SHS

AIRs - LM in

Statistics and Probability
Quarter 4: Week 5- Module 13
Solving Problems Involving Test of Hypotheses on a Population Mean And Formulating H_o and H_1 of Population Proportion

Statistics and Probability
Grade 11 Quarter 4: Week 5 - Module 13: **Solving Problems Involving Test of Hypotheses on a Population Mean and Formulating H_o and H_1 of population Proportion**

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Target

In the previous lesson, you already know how to estimate a population parameter either by using a point estimate or an interval estimate. This time, you will learn how to test a claim about a parameter. This claim is a hypothesis which we test using a sample data. You have been also equipped with the knowledge of identifying the appropriate test statistic in testing a hypothesis and making conclusion about the population mean based on the test-statistic value and the rejection region.

This module presents problem solving involving test of hypotheses on a population mean. It presents also the formulation of the null and alternative hypotheses on a population proportion and the appropriate form of test statistic when the Central Limit Theorem is to be used.

After going through this module, you are expected to:

1. solve problems involving test of hypothesis on the population mean (**M11/12SP-IVe-1**)
2. formulate the appropriate null and alternative hypotheses on a population proportion(**M11/12SP-IVe-2**)
3. identifies the appropriate form of test when the Central Limit Theorem is to be used(**M11/12SP-IVe-3**)
4. identifies the appropriate rejection region for a given level of significance when the Central Limit Theorem is to be used. (**M11/12SP-IVe-4**)

Subtasks:

1. formulate the null hypothesis and alternative hypothesis in words and in symbols.
2. identify the appropriate test statistic and the appropriate rejection region for a given level of significance using the CLT.
3. apply the steps in solving problems involving hypothesis testing.

Before going on, check how much you know about this topic. Answer the pretest on the next page in a separate sheet of paper.

Pretest

Directions: Read each item carefully and write the letter of the correct answer.

1. Which of the following refers to an intelligent guess about a population proportion?
   A. Decision B. Hypothesis
   C. Interpretation D. Test statistic
2. Which of the following serves as a guide in deciding whether to accept or reject the null hypothesis?
   A. Acceptance region B. Confidence level
   C. Decision Rule D. Interpretation
3. Under the normal curve, what do you call the values that separate the rejection region from the acceptance region?
   A. Confidence coefficients B. z-values
   C. Computed statistics D. t-values
4. What are the critical values if the level of significance is 0.01 and it is a two-tailed hypothesis test?
   A. ± 1.90 B. ± 1.96 C. ± 2.00 D. ± 2.58
5. How many samples are needed for the sample size to be considered large?
   A. $n>10$ B. $n > 30$ C. $n > 50$ D. $n > 100$
6. What statistical test for hypothesis is used when sample size is more than 30 and standard deviation is unknown?
   A. p B. r C. t D. z
7. If $p_o = 0.67$, what is q_o?
   A. 0.33 B. 0.35 C. 0.36 D. 0.37
8. When the null hypothesis is rejected, which of the following is true?
   A. The conclusion is guaranteed.
   B. The conclusion is not guaranteed.
   C. There is a sufficient evidence to back up the decision.
   D. There is no sufficient evidence to back up the decision.
9. In a *z*-test of proportion, what does it mean when the computed *z* lies in the rejection region?
   A. The sample proportion is equal to the population proportion
   B. The sample proportion is equal to the hypothesized proportion.
   C. The sample proportion is not equal to the population proportion.
   D. The sample proportion is not equal to the hypothesized proportion.
10. What is the significance of the rejection region?
    A. The rejection region has no significance.
    B. If the test statistic lies outside the rejection region, we will accept the null hypothesis.
    C. If the test statistics lies inside the rejection region, we will accept the null hypothesis.
    D. If the test statistics lies outside the rejection region, we will reject the null hypothesis.
11. A manufacturer of a certain brand of rice cereal claims that the average saturated fat content does not exceed 1.5 grams per serving. What is the parameter to be tested?
    A. number of cereal brands B. amount of rice cereal
    C. serving D. saturated fat content.

For items 12-13, use the problem below.

