11

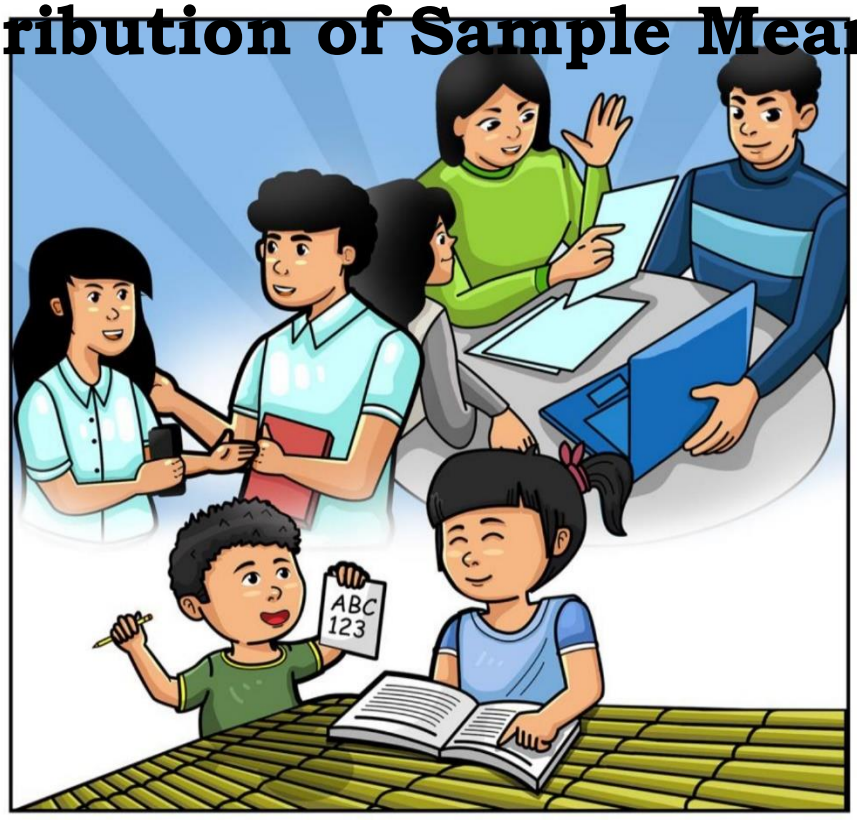
SENIOR HIGH SCHOOL

DEPARTMENT OF EDUCATION
SCHOOLS DIVISION OF NEGROS ORIENTAL
REGION VII
Kagawasan Ave., Daro, Dumaguete City, Negros Oriental

STATISTICS and PROBABILITY

Quarter 3 - Module 5

Random Sampling and Sampling Distribution of Sample Means



ALTERNATIVE DELIVERY MODE

NegOr_Q3_Stat_and_Prob11_Module5_v2

Statistics and Probability – Grade 11
Alternative Delivery Mode
Quarter 3 – Module 5: Random Sampling and Sampling Distribution of Sample Means
Second Edition, 2021

Published by the Department of Education
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Undersecretary: Diosdado M. San Antonio

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Printed in the Philippines by _____

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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

This module was designed to provide you with fun and meaningful opportunities for guided and independent learning at your own pace and time. You will be enabled to process the contents of the learning resource while being an active learner.

The module is intended for you to illustrate random sampling, distinguish between parameter and statistic, and identify sampling distributions of statistics.

After going through this module, you are expected to find the mean and variance of the sampling distribution of the sample mean.

What I Know

Before studying this module, take this test to determine what you already know about the topic covered.

PRE-ASSESSMENT

A. Indicate if the following refers to population or sample.

_____1. A group of 50 students selected to test a new learning technique.

_____2. The total machines produced by a factory in three weeks.

B. Classify each sample as simple random, stratified, systematic, or cluster.

_____3. Every 14^{th} customer entering shopping malls is asked to select his favourite food chain.

_____4. In a certain school in Negros Oriental, all grade 11 teachers are interviewed to determine whether they believe that students have higher grades now than in previous year.

