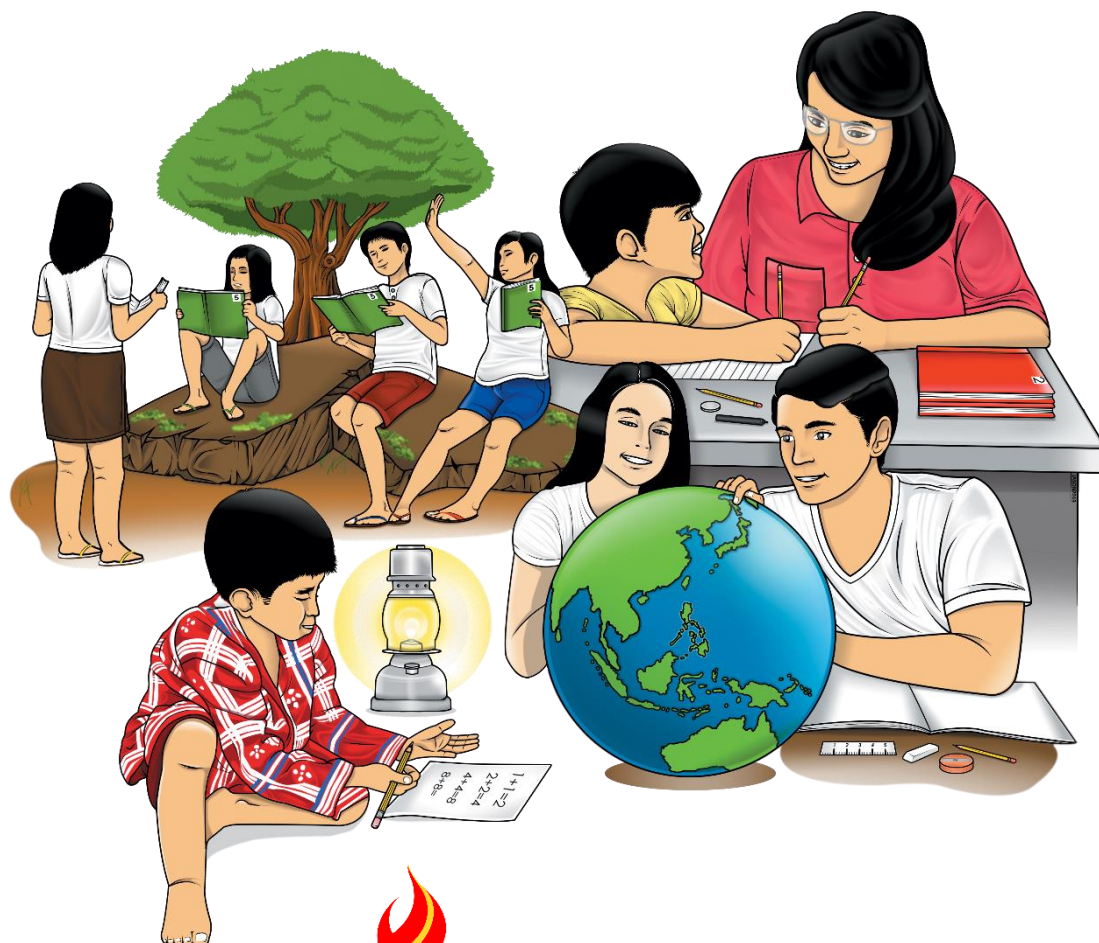


# Statistics and Probability

## Quarter 4 – Module 12:

### Computing Test Statistic Value Involving Population Proportion



**Statistics and Probability – Grade 11**

**Alternative Delivery Mode**

**Quarter 4 – Module 12: Computing Test Statistic Value Involving Population Proportion**  
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# **Statistics and Probability**

## **Quarter 4 – Module 12: Computing Test Statistic Value Involving Population Proportion**

# **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***

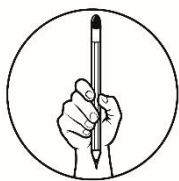
One of the processes in hypothesis testing is the calculation of the test statistic. It is the value used in determining the probability needed in decision-making. The conclusion we make depends on the computed test statistic.

Many hypothesis testing situations involve proportions. In fact, a hypothesis test involving a population proportion can be considered a binomial experiment. It means that there will only be two outcomes and the probability of a success or failure does not change from trial to trial since the outcome of each trial is independent. As you may recall, the Central Limit Theorem is not limited to sample means only. It can also be applied to sample proportions. In doing so, the *z-test statistics for population proportion* shall be applied.