A manufacturer claims that the average lifetime of his light bulbs is 3 years or 36 months. The standard deviation is 8 months. Fifty bulbs are selected, and the average lifetime is found to be 32 months. Should the manufacturer's statement be rejected at a = 0.01?

12. Which should be the null and alternative hypothesis?

A. $\mu = 36$ B. $\mu = 36$ C. $\mu = 32$ D. $\mu = 32$
$\mu \neq 36$ $\mu > 36$ $\mu \neq 32$ $\mu > 32$

13. What should be the appropriate statistical test to be used?

A. p B. r C. t D. z

For items 14-15, use the problem below.

Beefy Burgee, a fast-food restaurant claims that 85% of the burger fanatics prefer to eat in their place. To test the claim, a random sample of 90 burger customers are selected at random and ask what they prefer. If 76 of the 90 burger fanatics said they prefer to eat at Beefy Burger, what will conclusion do we draw at 0.05 level of significance? $p = p_o$

14. What will be the appropriate null hypothesis?

A. $p = 0.85$ B. $p > 0.85$ C. $p < 0.85$ D. $p \neq 0.85$

15. What will be population proportion, $\hat{p}$?

A. 0.8433 B. 0. 8434 C. 0.8444 D. 0.8544

Jumpstart

For you to understand the lesson well, do the following activity.
Have fun and good luck!

Activity 1: Fix Me Up!

Directions: Arrange in chronological order the given steps in solving hypothesis.

___ A. Identify the level of significance
___ B. Select the appropriate test statistic
___ C. Draw a decision
___ D. Formulate the Hypotheses
___ E. Compute for the test statistic
___ F. Compare the probability value and significance level
___ G. Identify the rejection area

Activity 2. Find Me!

Directions. Write the Null hypothesis, (H_o), Alternative hypothesis, (H_a) and population proportion, ($\hat{p}$) for each of the following scenario.

1. A certain population has a sample proportion of 85%, population proportion is 81%, and the sample size is 175.
   H_o : ______
   H_a : ______
   $\hat{p}$: ______
2. It is believed that at least 40% of the residents in a certain area is in favor of abolishing the death penalty. Out of the 500 residents surveyed, 210 are in favor of the issue.

   H_o : ______
   H_a : ______
   $\hat{p}$: ______
3. A large city's Department of Motor Vehicles claimed that 80% of candidates pass the driving test, but newspaper reports that out of 90 randomly selected local teens who had taken the test, only 60 passed.
   H_o : ______
   H_a : ______
   $\hat{p}$: ______

Discover

Hypothesis Testing on the Population Mean

In "Hypothesis Test for a Population Mean," the claims are statements about a population mean. But we will see that the steps and the logic of the hypothesis test are the same.

The tables and figure below are provided for your quick reference.

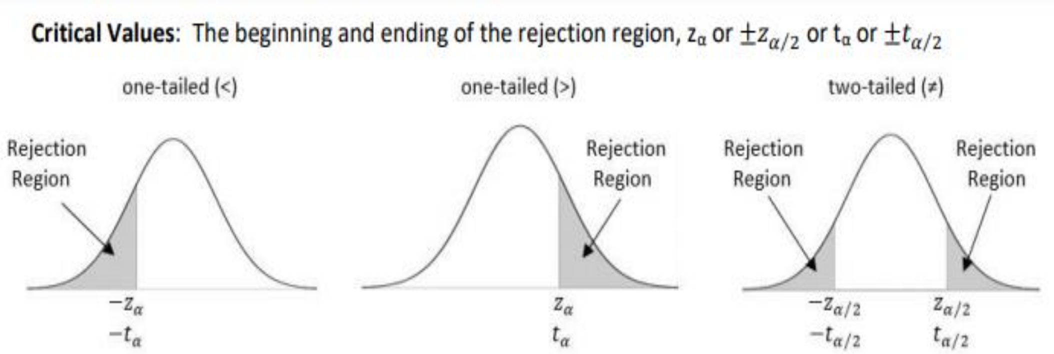
Table 1. Type of Hypothesis Test

Type of Hypothesis Test	Reject the Null Hypothesis if:
Left –Tailed (<)	The test statistic is located to the left of the critical value.
Right-tailed (>)	The test statistic is located to the right of the critical value.
Two-tailed (≠)	The test is located to the left of the negative critical value or to the right of the positive critical value.