C. Determine whether the underlined value is a parameter or a statistic.

_____5. In a national survey on substance abuse, <u>10% of respondents aged 12 to 17</u> reported using illicit drugs within the past month

_____6. 68% of students out of 100 surveyed planned to go to college right after high school.

D. You are given a population of 3 elements, which are 3, 4, 5. Suppose all possible samples of size 2 are drawn from the population with replacement, compute for the following:

a. mean of the sample means;

b. variance of the sample means; and

c. standard deviation of the sample means

Lesson 1 Random Sampling

What's In

Why do researchers resort to sampling and why is it important to them? Everyone who has undergone research projects knows that resources are limited. Time, money and people never come in an unlimited supply. Thus, most researches aim to gather data from a sample of people, rather than from the entire population. Sampling allows researchers to:

a. save time
b. save money; and
c. collect richer and meaningful data

But what exactly is sampling, and how does it work? A research sample is like any other sample, it's a small piece or part of something that represents a larger whole. But what does it mean to randomly sample people, and how does a researcher do that?

What's New

Task 1. Share me your idea!

1. What is census?
2. What is survey?
3. What is sample survey?
4. What is sample?
5. What is population?
6. What is sampling?
7. Why do we use sampling (getting only sample) rather than full enumeration (taking all the respondents/population)?
8. Do you have any idea how to do random sampling?
9. How do we conclude about the behavior/characteristic of a certain population/respondents?

In this lesson we will learn more about random sampling and sampling distribution.

What is It

In modern statistics, the main object to be analysed is data. If you get a portion of the totality of data to be analysed, then these data are called **sample**. Otherwise, if you analyse the whole data available, then it is called **population**.

When the recording of information of an entire population is conducted, this is called a **census**. An example of this is collecting the grades of all the Grade 11 learners, or the decennial population census done by the Philippine Statistics Authority (PSA). However, in most cases, censuses involve great challenges. Also, one does not need to do a full count to get information, especially on flow data, such as agricultural production, household expenditure, and establishment income. This brings us to **sampling**, which is the process of selecting a section of the population.

There are many reasons why we resort to sampling. Some of these reasons or to be considered are the cost, timeliness, accuracy, detailed information, and destructive testing.

Let us define some important terms that will help us understand more about random sampling.

Sample –part/portion/fraction/segment of the population being studied
Population – the whole universe or consists of all elements or totality of things considered in a study
Survey – method of systematically gathering of information
Sample survey - method of systematically gathering of information on a segment/part/fraction/portion of a population for the purpose of inferring quantitative descriptors of the attributes of the population
Sampling - process of selecting a section of the population
Random –the outcome is obtained only by chance
Random Sampling – method of choosing an equally distributed subset/portion from a larger population to be used as basis in describing or making conclusions about the population
Statistical Inference - process of using sample statistics to draw conclusions about true population parameters

There are two types of sampling. These are **probability and non-probability sampling**. Probability sampling involves units obtained using chance mechanism, and requires the use of a sampling frame (a list/map of all the sampling units in the population) while in a non-probability sample, units are chosen without regard to their probability of occurrence.

Probability Sampling

It is a sampling method that allows every member of the population to have an equal chance of being selected into the sample.

Basic types of Probability Sampling

a. **Simple random sampling (SRS)** involves allowing each possible sample to have an equal chance of being picked and every member of the population has an equal chance of being included in the sample. Selection may be with replacement (selected individual or unit is returned to frame for possible reselection) or without replacement (selected individual or unit is not returned to the frame). This sampling method requires a listing of the elements of the population called the sampling frame. Example of this is 'draw lots' activity.

b. **Stratified sampling** is an extension of simple random sampling which allows for different homogeneous groups, called strata, in the population to be represented in the sample. To obtain a stratified sample, the population is divided into two or more strata based on common characteristics. A SRS is then used to select from each strata, with sample sizes proportional to strata sizes. Samples from the strata are then combined into one. This is a common technique when sampling from a population of voters, stratifying across racial or socio-economic classes.

c. **Systematic sampling**, elements are selected from the population at a uniform interval that is measured in time, order, or space.

