $p > 0.70$

14. Suppose a TV network claims that at least 6% of their 15,000 employees are living in a condominium unit in the city. A survey was conducted randomly among 500 employees. Assume a significance level of 0.05. What is the appropriate alternative hypothesis of this study?
    a. H_a: $p \neq 0.06$ c. H_a: $p < 0.06$
    b. H_a: $p > 0.06$ d. H_o: $p = 0.06$

15. In problem no. 14, what specific type of test is applied?
    a. directional   c. one-tailed test
   b. left-tailed test   d. non-directional
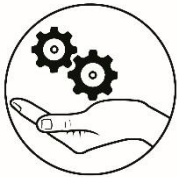
Additional Activities

Given below are alternative hypotheses (in sentence form or in symbols) on a population proportion. Determine if it is *one-tailed test* or *two-tailed test*.

1. H_a : $p \neq 0.12$ _____

2. H_a : $p < 0.58$ _____

3. H_a : $p > 0.27$ _____

4. The proportion of qualified students in an entrance examination for a certain college admission is greater than 10%.

    _____

5. The proportion of voters has decreased by 8% during this year's election.

    _____
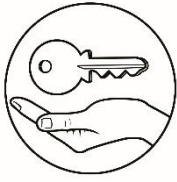
Activity 3   Please Correct Me If I'm Wrong

1. 🙂
2. 🙁 $Ha : p \neq 0.35$
3. 🙁 $Ha : p > 0.05$
4. 🙂
5. 🙁 $Ha : p \neq 0.55$

What's New – Synonyms Match

lesser	higher	changed
lower	increase	different
fewer	more	unequal
smaller	larger	
decrease	bigger	
	greater	

What I Know

1. B		9. C	
2. C		10. C	
3. D		11. C	
4. C		12. D	
5. D		13. C	
6. C		14. C	
7. D		15. B	
8. A			

What's In (Match Them Up!)

1. Ha
2. $\hat{p}$
3. H_0
4. p
5. n
6. q
7. α

Activity 4 Use It in a Sentence

i. H_o: The proportion of public market vendors who preferred using paper bags is 65%.

H_a: The proportion of public market vendors who preferred using paper bags is less than 65%.

ii. H_o: The percentage of students who are in favor of the new PE uniform is 35%.

H_a: The percentage of students who are in favor of the new PE uniform is not equal to 35%.

iii. H_o: The percentage of senior high school working students is 5%.

H_a: The percentage of senior high school working students is greater than 5%.

iv. H_o: The proportion of voters who preferred older candidates than younger ones is 75%.

H_a: The proportion of voters who preferred older candidates than younger ones is greater than 75%.

v. H_o: The percentage of elementary students who would rather play than read books is 55%.

H_a: The percentage of elementary students who would rather play than read books is not equal to 55%.

Activity 5. Tell me the Tail

1.	$H_o: p = 0.05$	$H_a: p > 0.05$	right-tailed
2.	$H_o: p = 0.10$	$H_a: p < 0.10$	left-tailed
3.	$H_o: p = 0.12$	$H_a: p \neq 0.12$	two-tailed
4.	$H_o: p = 0.35$	$H_a: p \neq 0.35$	two-tailed
5.	$H_o: p = 0.05$	$H_a: p < 0.05$	left-tailed

ASSESSMENT

1. A
2. C
3. A
4. C
5. A
6. C
7. A
8. A
9. D
10. D
11. D
12. B
13. A
14. C
15. B

ADDITIONAL ACTIVITIES

1. two-tailed test
2. one-tailed test
3. one-tailed test
4. one-tailed test
5. one-tailed test

WHAT I CAN DO

Students' answers may vary.

WHAT I HAVE LEARNED

1. $H_0: p = p_0$
2. a. $H_a: p < p_0$ b. $H_a: p > p_0$ c. $H_a: p \neq p_0$

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