Table 2. Level of Significance

Level of Significance (α)	One –tailed test		Two-tailed test
	Left (<)	Right (>)	
0.10	$-z_{\alpha}$ = - 1.28	z_{α} = +1.28	$z_{\frac{\alpha}{2}} = \pm 1.645$
0.05	$-z_{\alpha}$ = -1.645	z_{α} = +1.645	$z_{\frac{\alpha}{2}} = \pm 1.96$
0.01	$-z_{\alpha}$ = - 2.33	z_{α} = +2.33	$z_{\frac{\alpha}{2}} = \pm 2.575$

Figure 1.



Example 1

A random sample of 12 babies born in a charity ward of Cee Family Hospital was taken with a sample mean weight of 2.5083 kg. Assuming that this sample came from a normal population, investigate the claim that the mean weight is greater than 2.5 kg. The population standard deviation is 0.2 kg. Use the level of significance α = 0.05

Solution

Steps	Answer
1. Formulate the Hypotheses: the null hypothesis and alternative hypothesis	The null hypothesis is the mean weight of a born baby in a charity ward of Cee Family Hospital is 2.5 kg. In symbol, $H_o : \mu = 2.5$ The alternative hypothesis is the mean weight of a born baby in a charity ward of Cee Family Hospital is greater than 2.5 kg. In symbol, $H_1 : \mu > 2.5$
2. Determine the level of significance	$\alpha = 0.05$ One-tailed test as suggested by the alternative hypothesis, right-tailed test (>)

3. Calculate the test statistic and identify the rejection area	Claim: Sample mean, $\bar{x}$ = 2.5083 Hypothesized mean, μ = 2.5 Standard deviation,σ = 0.2 Number of sample, n = 12 Test-statistic to be used is z test, because the number of sample is less than 30. $z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}} = \frac{2.5083 - 2.5}{\frac{0.2}{\sqrt{12}}} = 0.1438$ at 0.05, the rejection area is, z_{α} = + 1.645
4. State the Decision Rule	Reject H_0 if the computed test statistics ≤ negative critical value. Do not reject (or accept) H_0 if the computed test statistic > negative critical value or test statistic < positive critical value
5. Make a decision based on the test statistics and the rejection area	The test statistic (z) 0.1438 < +1.645 (is not in the rejection area), thus, we decide to accept the null hypothesis and reject the alternative hypothesis.
6. Draw a conclusion	We say that at 5% level of significance, there is not enough evidence to support the claim that the mean weight of the babies in the charity ward of Cee Family Hospital is greater than 2.5 kg

Example 2

A sports trainer wants to know whether the true average time of his athletes who do 100-meter sprint in 98 seconds. He recorded 18 trials of his team and found that the average time is 98.2 seconds with standard deviation of 0.4 seconds. Is there a sufficient evidence to reject the claim at the 0.05 level of significance?

Solution

Steps	Answer
1. Formulate the Hypotheses: the null hypothesis and alternative hypothesis	The null hypothesis is the true average time of a sports trainer's athletes who do 100-meter sprint in 98 seconds. In symbols, $H_o : \mu = 98$ The alternate hypothesis is the true average time of a sports trainer's athletes who do 100-meter sprint in not 98 seconds. In symbols,$H_1 : \mu \neq 98$

2. Determine the level of significance	α = 0.05 Two-tailed test as suggested by the alternative hypothesis, ($\neq$)
3. Calculate the test statistic and identify the rejection area	Claim: Sample mean, $\bar{x}$ = 98.2 Hypothesized mean, μ = 98 Sample deviation, s = 0.4 Number of sample, n = 18 Test-statistic – t test $t= \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}} = \frac{98.2-98}{\frac{0.4}{\sqrt{18}}}$ = 2.1213 α = 0.05, df is 17 $t_{\frac{\alpha}{2}} = \pm 2.110$ - rejection area Decision Rule: Reject H_0 if $t_{\frac{\alpha}{2}}$ < - 2.111 or if $t_{\frac{\alpha}{2}}$ > +2.111
4. Make a decision based on the test statistics and the rejection area	The test statistic $t_{\frac{\alpha}{2}} < 2.1213$ is in the rejection area, thus we decide to reject the alternative hypothesis and accept the null hypothesis at 5% level of significance
5. Draw a conclusion	The recorded 18 trials of the sports trainer team is enough to claim that the true average time of his athletes who do 100-meter sprint in 98 seconds.

p-value Method

The *p-value* (or probability value) is the probability of getting a sample statistic as extreme as the test statistic in the direction of the alternative hypothesis when the null hypothesis is true.