   Typically, there is firstly, a decision on a desired sample size n. The frame of N units is then divided into groups of k units: k=N/n. Then, one unit is randomly selected from the first group, with every k^{th} unit thereafter also selected.

d. **Cluster sampling** divides the population into groups called clusters, selects a random sample of clusters, and then, subjects the sampled clusters to

complete enumeration, that is everyone in the sampled clusters are made part of the sample.

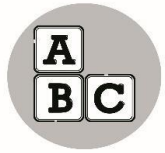
Non- probability Sampling

It is a sampling method that does not allow every member of the population to have an equal chance of being selected into the sample.

Basic types of Non-Probability Sampling

a. **Haphazard or accidental sampling** involves an unsystematic selection of sample units. Some disciplines like archaeology, history, and even medicine draw conclusions from whatever items are made available. Some disciplines like astronomy, experimental physics, and chemistry often do not care about the "representativeness" of their specimens.
b. In **convenience sampling**, sample units expedient/near/easy to access to the sampler are taken.
c. For **volunteer sampling**, sample units are volunteers in studies wherein the measuring process is painful or troublesome to a respondent.
d. **Purposive sampling** pertains to having an expert select a representative sample based on his own subjective judgment or his own purpose for the study.
e. In **Quota Sampling**, sample units are picked for convenience but certain quotas (such as the number of persons to interview) are given to interviewers. This design is especially used in market research.
f. In **Snowball Sampling**, additional sample units are identified by asking previously picked sample units for people they know who can be added to the sample. Usually, this is used when the topic is not common, or the population is hard to access.

Some methods of data collection – **mail**, **face-to-face interview**, **e-survey**, **phone survey, SMS survey.**



What's More

Task 2. Identify the sampling technique (as probability or non-probability sampling) and the type of sampling illustrated in the example situations below.

1. If a population has an equal number of males and females in it, so does the sample.
2. If we wish to draw a sample of 50 individuals from a population of 1000 patients admitted in a certain hospital, we could place the 1000 names in a container and blindfolded, draw one name at a time.
3. The Grade 11 student who happens to be taking a STEM course in the Senior High School and is therefore a convenient subject to use, frequently becomes part of the sample in a research. The students in a class may constitute the entire sample because they happen to be in a class whose teacher is interested in doing a research.
4. A school has 900 students of which 380 are males and 520 are females. A sample of 120 students are needed. To obtain a sample proportional to the given members in each stratum, and finding the proportion of the samples to the population which is equal to the desired sample size of 120 students.
5. In a population of 200, we wish to get a sample of 40. We obtain n by dividing 200 by 40 to obtain n=5. This means that every 5^{th} element of a given population that is arranged alphabetically or in any systematic fashion is selected to make the sample size.

Lesson 2 Parameter and Statistic

What's In

Justify your answer.

A. Which sampling method will better represent the entire population.

a.

Sampling Method	Results
Claire surveys every other parent who came in every Monday during giving of modules	80% want (MDL) Modular Distance Learning

Jessica questions the parents of HUMSS students	50% want (MDL) Modular Distance Learning

Answer: Claire's sample is a random sample, giving results that better represent the entire parents of the school, so it is the better method.

b.

Sampling Method	Results
Jean surveys only the family of the patients she knows personally.	78% claims their patients do not have health problems for the past week
Peter writes each patient's name on a card. He questions those family members whose name he draws.	60% claims their patients do not have health problems for the past week

Answer: Peter's 's sample is a random sample, giving every family member equal chance to be surveyed, so it is the better method.

B. Determine which sample better represents the entire population.

a. A TV ratings service is surveying residents of Brgy. Cambaluktot who bought TVs in the last month about their favorite TV show.

b. A TV ratings service called residents of Brgy. Cambaluktot randomly selected from the phone directory to conduct a survey about their favorite show. *Answer: b*

What's New

To start with the discussion, answer first these 4 items.