This module will be dealing on the computation of the test statistic value for population proportion.

After going through this module, you are expected to:

1. describe the *z-test* statistic of proportion;
2. compute the *z-value* for population proportion; and
3. solve problems involving the *z-value* for population proportion



## ***What I Know***

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

1. A randomly selected sample of 500 senior high students was surveyed if they spend more than 3 hours playing Mobile Legends. Thirty percent (30% or 0.30) of the 500 students surveyed said they do. Which one of the following statements about the number 0.30 is correct?
  - a. It is a margin of error.
  - b. It is a sample proportion.
  - c. It is a population proportion.
  - d. It is a randomly chosen number.
2. Which of the following is NOT included in using the statistic z-test?
  - a. The situation contains count data.
  - b. The situation contains the mean or average.
  - c. The situation contains the population proportion.
  - d. The situation has only two possible outcomes: success or failure.
3. In testing the proportion, which of the following assumptions should be proven true?
  - a.  $np > 5$  and  $nq > 5$
  - b.  $np \geq 5$  and  $nq \geq 5$
  - c.  $np < 5$  and  $nq < 5$
  - d.  $np \leq 5$  and  $nq \leq 5$
4. If  $p = 0.37$ , what is the value of  $q$ ?
  - a. 0.37
  - b. 0.53
  - c. 0.63
  - d. 0.73

For nos. 5-7, refer to the problem below.

A school administrator claims that less than 50% of the students are dissatisfied with the food served in the school canteen. The claim used a sample data obtained from a survey of 500 students of the school wherein 54% indicated their dissatisfaction with the food served in the school canteen.

5. What is the value of the hypothesized population proportion?
  - a. 0.46
  - b. 0.50
  - c. 0.54
  - d. 500
6. What is the value of the sample proportion?
  - a. 0.46
  - b. 0.50
  - c. 0.54
  - d. 500
7. What is the z-value?
  - a. 0.0005
  - b. 0.0224
  - c. 1.7857
  - d. 1.8021

8. When should you NOT use z-test?
- when you are testing for a mean
  - when you are given the population standard deviation
  - when you are ONLY given the sample standard deviation
  - when you are testing a proportion/percentage of a population
9. When performing a test about population proportion, what test statistic would you need to use?
- t-test
  - z-test
  - chi-square
  - standard deviation
10. Considering the pandemic, a survey is held to 1,000 randomly chosen students in which more than 80% are in favor of holding online classes. What is the value of the sample proportion  $\hat{p}$ ?
- 0.013
  - 0.160
  - 0.640
  - 0.800
11. Which of the following is NOT included in the computation of the z-test for population proportion?
- n
  - p
  - $\hat{p}$
  - $\mu$
12. What is the formula to find the z-test for population proportion?
- $z = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}}$
  - $z = \frac{\hat{p} - \mu}{\sqrt{\frac{p(1-p)}{n}}}$
  - $z = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{\mu}}}$
  - $z = \frac{p - \hat{p}}{\sqrt{\frac{p(1-p)}{n}}}$
13. The record of patients in Kalinga Community Hospital shows that 45 out of 100 patients have high cholesterol level of 240mg/dl and above. Using a one-tailed test with  $\alpha = 5\%$ , can we conclude that 30% of the patients have high cholesterol level? In this problem, which test should be used?
- t-test
  - p-test
  - chi-square test
  - z-test for proportion

For nos. 14-15, refer to the problem below.

A new proposition on a ballot wants to know whether it is likely to pass upon obtaining more than 50% of the vote. A poll is taken and 571 out of 1,000 people support the proposition.

14. What test statistic should be applied in the problem?
- mean
  - t-test
  - z-test
  - z-test for proportion
15. What is the value of the test statistic?
- 2.37
  - 3.46
  - 4.10
  - 4.49

**Lesson****1****Computing Test Statistic Value Involving Population Proportion**

In the previous modules, you have learned how to test hypotheses involving means or averages. In this one, you will learn how to conduct tests involving count data, percentages, or population proportion. Inferences involving proportions are made in the context of probability of “**success**” (***p***) or “**failure**” (***q***) for a binomial distribution. When testing about a proportion, a percentage, or a probability, there are some assumptions to be considered. Once these assumptions are met, then the *z-test statistics for proportions* can be applied.