To use a *p-value* in making conclusions for a given data at the level of significance α, we use the following rule:

Reject H_o if p-value $\leq \alpha$

Or

Do not reject H_o if p-value $> \alpha$

Example 3

A claim is published that in a certain area of high unemployment, 195 is the average amount spent on food per week by a family of four. A home economist wants to test this claim against the suspicion that the true average is lower than 195. She surveys a random sample of 36 families from the locality and finds the mean to be 193.20 with a standard deviation of 6.80. Using p-value method at 0.01 level of significance, test the home economists claim.

Solution

Steps	Answer
1. Formulate the Hypotheses: the null hypothesis and alternative hypothesis	The null hypothesis is the average amount spent on food per week by a family of four is 195. In symbols, $H_o : \mu = 195$ The alternate hypothesis is the average amount spent on food per week by a family of four is less than195. In symbols, $H_1 : \mu < 195$
2. Determine the level of significance	$\alpha = 0.01$ One-tailed test as suggested by the alternative hypothesis
3. Calculate the test statistic and identify the rejection area	Claim: Sample mean, $\bar{x} = 195$ Hypothesized mean, $\mu = 193.20$ Standard deviation, $\sigma = 6.80$ Number of sample, n = 36 Test-statistic – z test $z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}} = \frac{195 - 193.20}{\frac{6.80}{\sqrt{36}}} = 1.588 \approx 1.59$ The p-value is to the right of the computed z. Using the z-table of areas under the normal curve **p-value =P(z> 1.59)** The area between z=0 and z=1.59 is 0.4441 So, p-value = 0.5000 – 0.4441 = 0.0559 Since the test is one-tailed, the p-value remains as is. The p-value = 0.0559
4. Make a decision based on the test statistics and the rejection area	Decision rule is: Reject H_o if p-value $\leq \alpha$ Or Do not reject H_o if p-value $> \alpha$ We know that 0.0559 > 0.01
5. Draw a conclusion	We say that at 1% level of significance, the population mean is 195, hence, the null hypothesis is accepted and the alternate hypothesis is rejected. A published issue that in a certain area of high unemployment, economist survey proved that the average amount spent on food per week by a family of four is 195.

The Null and Alternative Hypotheses of Population Proportion

Population proportion, denoted by $\boldsymbol{p}$, refers to a fractional part of a population possessing certain characteristics. It can take on any value from 0 to 1.

When we perform a test of hypothesis for population proportion, we take a random sample from the population. This test can be considered a binomial experiment since there are only two outcomes for any trial, that is, success and failure, and the probability of a success does not change for each trial. For this binomial distribution to be similar to the shape of the normal distribution, we apply the **Central Limit Theorem.**

The **Central Limit Theorem for Proportion** states that the sampling distribution of the sample proportion $\hat{\boldsymbol{p}}$ (read: "p hat") is approximately normally distributed with mean p and standard deviation $\sqrt{\frac{pq}{n}}$ if the sample size **n** is sufficiently large but no more than 5% of the population size, where **p** is the population proportion and **q = 1 − p.**

Moreover, the test statistic **z** used for hypothesis testing of a population proportion p is given by:

$$z = \frac{\hat{p}-p}{\sqrt{\frac{pq}{n}}}$$

where: $\hat{p}$ – sample population proportion, $\hat{p} = \frac{x}{n}$
p – population proportion, q = 1 - p
n – sample size

The following conditions should be met:

- $np \geq 5$ and $nq \geq 5$
- $\mu = np$ and $\sigma = \sqrt{npq}$.