1. A survey will be given to 100 students randomly selected from the Grade 12 TVL class at JMLMHS. What is the population?
   A. The 100 selected students
   B. All Grade 12 students at JMLM High School
   C. All students at JMLM High School
2. From the situation in number 1, what is the sample?
   A. The 100 selected students
   B. All Grade 12 students at JMLM High School
   C. All students at JMLM High School
3. Sixty bottles of water were randomly selected from a large collection of bottles in a company's warehouse. These sixty bottles are referred to as the

A. Parameter B. Population C. Sample

4. From situation number 3, the large collection of bottles is referred to as

A. Parameter B. Population C. Sample

Answer: 1. B 2. A 3. C4. B

What is It

Parameters in statistics are important component of any statistical analysis. In simple words, a parameter is any numerical quantity that characterizes a given population. This means that the parameter tells us something about the whole population.

What is the difference between a statistic and a parameter?

A statistics and parameter are very similar. They are both descriptors of groups, like "50% of dog owners prefer X Brand dog food." The difference between a statistic and parameter is that **statistic** describe a sample, while **parameter** describes an entire population.

Comparison Chart

Basis for Comparison	Statistic	Parameter
Meaning	Statistic is a measure which describes a fraction of a population.	Parameter refers to a measure which describes population.
Numerical Value	Variable and Known	Fixed and unknown
Statistical Notation	$\overline{x}$ = sample mean s = sample standard deviation p = sample proportion x = data element n = size of sample r = correlation coefficient	μ= population mean σ= population standard deviation P= population proportion X= data element N = size of population ρ= correlation coefficient

(Surbhi. 2017)

Examples of Parameter.

1. You could ask a class of grade 11 students in a certain school who like vanilla ice cream. 85% raise their hands. You have a parameter: <u>85% of that class likes vanilla ice cream</u>. You know this because you asked everyone in the class.

2. 60% of Philippine senators voted for a particular measure. There are only 24 senators you can count that every one of them voted.

Examples of Statistic.

1. 40% of 1,211 students at a particular elementary school got below a 3 on a standardized test. You know this because you have each and every students' test score.
2. 25% of 100 residents in a particular barangay would like to be vaccinated.

What's More

Illustration of parameter and statistic

1. A researcher wants to know the average weight of females aged 22 years or older in Region VII. The researcher obtains the average weight of 54 kg, from a random sample of 40 females.

   Solution: In the given situation, the statistics are the average weight of 54 kg, calculated from a simple random sample of 40 females, in Region VII while the parameter is the mean weight of all females aged 22 years or older.

2. A researcher wants to estimate the average amount of water consumed by male teenagers in a day. From a simple random sample of 55 male teens the researcher obtains an average of 1.5 litres of water.

   Solution: In this question, the parameter is the average amount of water consumed by all male teenagers, in a day whereas the statistic is the average 1.5 litres of water consumed in a day by male teens, obtained from a simple random sample of 55 male teens.

Lesson 3 Sampling Distribution

What's In

Task 3

Suppose a population is composed of only 3 measures: 1, 2, and 3. The possible samples of size 2 can be draw from this population. List all the possible sample size 2 when repetition is allowed or with replacement.

Task 4

Find the mean, variance and standard deviation of the following measures: 2, 5, 6, 3, 9, 10, 12, and 15.

What's New

A lot of data drawn by researchers are not population but are actually samples. Below are a series of questions that somehow will be answered as we go through with the discussions below.

1. How is a sampling distribution different from the distribution of a sample? From the distribution of a population? What do these differences tell us about the properties of a sampling distribution?
2. In what situation would we examine a normal distribution curve? In what situation would we examine a sampling distribution curve?
3. If we took three different samples of high school students (one from the 1st Congressional District, one from the 2nd Congressional District, and one from 3rd Congressional District) and each sample had 500 students, what would the sampling distribution for age look like? What about for parent's annual income? Explain each response.

What is It

In previous lessons, we were provided the concepts about sampling, including the reasons for sampling as opposed to the conduct of a full-enumeration census. It was also pointed out that probability sampling, where samples are selected using chance methods, enable the samples to be representative of the population being studied.