***What's In*****Activity 1. Say Something!**

Copy the table below. In your own words, briefly describe each of the following terms.

1.	$\alpha$	Level of Significance
2.	$Z_{\text{tab}}$	Critical Value
3.	$\hat{p}$	Sample Proportion
4.	$p$	Population Proportion
5.	$n$	Size of Samples
6.	Rejection Region	
7.	Z test for Population Proportion	





### Notes to the Teacher

In this module, all situations presented involve sample sizes which are large enough so that CLT or Central Limit Theorem can be applied. Therefore, there is no need for the learners to present or prove the two assumptions presented and discussed in the lesson. Instead, the lesson will mainly focus on calculating for the value of z-test statistics involving population



### What's New

Here, you will use the concepts that you have learned in module 10.

#### Activity 2. Home Sweet Home!

Look for the word by carefully reading and answering the guide questions that follow. Choose your answer from the list. Copy the answer box and write the letter that corresponds in your answer.

A recent survey done by the Philippine Housing Authority found that 35% of the population owns their homes. In a random sample of 240 heads of households, 78 responded that they own their homes.

A = 0.35

U = 78

L = 240

E = 0.325

V = 35%

#### Guide Questions.

1. What part of the whole population own their homes?
2. What is the value of  $p$ ?
3. What is the size of the sample,  $n$ ?
4. How many owned their homes,  $x$ ?
5. Compute for the value of  $\hat{p}$ .

1	2	3	4	5



## What is It

It is observable that the previously cited situation did not use nor mention words like “mean” or “average” but “percentage” instead. Also, it utilized count data. Problems such as this involves population proportion. Inferences involving proportions are made in the context of probability of “success”,  $p$ , in a binomial distribution.

From the situation that we presented in the above activity, the respondents have only two possible options for their responses and those are the following:

Option 1	They own their house.	<b>“success” or <math>p</math></b>
Option 2	They do not own their house.	<b>“failure” or <math>q</math></b>

Showing if the number of samples is large enough as the Central Limit Theorem states, we need to satisfy the two assumptions. It is evident that the responses have only two possible outcomes: “owned” (success) or “not owned” (failure). Therefore, the condition for binomial experiment is met. Also, to be able to satisfy the condition that  $np \geq 5$  and  $nq \geq 5$ , we find that the hypothesized value of the population proportion is  $p = 0.35$  while  $n = 240$ . To get  $q$ ,  $q = 1 - p$  makes  $q = 1 - 0.35 = 0.65$ .

Through substitution, we can show that the second condition is also met, since:

$$\begin{array}{lll}
 np \geq 5 & \text{and} & nq \geq 5 \\
 240 (0.35) \geq 5 & \text{and} & 240 (0.65) \geq 5 \\
 84 \geq 5 & \text{and} & 156 \geq 5
 \end{array}$$

Since we have shown that  $np \geq 5$  and  $nq \geq 5$ , all conditions are met where the sample size is large enough to use Central Limit Theorem. In this condition, the test statistic to be used is the *z-test statistic* for proportions denoted by  **$Z_{com}$  or the computed z-value**.



Again, the problems presented here contain sample sizes that are large enough to consider the Central Limit Theorem or CLT. Thus, in solving these problems, there is no need to show these assumptions.

## Z – Test Statistic for Population Proportion

Remember that the formula for the value of *z-test statistic for population proportion* would be:

$$Z_{\text{com}} = \frac{\hat{p} - p}{\sqrt{\frac{pq}{n}}} \quad \text{or} \quad Z_{\text{com}} = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}}$$

where:

- $z_{\text{com}}$  is the z-test statistic for proportion.
- $\hat{p}$  is the sample proportion ( $\frac{x}{n}$ ).
- $p$  is the hypothesized value of the population proportion.
- $n$  is the sample size or the number of observations in the sample.
- $q$  is equal to  $1 - p$ .

We will use this formula in the examples that follow.