There are two ways in testing the hypothesis. The **classical or critical value approach** and the **probability (or p-value) approach**. The classical or critical approach results in a *reject/ do not reject* conclusion, while the p-values measure *how confident* we are in rejecting a null hypothesis. The critical approach compares the test statistic to the critical values whereas the p-value method compares the p-value to the significance level ($\boldsymbol{\alpha}$).

In general, using the p-value approach

The rejection region is p-value ≤ α

using the critical value approach

For a one-tailed test:

$H_o : p = p_o$

$H_1 : p > p_o$, **the rejection region is z > $+z_\alpha$**

Or $H_1: p < p_o$, **the rejection area is z < $-z_\alpha$**

For a two-tailed test:

$H_o : p = p_o$
$H_1: p \neq p_o$

The rejection region is $z < -z_{\frac{\alpha}{2}}$ or $z > z_{\frac{\alpha}{2}}$

The following table shows the rejection region for common values of level of significance α using the critical value approach.

α	Critical Regions		
	Left- tailed	Right-tailed	Two-tailed
0.10	$z < -1.28$	$z > 1.28$	$z < -1.645$ or $z > 1.645$
0.05	$z < -1.645$	$z > 1.645$	$z < -1.96$ or $z > 1.96$
0.01	$z < -2.33$	$z > 2.33$	$z < -2.575$ or $z > 2.575$

Let's determine the null and alternative hypothesis of the following examples:

Example 1: The principal of a school claims that 30% of grade 3 pupils stay in the playground after their classes. A survey among 500 grade 3 pupils revealed that 150 of them stay in the playground after their classes.

Solution: Let p be the proportion of the grade 3 pupils stay in the playground after classes. The claim is 30% of grade 3 pupils stay in the playground after their classes, hence, $p = 0.3$

In words the hypotheses are:

H_o = 30% of grade 3 pupils stay in the playground after their classes.
H_1 = 30% of grade 3 pupils do not stay in the playground after their classes,

In symbols,

$H_o: p = 0.3$
$H_1: p \neq 0.3$

Example 2: According to the survey, "23.8% of Filipinos aged 15 and above are smokers as of 2015." We are testing the claim that the percentage of Filipino smokers aged 15 and above in 2019 is less than 23.8% from a randomly selected 300 samples.

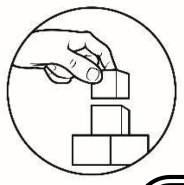
Solution: Let p be the proportion of Filipino smokers aged 15 and above. The claim is "23.8% of Filipinos aged 15 and above are smokers as of 2015." Hence, $p = 0.238$.

In words, the hypotheses are:

H_o : The proportion of Filipino smokers aged 15 and above is at least 0.238.
H_1 : The proportion of Filipino smokers aged 15 and above is less than 0.238.

In symbols,

$H_o : p \geq 0.238$
$H_1: p < 0.238$



Explore

Here are some enrichment activities for you to work on to master and strengthen the basic concepts you have learned from this lesson

Activity 1: Decide for the Best!

Direction: Perform hypothesis test for the following.

1. The X Last Company has developed a new battery. The engineering department of the company claims that each battery lasts for 200 minutes. In order to test this claim, the company selects a random of 100 new batteries so that this sample has a mean of 190 minutes with a standard deviation of 30 minutes. Test the engineering department claim that the new batteries run with an average of 200 minutes. Use a 0.01 level of significance.
   Solution:
   a. State the Null and Alternative Hypotheses
      H_0 : ________________
      H_1 : ________________
   b. What is the level of significance? α = _______
   c. Identify the rejection regions. $z_{\frac{\alpha}{2}}$ = ________
   d. Calculate the test statistics. Z = ____________
   e. What will be the decision rule? __________________
   f. Draw the conclusion: ____________________________
      ____

2. A mobile company is innovating a new mobile phone and is interested how long it will take for a battery to charge fully. The standard deviation is known to be 15 minutes. The company wishes to test if the mean charging time is at most 30 minutes compared to the claim that it is more than 30 minutes. A random sample of 35 mobile phones was selected and the mean charging time is more than 35 minutes. Can it be concluded that the mean charging time is not at most 30 minutes if the critical region is greater than 35 minutes?
   Solution
   a. State the Null and Alternative Hypotheses
      H_0 : ________________
      H_1 : ________________
   b. Identify the test if one-tailed or two-tailed. ____________
   c. Calculate the test statistics. Z = ____________
   d. Find the probability area which is the rejection area. α = _______
   e. Draw the conclusion: ____________________________
      ____

Activity 2: Complete Me!