A statistic, such as the sample mean or the sample standard deviation, is a number computed from a sample. Since a sample is at random, every statistic is a random variable: it varies from sample to sample in a way that cannot be predicted with certainty. As a random variable it has a mean, a variance, a standard deviation, and a probability distribution. The probability distribution of a statistic or the set of all possible estimates generated is called **sampling distribution,** the mean of sample means or this statistic is called **expected value,** and the standard deviation of sample means or this statistic is called the **standard error.**

Samples can be drawn with and without replacement. In addition, if the sampling protocol were to be replicated, then a new set of samples (and data) would be obtained, thus yielding different estimates from one sample to another. Thus, an estimate based on sample could be different if the sampling process were to be repeated many times.

Example.

There are three balls numbered 1, 2, and 3. Two of the balls are selected randomly and the average/mean of their numbers is computed.

Population (1,2,3), **N=3**

Sample size of two, **n=2**

List of possible samples

1. Without replacement

Sample 1: {1, 2}
Sample 2: {1, 3}
Sample 3: {2, 1}

Sample 4: {2, 3}
Sample 5: {3,1}
Sample 6: {3, 2}

There are six possible outcomes of size 2 from a population of size 3. Since there are 6 possible samples, there are also 6 sample means. The sample means are shown in the table below.

Outcome/ Sample #	Ball 1	Ball 2	Sample mean
1	1	2	**1.5**
2	1	3	**2**
3	2	1	**1.5**
4	2	3	**2.5**
5	3	1	**2**
6	3	2	**2.5**

Table 1.0 All possible outcomes when two balls are drawn without replacement.

We now summarize these means as follows:

a. two samples have mean of 1.5;
b. two samples have mean of 2;
c. two samples have mean of 2.5

From the summary, we see that

a. the probability of mean equal to 1.5 is 2/6 or 1/3
b. the probability of mean equal to 2 is 2/6 or 1/3
c. the probability of mean equal to 2.5 is 2/6 or 1/3

Therefore, the sampling distribution of the means from the population of measures 1, 2, and 3 that has sample size two without replacement is as follows:

Sample mean	frequency	probability
1.5	2	2/6 0r 1/3
2	2	2/6 or 1/3
2.5	2	2/6 or 1/3

Table 1.2 Sampling Distribution of Sample Means from Population N=3 (1,2, and 3) and Sample Size 2 (n=2) Without Replacement.

2. With replacement

Sample 1: {1, 1}
Sample 2: {1, 2}
Sample 3: {1, 3}
Sample 4: {2, 1}
Sample 5: {2, 2}
Sample 6: {2, 3}
Sample 7: {3, 1}
Sample 8: {3, 2}

Sample 9: {3, 3}

There are 9 possible outcomes of size 2 from a population of size 3. Since there are 9 possible samples, there are also 9 sample means. The sample means are shown in the table below.

Outcome/ Sample #	Ball 1	Ball 2	Sample mean
1	1	1	**1**
2	1	2	**1.5**
3	1	3	**2**
4	2	1	**1.5**
5	2	2	**2**
6	2	3	**2.5**
7	3	1	**2**
8	3	2	**2.5**
9	3	3	**3**

Table 1.3 All possible outcomes when two balls are drawn with replacement.

We now summarize these means as follows:

a. one sample has mean of 1;
b. two samples have mean of 1.5;
c. three samples have mean of 2;
d. two samples have mean of 2.5
e. one samples have mean of 3

From the summary, we see that

a. the probability of mean equal to 1 is 1/9
b. the probability of mean equal to 1.5 is 2/9
c. the probability of mean equal to 2 is 3/9
d. the probability of mean equal to 2.5 is 2/9
e. the probability of mean equal to 3 is 1/9

Therefore, the sampling distribution of the means from the population of measures 1, 2, and 3 that has sample size two with replacement is as follows:

Sample mean	frequency	probability
1	1	1/9
1.5	2	2/9
2	3	3/9

2.5	2	2/9
3	1	1/9

Table 1.4 Sampling Distribution of Sample Means from Population N=3 (1,2, and 3) and Sample Size 2 (n=2) With Replacement.

