INFS 323
Research Methodology

Lesson 9 – Sampling

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UNIVERSITY OF GHANA
College of Education
School of Continuing and Distance Education
2014/2015 – 2016/2017

Lesson Overview

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Lesson Overview

I welcome you to Session Nine which takes a look *Sampling*. Sampling is an important step in the entire research process. It involves procedures used to select research participants. It simply means taking part of some population to represent the whole population. Nearly every survey uses some form of sampling.

Suppose the researcher has defined his research problem and has examined the relevant literature to determine what theories and data are available to guide him. On the basis of this knowledge the researcher has developed hypotheses to be tested, or has stated research questions to guide the research.

Lesson Overview

He has also operationally defined his concepts and variables in the hypotheses to make this test possible. The next thing the researcher has to do is to collect data from the population he wishes to investigate.

If the researcher could investigate every member in the population, he would surely have answers to his research questions. But populations could be very large and for practical reasons, it may be impossible to study every element in the population (Kerlinger,1973).

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It would be too costly, and many individuals or groups would not be available for interview, or observation, or to complete questionnaires (Descombe,1998). The researcher resolves this problem by studying a sample and generalising the findings from the sample to the population

According to authoritative sources (Kerlinger,1973; Babbie1999; Descombe,1999), this is the most efficient way to do research, because there are methods that allow researchers to estimate characteristics of populations by measuring only a small sample of population elements

Lesson Overview

The researcher has to ensure that the sample is representative of the population from which it was selected otherwise, what he finds in the sample may not be true for the population.

Of course, there are times when a researcher may want to study every element of some population. This is when the population is small enough so that every element can be measured without much additional cost and effort.

Lesson Overview

It will also be the case where the researcher is not interested in generalising to some larger group (Kerlinger, 1973; Descombe,1999; Babbie,1999).

This lesson begins by describing briefly the or stages involved in the sampling process and discusses the commonly used terms in sampling. We go on to discuss the need for sampling and the different types of sampling techniques.

Lesson Objectives

Objectives

After completing this Session the student should be able to:

1. Outline the stages in the sampling process
2. Explain the basic terms associated with sampling
3. Differentiate between the types of sampling selection methods
4. Discuss the factors which researchers need to consider when determining sample size

Lesson Outline

The key topics to be covered in the session are as follows:

1. Topic One: Defining and Explaining Sampling
2. Topic Two: Explaining Terminology Associated with Sampling
3. Topic Three: Sampling Design Process
4. Topic Four: Sample Selection Methods I (Probability Sampling Design
5. Topic Five: Sample Selection Methods II (Non Probability Sampling
6. Topic Four: Determining the Sample Size