### Illustrative Example 1:

Let us now determine the z-value in the situation presented previously. To be able to solve it, we need to identify first the values of the following:

$$Z_{\text{com}} = ?$$

$$\hat{p} = \frac{x}{n} = \frac{78}{240} = 0.325$$

$$p = 35\% = 0.35$$

$$n = 240$$

$$q = 1 - p = 1 - 0.35 = 0.65$$

Then, substitute these values in the formula:

$$\begin{aligned} Z_{\text{com}} &= \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}} \\ &= \frac{0.325 - 0.35}{\sqrt{\frac{0.35(0.65)}{240}}} \\ &= \frac{-0.025}{\sqrt{\frac{0.2275}{240}}} \\ &= \frac{-0.025}{\sqrt{0.0009479}} \\ &= \frac{-0.025}{0.03079} \end{aligned}$$

Therefore, the computed z-value is  $Z_{\text{com}} = -0.812$

If you are still a bit confused, here is another example.

### Illustrative Example 2:

Determine the value of  $Z_{\text{com}}$  given the following information:

$$p = 0.42$$

$$\text{Sample Size: } n = 150$$

$$\text{Sample Proportion: } \hat{p} = 0.45$$

**Solution:**

To start your solution, identify first the values of the following:

$$Z_{\text{com}} = ?$$

$$\hat{p} = 0.45$$

$$p = 0.42$$

$$n = 150$$

$$q = 1 - p = 1 - 0.42 = 0.58$$

Then, substitute these values in the formula:

$$\begin{aligned} Z_{\text{com}} &= \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}} \\ &= \frac{0.45 - 0.42}{\sqrt{\frac{0.42(0.58)}{150}}} \\ &= \frac{0.03}{\sqrt{\frac{0.2436}{150}}} \\ &= \frac{0.03}{\sqrt{0.001624}} \\ &= \frac{0.03}{0.0403} \end{aligned}$$

$$Z_{\text{com}} = 0.7444$$

**Illustrative Example 3:**

The claim is made that 40% of tax filers use computer software to file their taxes. In a sample of 50, 14 used computer software to file their taxes. To test  $H_0: p = 0.4$  versus  $H_a: p > 0.4$  at  $\alpha = 0.05$  where  $p$  is the population proportion who use computer software to file their taxes. And to test using the binomial distribution and test using the normal approximation to the binomial distribution. Determine first the value of  $Z_{\text{com}}$ .

**Solution:**

First, determine the value of the following:

$$Z_{\text{com}} = ?$$

$$\hat{p} = \frac{x}{n} = \frac{14}{50} = 0.28$$

$$p = 40\% = 0.40$$

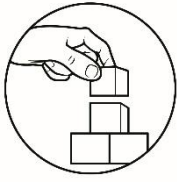
$$n = 50$$

$$q = 1 - p = 1 - 0.40 = 0.60$$

Then, substitute these values in the formula:

$$\begin{aligned} Z_{\text{com}} &= \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}} \\ &= \frac{0.28 - 0.40}{\sqrt{\frac{0.40(0.60)}{50}}} \\ &= \frac{-0.12}{\sqrt{\frac{0.24}{50}}} \\ &= \frac{-0.12}{\sqrt{0.0048}} \\ &= \frac{-0.12}{0.069} \end{aligned}$$

Therefore, the computed z-value is  $Z_{\text{com}} = -1.739$



## What's More

### Activity 3. Fancy Meeting You

Tell if each part of the numbered solution is right or wrong. If wrong, encircle the part of the solution that is incorrect. Then, replace it with the correct answer. **Total Points: 18**

#### Problem A:

An insurance industry report indicated that 30% of those persons involved in minor traffic accidents this year have been involved in at least one traffic accident in the last five years. Believing it was too large, an advisory group decided to investigate this claim. A sample of 200 traffic accidents this year showed that 56 persons were also involved in another accident in the last five years. Determine the value of  $z_{\text{com}}$ .

#### Solution:

First, prepare the data that will be used in the formula.

$$Z_{\text{com}} = ?$$

$p$  = percentage of those who were involved in an accident during the last five years

$$= 30\%$$

$$p = 0.30$$

$$\hat{p} = \frac{\text{number of persons involved in another accident in the last five years}}{\text{number of persons involved in accidents in the last five years}}$$

$$= \frac{56}{200} = 0.28$$

$$n = 200$$

$$q = 1 - p = 1 - 0.30 = 0.70$$

1

Substitute the values in the formula.

$$Z_{\text{com}} = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}}$$

$$= \frac{0.28 - 0.30}{\sqrt{\frac{0.30(0.70)}{200}}}$$

$$= \frac{-0.20}{\sqrt{\frac{0.210}{200}}}$$

$$= \frac{-0.20}{\sqrt{0.00105}}$$

$$= \frac{-0.02}{0.0324}$$

$$Z_{\text{com}} = 0.6173$$

2

3

4

5

6

**Problem B:**

In the website of Sweet Choco, it was stated that an ideal bag of chocolates contains 24% white chocolates. Suppose we counted the number of white chocolates in 40 chocolate sachet packs and the proportion from the sample is found to be 23.04%, what is the value of z?