Mean, Variance, and Standard Deviation of Sample Means

Take note of the following symbols and formulas:

Mean of the population

$$\mu = \frac{\sum x}{N}$$

Example on the 3 balls numbered 1, 2, and 3.

$$\mu = \frac{\sum x}{N}$$

$$= \frac{1+2+3}{3}$$

$$= \frac{6}{3}$$

$$= 2$$

Variance of the population

$$\sigma^2 = \frac{\sum (x-\mu)^2}{N}$$

Example on the given above.

$$\sigma^2 = \frac{\sum (x-\mu)^2}{N}$$

$$= \frac{(1-2)^2+(2-2)^2+(3-2)^2}{3}$$

$$= \frac{(-1)^2+(0)^2+(1)^2}{3}$$

$$= \frac{2}{3}$$

Standard Deviation of the population

$$\sigma = \sqrt{\sigma^2}$$

Example on the given above.

$\sigma = \sqrt{\sigma^2}$

$= \sqrt{\frac{2}{3}}$

Sample mean

$\overline{x}$

Mean of sample means or expected value (EV)

$$\mu_{\overline{x}} = \frac{\sum \overline{x}}{N}$$

Variance of sample mean

$$\sigma^2{}_{\overline{x}} = \frac{\sum(\overline{x} - \mu_{\overline{x}})^2}{N}$$

Standard Deviation of sample mean or the standard error (SE)

$$\sigma_{\overline{x}} = \sqrt{\sigma^2{}_{\overline{x}}}$$

Example:

There are three balls numbered 1, 2, and 3. Two of the balls are selected randomly with replacement and the average/mean of their numbers is computed.

Compute for the following:

a. mean of the sample means
b. variance of the sample means
c. standard deviation of the sample means

Outcome/ Sample #	Ball 1	Ball 2	Sample mean
1	1	1	**1**
2	1	2	**1.5**
3	1	3	**2**
4	2	1	**1.5**
5	2	2	**2**
6	2	3	**2.5**
7	3	1	**2**
8	3	2	**2.5**
9	3	3	**3**

Table 1.3 All possible outcomes when two balls are drawn with replacement.

a. The mean of the sample means is:

$$EV \text{ or } \mu_{\overline{x}} = \frac{\sum \overline{x}}{N}$$

$$\mu_{\overline{x}} = \frac{1+1.5+1.5+2+2+2+2.5+2.5+3}{9}$$

$$= \frac{18}{9}$$

$\mu_{\overline{x}} = 2$ **The variance of the sample means is:**

$$\sigma^2{}_{\overline{x}} = \frac{\sum(\overline{x} - \mu_{\overline{x}})^2}{N}$$

$$= \frac{(1-2)^2 + (1.5-2)^2 + (1.5-2)^2 + (2-2)^2 + (2-2)^2 + (2-2)^2 + (2.5-2)^2 + (2.5-2)^2 + (3-2)^2}{9}$$

$$= \frac{(-1)^2+(-0.5)^2+(-0.5)^2+(0)^2+(0)^2+(0)^2+(0.5)^2+(0.5)^2+(1)^2}{9}$$

$$= \frac{3}{9}$$

$$= 0.33333$$

b. The standard deviation of the sample means is:

$$\sigma_{\overline{x}} = \sqrt{\sigma^2{}_{\overline{x}}}$$

$$\sigma_{\overline{x}} = \sqrt{0.33333}$$

$$= 0.57735$$

Sampling Distribution of the Sample Mean for Normal Population when the Variance/Standard deviation is known or unknown.

Three major points about the Sampling Distribution of the Sample Mean

1. The **EV or expected value** or mean of sample means is equal to the population mean μ.

   EV = μ

This is the reason why sample can be used to represent a population because they have the same value for the mean.

You can prove this by simply comparing the value of population mean of the three balls in the given examples above and the mean of sample means when two balls are drawn with replacement.

2. The **SE or standard error** or standard deviation of sample means can be computed when population variance is known using

$SE = \frac{\sigma}{\sqrt{n}}$ (for samples with replacement) and

$SE = \frac{\sigma}{\sqrt{n}} . \sqrt{\frac{N-n}{N-1}}$ (for samples without replacement) where σ is the population standard deviation.