Reading List

1. Pickard, AJ. (2007) *Research Methods in Information*, London, Facet Publishing.

2. Powell, RR. (2004) *Basic Research Methods for Librarians, (4th ed.)* Westport, Connecticut, Libraries Unlimitd.

TOPIC ONE

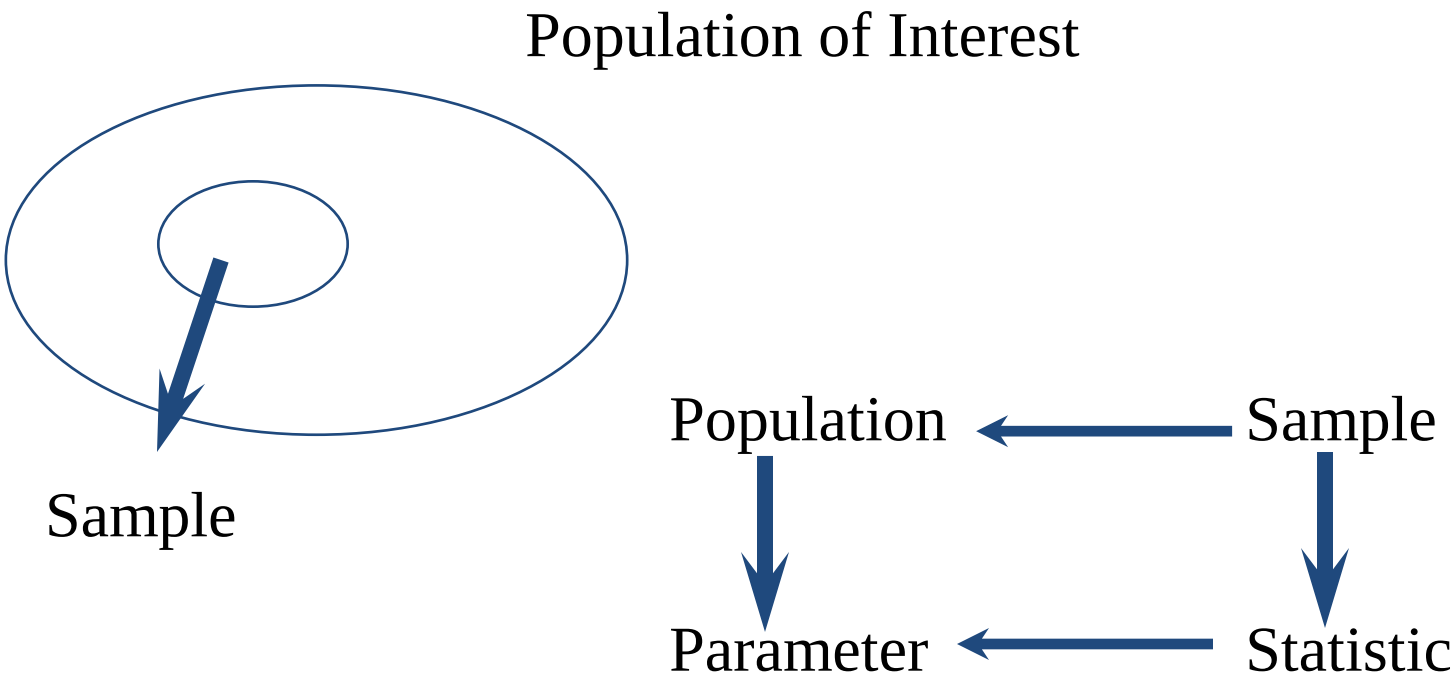
DEFINING AND EXPLAINING SAMPLING

Defining and explaining sampling

What is sampling?

It is the process of obtaining information from a subset (sample) of a larger group (population). The results obtained by studying the sample are then used to make estimates of the larger group (Pickard, 2007).

Defining and explaining sampling



We measure the sample using statistics in order to draw inferences about the population and its parameters.

Suppose there are four individuals A, B, C and D. Further suppose that A is 18 years of age, B is 20, C is 23 and D is 25. As you know their ages, you can *find out* (calculate) their average age by simply adding 18 + 20 + 23 + 25 = 86 and dividing by 4. This gives the average (mean) age of A, B, C and D as 21.5 years.

Population Parameter = **21.5 years**

1. A + B = 18 + 20 = 38/2 = 19.0 years;
2. A + C = 18 + 23 = 41/2 = 20.5 years;
3. A + D = 18 + 25 = 43/2 = 21.5 years;
4. B + C = 20 + 23 = 43/2 = 21.5 years;
5. B + D = 20 + 25 = 45/2 = 22.5 years;
6. C + D = 23 + 25 = 48/2 = 24.0 years.

The Goal of Sampling

To be able to make inferences about the **population parameter** from knowledge of the **sample statistic** - to draw general conclusions about the population with the assumption that the sample chosen is **representative** of the population.