Tasks: Complete the table by providing critical values based in the Table of Areas under the Normal Curve.

Level of significance	Critical Regions	
	One-tailed	Two-tailed
.05		
.01		

Activity 3. Formulate Me!

Directions: Write the Null and alternative hypothesis for each of the following population proportion.

1. Some boxes of a certain brand of breakfast cereal include a voucher for a free video rental inside the box. The company that makes the cereal claims that a voucher can be found in 20% of the boxes. However, based on their experiences eating this cereal at home, a group of students believe that the proportion of boxes with vouchers is less than 0.2. This group of students purchased 65 boxes of the cereal to investigate the company`s clam.
   H_0 : _______________
   H_1 : _______________

2. Haus of Gaz claims that more than two-thirds of the houses in a certain subdivision use their brand. Do we have a reason to claim if in a random sample of 40 houses in this subdivision, it is found that 25 use the company's brand.
   H_0 : _______________
   H_1 : _______________

3. A pharmacy claims that 9 out of 10 doctors recommend Ibuprofen to combat migraine. To test this claim, a random sample of 400 doctors is obtained so that only 320 of them indicate that they recommend Ibuprofen.
   H_0 : _______________
   H_1 : _______________
4. A factory, producing mobile chargers, claims that at least 95% of the mobile chargers they produced are not defective. A random sample of 100 mobile chargers were tested and 93 were found to be not defective.
   H_0 : _______________
   H_1 : _______________
5. A barangay captain claims that less than 50% of its constituents are dissatisfied with the distribution of relief goods. Test this claim by using the sample data obtained from a survey of 300 families where 54% indicated their dissatisfaction.
   H_0 : _______________
   H_1 : _______________

Deepen

Activity 1: It's your time to shine!

1. A canteen owner claims that the average meal cost of his usual clients is Php180. In order to test his own claim, he took a random sample of 30 receipts and computed the mean cost of Php210 with a standard deviation of Php25. Test the hypothesis at 0.01 level of significance. Show all steps

2. Suppose that scores on the Scholastic Aptitude Test form a normal distribution with μ = 500 and σ = 100. A high school counselor has developed a special course designed to boost SAT scores. A random sample of 16 students is selected to take the course and then the SAT. The sample had an average score of 544. Does the course boost SAT scores? Test at σ = 0.01. Show all steps.

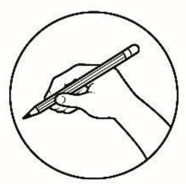
Activity 2. Concept Mapping

Make a concept/mind map on the process of hypothesis testing for population mean**.** A concept map is a graphical way to signify ideas and concepts. It is a visual thinking tool that helps arranging and organizing information, helping you to better comprehend, analyze, and synthesize, recall and remember new ideas. Place your output in A4 bond paper.

Rubrics for Mind/Concept Output

	5	4	3	2
Neatness and Presentation	The mind map was well presented and all the information is easy to understand	The mind map was well presented and most of the information is easy to understand	The mind map was mostly well presented but some of the information was difficult to understand	The mind map was not neat enough to understand
Use Images/Symbols	Most categories are enhanced with simple symbols or diagrams	Some categories are enhanced with simple symbols or diagrams	A few categories are enhanced with simple symbols or diagrams	The map includes some images
Understanding	The mind map demonstrate a thorough	The mind map demonstrate a very good	The mind map demonstrates	

	understanding of the lesson	understanding of the lesson	some understanding of the lesson	



Gauge

Directions: Answer the following questions and write your answer on the separate sheet of paper.