**Solution:**

As preparation for our solution, let us again identify first the needed data for the formula.

$$\left. \begin{aligned} Z_{\text{com}} &= ? \\ p &= 24\% = 0.24 \\ \hat{p} &= 23.04\% = .02304 \\ n &= 40 \\ q &= 1 - p = 1 - 0.24 = 78 \end{aligned} \right\} \boxed{1}$$

Then, substitute these values in the formula.

$$\begin{aligned} Z_{\text{com}} &= \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}} \\ &= \frac{0.2304 - 0.24}{\sqrt{\frac{0.24(0.76)}{40}}} \\ &= \frac{-0.0096}{\sqrt{\frac{0.1724}{40}}} \\ &= \frac{-0.0096}{\sqrt{0.00456}} \\ &= \frac{-0.0069}{0.0675} \\ Z_{\text{com}} &= 0.1422 \end{aligned} \left. \begin{array}{l} \\ \\ \\ \\ \\ \end{array} \right\} \begin{array}{l} \boxed{2} \\ \boxed{3} \\ \boxed{4} \\ \boxed{5} \\ \boxed{6} \end{array}$$

**Problem C:**

A national survey asked the following question of 2500 registered voters: “Is the character of a candidate for president important to you when deciding for whom to vote?” Two thousand of the responses were yes. The survey revealed that 90% of all registered voters who believe the character of the president is important when deciding for whom to vote. Compute for the test statistic  $Z_{\text{com}}$ .

**Solution:**

$$Z_{\text{com}} = ?$$

$$p = 90\% = 0.90$$

$$\hat{p} = \frac{2000}{2500} = .80$$

$$n = 2500$$

$$q = 1 - p = 1 - 0.90 = 0.10$$

Substituting these values in the formula,

$$Z_{\text{com}} = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}}$$

$$= \frac{0.80 - 0.90}{\sqrt{\frac{0.90(0.10)}{2500}}}$$

$$= \frac{-0.01}{\sqrt{\frac{0.09}{2500}}}$$

$$= \frac{-0.10}{\sqrt{0.00036}}$$

$$= \frac{-0.10}{0.06}$$

$$Z_{\text{com}} = -16.67$$

1

2

3

4

5

6

Did you get a very satisfying score? I hope you did.

I think by this time you can handle well how to compute for the test statistic or z test.

Please try to answer the next activity with your utmost confidence.



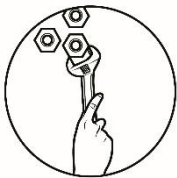


## ***What I Have Learned***

### **Activity 4. Missing Piece**

Complete the following statements.

1. The test statistic to be used in testing hypothesis involving population proportion is called \_\_\_\_\_.
2. The formula to find the value of z-value for population proportion is \_\_\_\_\_.
3. The symbol for the computed z-value is \_\_\_\_\_.
4. The symbol  $\hat{p}$  represents \_\_\_\_\_.
5. The hypothesized value of the population proportion is denoted by \_\_\_\_\_.
6. The sample size or a number of observation in the sample is symbolized by \_\_\_\_\_.
7. To be able to find  $q$ , subtract \_\_\_\_\_ from \_\_\_\_\_ or simply \_\_\_\_\_.
8. If  $p = 0.56$ , then  $q =$  \_\_\_\_\_.
9. The Central Limit Theorem (CLT) can be used when the sample is sufficiently large enough. Sample is large enough if it satisfies the condition that \_\_\_\_\_.
10. The standard deviation for population is used in z-test. Is it true or false? Explain.



## ***What I Can Do***

### **Activity 5. Finding $Z_{\text{com}}$**

Determine the value of  $Z_{\text{com}}$  given the following information.

1.  $p = 0.35$   
sample size = 180  
sample proportion = 0.40
2.  $p = 0.36$   
sample size = 250  
sample proportion = 29%
3.  $p = 0.65$   
sample size = 200  
sample proportion = 78%

**A.** Carefully analyze the following situations. Then, fill in the missing data and solve for  $Z_{\text{com}}$ .

1. A politician claims that he will receive 60% of the votes in the upcoming election. In a random sample of 500 voters, there are 175 who will surely vote for him.