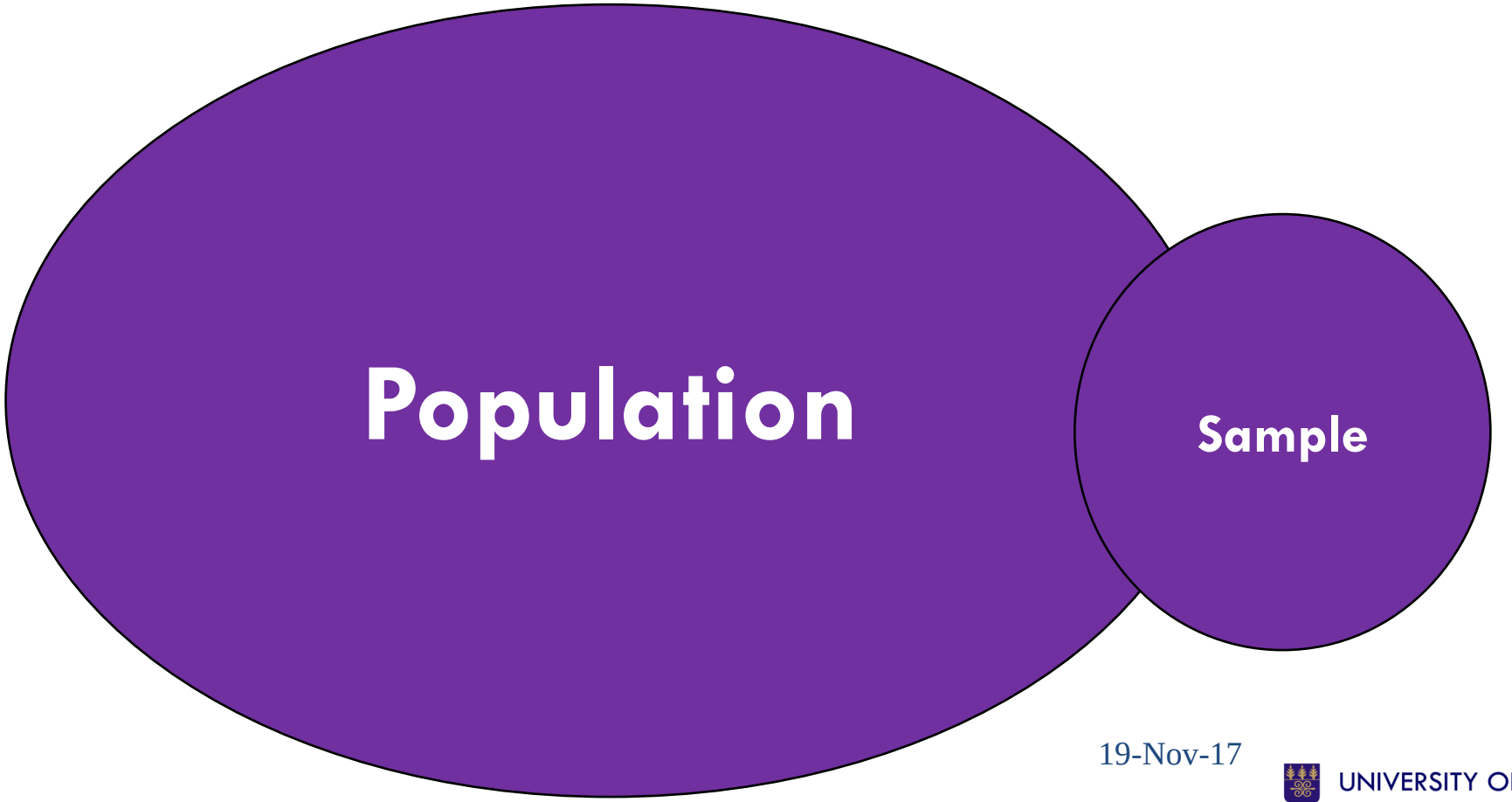
For a sample to be representative of the population …