1. Which of the following serves as a guide in deciding whether to accept or reject the null hypothesis?
   A. Acceptance region B. Decision Rule
   C. confidence level D. interpretation
2. When the null hypothesis is rejected, which of the following is true?
   A. The conclusion is guaranteed.
   B. The conclusion is not guaranteed.
   C. There is a sufficient evidence to back up the decision.
   D. There is no sufficient evidence to back up the decision.
3. A manufacturer of a certain brand of rice cereal claims that the average saturated fat content does not exceed 1.5 grams per serving. What is the parameter to be tested?
   A. number of cereal brands B. amount of rice cereal
   C. serving D. saturated fat content.

4. A certain medical health association reports that the average cost of a 6-month medication for a patient with tuberculosis is ₱26 500. To see if the average cost is different in a nearby hospital, a researcher randomly sampled 25 patients from the said hospital with tuberculosis and found that the average cost of their medication is ₱24 800 with a standard deviation of ₱1 300. Calculate the test statistic for the hypothesis testing.
   A. 6.3 B. 6.5 C. 6.7 D. 6.9
5. What is the significance of the rejection region?
   A. The rejection region has no significance.
   B. If the test statistic lies outside the rejection region, we will accept the null hypothesis.
   C. If the test statistics lies inside the rejection region, we will accept the null hypothesis.
   D. If the test statistics lies outside the rejection region, we will reject the null hypothesis.

6. Previous research showed that the average height of the female students of a certain university is 1.55 meters with a standard deviation of 0.14 meters. In order to verify this, researchers chose a random sample of 144 female students of the said university, and the average height obtained is 1.48 meters. What is the value of the test statistic?
   A. – 9 B. – 8 C. – 7 D. – 6

For items 7-9, use the problem below.

A random sample of 225 nails produced by a manufacturing company is gathered. The engineer specified that the nails must have a mean length of 8 cm and a standard deviation of 0.04 cm. the average length of the nails in the sample is 8.055 cm. Test the claim using 0.01 level of significance.

7. Which should be the null and alternative hypothesis?
   A. $H_0: \mu = 8$
      $H_1: \mu \neq 8$
   B. $H_0: \mu = 8$
      $H_1: \mu > 8$
   C. $H_0: \mu = 8$
      $H_1: \mu < 8$
   D. $H_0: \mu < 8$
      $H_1: \mu > 8$
8. What is the value of the test statistic?
   A. – 20.6 B. -21.6 C. 20.6 D. 21.6
9. Based on the computed test statistics, what is your conclusion about the hypothesized and the sample mean?
   A. The hypothesized mean is greater than the sample mean
   B. No relationship between the hypothesized and the sample mean
   C. There is significant difference between the hypothesized mean and the sample mean
   D. There is no significant difference between the hypothesized mean and the sample mean.
10. In a z-test of proportion, what does it mean when the computed z lies in the rejection region?
    A. The sample proportion is equal to the population proportion
    B. The sample proportion is equal to the hypothesized proportion.
    C. The sample proportion is not equal to the population proportion.
    D. The sample proportion is not equal to the hypothesized proportion.

11. According to a research, 17 out of 50 working adults save 20% of their monthly salary. Which of the following is the null hypothesis?
    A. $H_0: \mu = 0.2$ B. $H_0: \mu = 17$ C. $H_0: p=0.34$ D. $H_0: p= 0.2$
12. For a z-test of proportions, which of the following is the rejection region for a one-tailed test?
    A. $Z > z_{\alpha}$ B. $z > z_{\frac{\alpha}{2}}$ C. $z < z_{\alpha}$ D. $z < z_{\frac{\alpha}{2}}$
13. What kind of hypothesis is represented by a proportion statement $p \geq 0.13$?
    A. H_0 B. H C. H_1 D. None of these
14. If $p_o = 0.83$, what is q_o?
    A. 0.07 B. 0. 17 C. 0. 27 D. 0.37
15. For a z-test of proportions, which of the following is the rejection region for a two-tailed test?
    A. $z > z_{\alpha}$ or $z < -z_{\alpha}$
    B. $z < z_{\alpha}$ or $z > -z_{\alpha}$
    C. $z > -z_{\frac{\alpha}{2}}$ or $z > z_{\frac{\alpha}{2}}$
    D. $z < -z_{\frac{\alpha}{2}}$ or $z > z_{\frac{\alpha}{2}}$

References:

Printed Materials

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