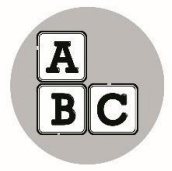
Example on the case above, three balls numbered 1, 2, and 3. Two samples are drawn.

The standard deviation of the population is $\sigma = \sqrt{\frac{2}{3}}$.

Let us solve for the SE.

$SE = \frac{\sigma}{\sqrt{n}} = \frac{\sqrt{\frac{2}{3}}}{\sqrt{2}} = \sqrt{\frac{2}{6}} = 0.577$

3. The shape is approximately normal, provided the sample size is large enough, and regardless of the shape of parent distribution.



What's More

Task 5

Challenge yourself!

A population consists of the numbers 3, 5, 7.

1. Enumerate all possible samples of size 2 with replacement.
2. Construct a sampling distribution table and compute for the mean of each sample.
3. Find the variance of the sample means.
4. Find the standard deviation of the sample means.
5. Find the population mean.
6. Find the variance of the population.
7. Find the standard deviation of the population.
8. Find the standard error of the mean.

What I Have Learned

Task 6

Do your best!

Apply what you have learned by explaining the cycle on how we give inference/conclusions on the population from sample.

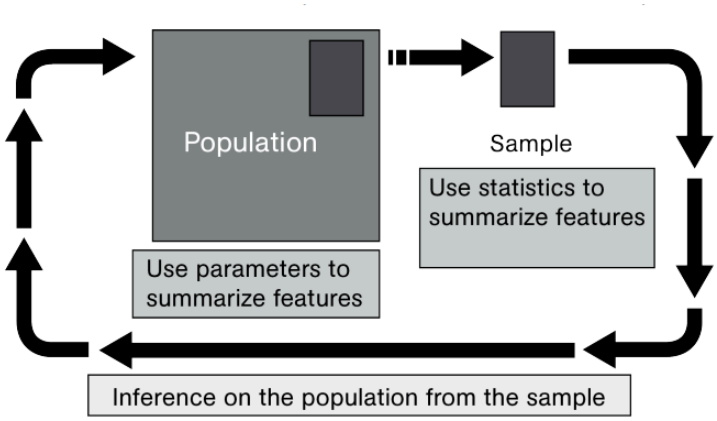


Figure 1.0 Population, sample, and inference

Source: Jose Ramon G. Albert, Ph.D. Teaching Guide for Senior High School STATISTICS AND PROBABILITY. Quezon City: Commission on Higher Education, 2016, p. 228

RUBRICS

OUTSTANDING (20 pts) – demonstrate/show an **exemplary** ability to analyze and interpret the cycle and **excellent** understanding of the concepts, processes and methods used.

EFFECTIVE (15 pts) – demonstrate/show a **proficient** ability to analyze and interpret the cycle and **good** understanding of the concepts, processes and methods used.

ADEQUATE (10 pts) – demonstrate/show a **developing** ability to analyze and interpret the cycle and **beginning** understanding of the concepts, processes and methods used.

INEFFECTIVE (5 pts) – demonstrate/show **deficiencies** on their ability to analyze and interpret the cycle and **insufficient** understanding of the concepts, processes and methods used.

http://www.csu.edu/CTRE/pdf/rubricexamples-all.pdf

What I Can Do

Task 7

You can do it!

Consider the heights of 5 learners. Suppose you are interested in estimating the average height of the learners by getting estimates based on the sample average height of two learners selected at random with replacement. The learners have equal chance of being selected.

Learner	Height (in meter)
1	1.64
2	1.58
3	1.58
4	1.33
5	1.60

Find the following (2pts each):

1. list of all possible random samples.
2. the population mean.
3. the population variance and standard deviation
4. the expected value
5. the standard error