Identify the following:

$$\begin{aligned} p &= \underline{\hspace{2cm}} \\ \hat{p} &= \underline{\hspace{2cm}} \\ n &= \underline{\hspace{2cm}} \underline{\hspace{2cm}} \\ q &= 1 - p = \underline{\hspace{2cm}} \\ Z_{\text{com}} &= ? \end{aligned}$$

Solution:

$$Z_{\text{com}} = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}}$$

2. A social worker reports that 30% of workers in a factory are below 25 years of age. Of the 120 employees surveyed, 38 said they are 15 years old.

Identify the needed data:

$$\begin{aligned} p &= \underline{\hspace{2cm}} \\ \hat{p} &= \underline{\hspace{2cm}} \\ n &= \underline{\hspace{2cm}} \\ q &= 1 - p = \underline{\hspace{2cm}} \\ Z_{\text{com}} &= ? \end{aligned}$$

Solution:

$$Z_{\text{com}} = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}}$$

3. Health-care coverage for employees varies with company size. It is reported that 30% of all companies with fewer than 10 employees provide health benefits for their employees. A sample of 50 companies with fewer than 10 employees is selected. It is found that 19 of the 50 companies surveyed provide health benefits for their employees.

Identify the needed data:

$$\begin{aligned} p &= \underline{\hspace{2cm}} \\ \hat{p} &= \underline{\hspace{2cm}} \\ n &= \underline{\hspace{2cm}} \underline{\hspace{2cm}} \\ q &= 1 - p = \underline{\hspace{2cm}} \\ Z_{\text{com}} &= ? \end{aligned}$$

Solution:

$$Z_{\text{com}} = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}}$$

4. A survey of 2500 women between the ages of 15 and 50 found that 28% of those surveyed relied on the pill for birth control. The research shows that 25% of them are using the pill for birth control.

Identify the needed data:

$$\begin{aligned} p &= \underline{\hspace{2cm}} \\ \hat{p} &= \underline{\hspace{2cm}} \\ n &= \underline{\hspace{2cm}} \underline{\hspace{2cm}} \\ q &= 1 - p = \underline{\hspace{2cm}} \\ Z_{\text{com}} &= ? \end{aligned}$$

Solution:

$$Z_{\text{com}} = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}}$$

5. A group of online shoppers were surveyed and 70% said that they spent around P1000 to P1500 every month on the internet shopping. From 400 respondents, 235 said that they consumed P1000 – P1500 in online shopping.

Identify the needed data:

$p =$  \_\_\_\_\_  
 $\hat{p} =$  \_\_\_\_\_  
 $n =$  \_\_\_\_\_  
 $q = 1 - p =$  \_\_\_\_\_  
 $z_{\text{com}} = ?$

Solution:

$$Z_{\text{com}} = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}}$$

6. A poll taken just prior to election day finds that 389 of 700 registered voters intend to vote for Kris P. Bacon for mayor of a certain city. The poll resulted that 50% of all voters intend to vote for Kris.

Identify the needed data:

$p =$  \_\_\_\_\_  
 $\hat{p} =$  \_\_\_\_\_  
 $n =$  \_\_\_\_\_  
 $q = 1 - p =$  \_\_\_\_\_  
 $z_{\text{com}} = ?$

Solution:

$$Z_{\text{com}} = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}}$$



## Assessment

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

1. Which is NOT one of the basic characteristics of life?
  - a. air
  - b. response
  - c. metabolism
  - d. reproduction
2. Life activities such as ingestion and digestion are parts of the process of
  - a. growth
  - b. response
  - c. metabolism
  - d. respiration
1. Which of the following is NOT necessary in solving the statistic z-test for population proportion?
  - a. Mean
  - b. sample proportion
  - c. size of the sample
  - d. population proportion
2. The following are to be considered in using the Central Limit Theorem. Which one should NOT be included?
  - a. the critical value
  - b.  $np \geq 5$  and  $nq \geq 5$
  - c. The sample size is large enough.
  - d. The situation should only have two outcomes: “success” or “failure”.
3. If  $p = 0.63$ , what is the value of  $q$ ?
  - a. 0.37
  - b. 0.42
  - c. 0.58
  - d. 37.0
4. Mr. Makisig asserts that fewer than 5% of the bulbs that he sells are defective. Suppose 300 bulbs are randomly selected. Each is tested and 10 defective bulbs are found. What is the value of the sample proportion?
  - a. 0.013
  - b. 0.023
  - c. 0.033
  - d. 0.043
5. In problem no. 4, what is the value of  $z$ ?
  - a.  $-1.20$
  - b.  $-1.25$
  - c.  $-1.30$
  - d.  $-1.35$
6. A randomly selected sample of 500 senior high students was surveyed whether they spend more than 3 hours playing Mobile Legends. Thirty percent (30% or 0.30) of the 500 students surveyed said they do. Which one of the following statements about the number 500 is correct?
  - a. It is the size of samples.
  - b. It is the sample proportion.
  - c. It is the population proportion.
  - d. It is the randomly chosen number.

7. If  $p = 0.46$ , what is the value of  $q$ ?
- a. 0.46                      b. 0.53                      c. 0.54                      d. 0.64

For nos. 8-10, refer to the problem below.

A research conducted on a certain company last year revealed that 25% of the employees prefer drinking milk tea than coffee during break time. The company has decided to give free milk tea during break time. In a recent study, out of 100 randomly sampled employees, 28% said that they would rather drink milk tea than coffee.

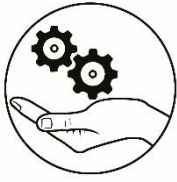
8. What is the value of the hypothesized population proportion?
- a. 0.25                      b. 0.28                      c. 0.75                      d. 100
9. What is the value of the sample proportion?
- a. 0.25                      b. 0.28                      c. 0.75                      d. 100
10. What is the z-value?
- a. 0.5682                      b. 0.6065                      c. 0.6928                      d. 0.7713
11. Which of the following should NOT be considered in using z-test for proportion?
- a. when you are testing for the mean  
b. when you are given the sample proportion  
c. when you are testing a proportion/percentage of a population  
d. when each sample point can result in just two possible outcomes: success or failure
12. Which of the following is NOT included in the computation of the z-test for population proportion?
- a.  $N$                       b.  $\sigma$                       c.  $\hat{p}$                       d.  $p$

For nos. 13-15, refer to the problem below.

In the recent city triathlon, the sponsors have encouraged more women to participate in the event. A sample is chosen randomly and among 70 runners, 32 are women. The sponsors would somewhat like to be 90% certain that at least 40% of the participants are women.

13. What test statistic should be applied in the problem?
- a. mean                                      c. t-test  
b. p-test                                      d. z-test for proportion
14. Which of the following is the value of  $\hat{p}$ ?
- a. 0.90                      b. 0.46                      c. 0.40                      d. 0.32
15. What is the value of the test statistic?
- a. 0.973                      b. 0.819                      c. - 0.973                      d. - 0.819

Did you pass the assessment?  
CONGRATULATIONS! if you do. But if not, please go back otherwise the next modules would become more difficult.



## ***Additional Activities***

### **Activity 6. You Complete Me**

**A.** Carefully analyze the following and solve for the value of z-test statistic,  $z_{com}$ . Write your complete solutions.

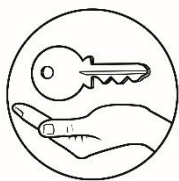
1. A school principal claims that 40% of Grade 3 pupils stay in the playground after their classes. A survey among 500 Grade 3 pupils revealed that 150 of them stay in the playground after their classes.
2. A certified public accountant (CPA) claims that more than 30% of all accountants advertise. A sample of 112 accountants in Metro Manila showed that 40 use some form of advertising.
3. The GSIS states that 80% of its claims are settled within a month. A consumer group selected a random sample of 240 of the company's claims to test this statement. It is found that 200 of the claims were settled within a month.

### **B. Think and Reflect**

1. Think of anything that you did today where you demonstrated or practiced zeal or eagerness. How did you feel about it?

**"Through zeal, knowledge is gotten; through lack of zeal, knowledge is lost."**

**- Buddha**



## Answer Key

<p><b>You Complete Me</b></p> <p>1. - 4.55 2. 1.39 3. 1.16</p>	<p><b>Fancy Meeting You!</b></p> <p>A.1) False, <math>p = .30</math> 2) True 3) False, - 0.02 4) False, - 0.02 5) True 6) False, - 0.6173 B.1) False, <math>\hat{p} = 0.2304</math> <math>q = 0.76</math> 2) True 3) False, 0.1824 4) True 5) False, -0.0096 6) False, - 0.1422 C. 1) True 2) True 3) False, -0.10 4) False, <math>\sqrt{0.000036}</math> 5) False, 0.006</p>
<p><b>Missing Piece</b></p> <p>1. Z- test statistic for Proportion <math>2. Z = Z_{com} = \frac{\hat{p} - p}{\sqrt{\frac{pq}{n}}}</math> 3. <math>Z_{com}</math> 4. Sample Proportion 5. <math>p</math> 6. <math>n</math> 7. a. <math>p</math>      b. 1 8. 0.44 9. <math>np \geq 5</math> and <math>nq \geq 5</math> 10. False</p>	<p><b>Home Sweet Home!</b></p> <p>1. 35% 2. 0.35 3. 240 4. 78 5. 0.325</p> <p>The hidden word is</p> <p>VALUE</p> <p><b>Say Something!</b></p> <p>Answers may vary</p>
	<p><b>What I Know</b></p> <p>1. B 2. B 3. B 4. C 5. B 6. C 7. C 8. C 9. B 10. D 11. D 12. A 13. D 14. D 15. D</p>

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

<b>Finding <math>Z_{com}</math></b>		
A. 1. 1.40	2. -2.33	3. 3.82
B.		
1.	2.	3.
$p = 0.60$	$p = 0.30$	$p = 0.30$
$\hat{p} = 0.35$	$\hat{p} = 0.32$	$\hat{p} = 0.38$
$n = 500$	$n = 120$	$n = 50$
$1 - p = 0.40$	$1 - p = 0.70$	$q = 0.70$
$Z_{com} = -11.41$	$Z_{com} = 0.479$	$Z_{com} = 1.23$
4.	5.	6.
$p = 0.25$	$p = 0.70$	$p = 0.50$
$\hat{p} = 0.28$	$\hat{p} = 0.59$	$\hat{p} = 0.56$
$n = 2500$	$n = 400$	$n = 700$
$q = 0.72$	$q = 0.30$	$q = 0.50$
$Z_{com} = 3.33$	$Z_{com} = -4.78$	$Z_{com} = 3.16$



# References

## Textbooks

- Albacea, Zita VJ., Mark John V. Ayaay, Isidoro P. David, and Imelda E. De Mesa. *Teaching Guide for Senior High School: Statistics and Probability*. Quezon City: Commission on Higher Education, 2016.
- Arciaga, Ronald L., and Dan Andrew H. Magcuyao. *Statistics and Probability*. Pasay City: JFS Publishing Services, 2016.
- Caraan, Avelino Jr S. *Introduction to Statistics & Probability: Modular Approach*. Mandaluyong City: Jose Rizal University Press, 2011.
- De Guzman, Danilo. *Statistics and Probability*. Quezon City: C & E Publishing Inc., 2017.
- Punzalan, Joyce Raymond B. *Senior High School Statistics and Probability*. Malaysia: Oxford Publishing, 2018.
- Sirug, Winston S. *Statistics and Probability for Senior High School CORE Subject A Comprehensive Approach K to 12 Curriculum Compliant*. Manila: Mindshapers Co., Inc., 2017.
- Stephens, Larry J. *Schaum's Outline of Theory and Problems Of Beginning Statistics*. McGraw-Hill Companies, Inc., 1998.
- Stephens, Larry J. *Theory and Problems of Statistics Fourth Edition*. The McGraw-Hill Companies, Inc. 2008.

## Online Resources

- CliffsNotes. "Test for a Single Population Proportion." Accessed May 28, 2020 <https://www.cliffsnotes.com/study-guides/statistics/univariate-inferential-tests/test-for-a-single-population-proportion>
- Quizizz. "Hypothesis Tests for Population Proportions." Accessed May 27, 2020 <https://quizizz.com/admin/quiz/5c70658f40b384001a7dc327/hypothesis-tests-for-population-proportions>
- Quizizz. "Population Proportion." Accessed May 29, 2020 <https://quizizz.com/admin/search/population%20proportion>
- UCI Donald Bren School of Information & Computer Sciences. "Sample Multiple Choice Questions." Accessed May 28, 2020 <https://www.ics.uci.edu/~jutts/8/SampleFinalMCKey.pdf>

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