Assessment

Task 8

I. Select the best choice.

1. It is the process of using sample statistics to draw conclusions about true population parameters.

   A. statistical inference C. sampling

   B. the scientific method D. descriptive statistics

2. It is the universe or "totality of items or things" under consideration.

   A. sample B. population C. parameter D. statistic

3. It is the portion of the universe that has been selected for analysis.

A .sample B. frame C. parameter D. statistic

4. It is a summary measure that is computed to describe a characteristic from only a sample of the population.

   A. parameter B. census C. statistic D. scientific method

5. Which of the following is most likely a parameter as opposed to a statistic?

   A. The average score of the first five learners completing an assignment

   B. The proportion of females registered to vote in a county

   C. The average height of people randomly selected from a database

   D. The proportion of trucks stopped yesterday that were cited for bad brakes

II. Identify which sampling method is applied in the following situations.

6. The teacher randomly selects 20 boys and 15 girls from a batch of learners to be members of a group that will go to a field trip. (Probability Sampling)
7. A sample of 10 mice are selected at random from a set of 40 mice to test the effect of a certain medicine. (Probability Sampling)
8. The people in a certain seminar are all members of two of five groups are asked what they think about the president. (Probability Sampling)
9. A salesclerk for a brand of clothing asks people who comes up to her whether they own a piece of article from her brand. (Non-probability Sampling)
10. A brand manager of a toothpaste asks ten dentists that have clinic closest to his office whether they use a particular brand of toothpaste. (Non-probability Sampling)

III. Find what is ask.

Random samples of size 4 are drawn with replacement from a finite population 3,6,9.

a.) How many possible samples of size 4 are possible?

b.) Find the mean of the sample means.

c.) Find the variance of the sample.

d.) Find the standard deviation of the sample.

Answer Key

PRETEST

A. 1. Sample
2. population

B. 3. Systematic sampling
4. cluster sampling

C. 5. parameter
6. Statistic

D.

a) $\mu_{\overline{x}} = 4$
b) $\sigma^2{}_{\overline{x}} = 0.333$
c) $\sigma_{\overline{x}} = 0.577$

What's More (Lesson 1) Task 2.

1. Non-Probability (Quota Sampling)
2. Probability (Simple random Sampling)
3. Non-Probability (Accidental)
4. Probability (Stratified)
5. Probability (Systematic)

Task 3.

Possible samples

(1, 1)	(1, 3)	(2, 2)	(3, 1)	(3, 3)
(1, 2)	(2, 1)	(2, 3)	(3, 2)	

Task 4. Mean: 7.75 Variance: 17.9375 Standard Deviation: 4.235

Task 5.

1. (3, 3) (3, 5) (3, 7) (5, 3) (5, 5) (5, 7) (7, 3) (7, 5) (7, 7)
2.

sample	Mean
3, 3	3
3, 5	4
3, 7	5
5, 3	4
5, 5	5
5, 7	6
7, 3	5
7, 5	6
7, 7	7

3. $\sigma^2{}_{\overline{x}} = 2.6667$
4. $\sigma_{\overline{x}} = 1.633$
5. $\mu = 5$
6. $\sigma^2{}_{\overline{x}} = 1.333$
7. $\sigma_{\overline{x}} = 1.1547$
8. $SE = 1.1547$

Task 6. Answer may vary.

Task 7.

Task 8.

Assessment.

I.	II.
1. A	6. Stratified sampling
2. B	7. Simple random sampling
3. A	8. Cluster sampling
4. C	9. Voluntary sampling
5. C	10. Convenience sampling

III.

a) 81
b) $\mu_{\overline{x}} = 6$
c) $\sigma^2{}_{\overline{x}} = 1.5$
d) $\sigma_{\overline{x}} = 1.225$

References

Books

Albert, Jose Ramon G. 2016. In *Teaching Guide for Senior High School Statistics and Probability* , 221-242. Quezon CItyCommision on Higher Education.

Malate, Jose S. 2017. In *Statistics and Probability for Senior High School*. Sta. Ana, Manila: Vicarish Publications and Trading, Inc.

Mamhot, Millard R., Alice A. Mamhot. 2016. In *Statistics and Probability*. Manila: Unlimited Books Library Services and Publishing Inc.

Websites

Surbhi, S. 2017. September 1. Accessed February 7, 2021. https://keydifferences.com/difference-between-statistic-and-parameter.html.

https://lrmds.deped.gov.ph/com.

http://www.csu.edu/CTRE/pdf/rubricexamples-all.pdf

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