… (1) Select people from the target population only

… (2) Select the right number of people from the population

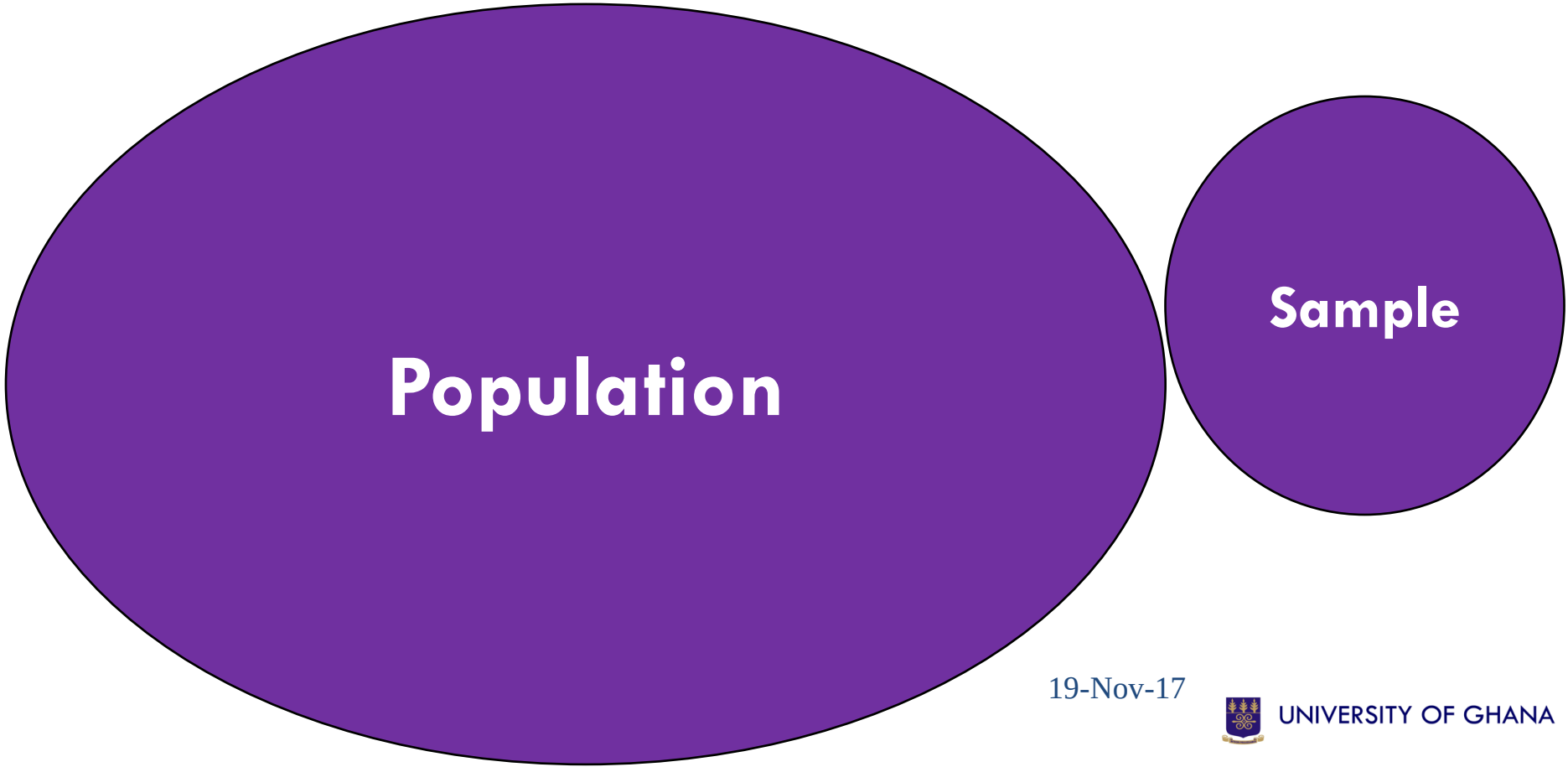
Defining and explaining sampling

…this (bad)…



Defining and explaining sampling

…or this ? (VERY bad)…



TOPIC TWO

SAMPLING TERMINOLOGY

Sampling terminology

Population

- The entire group of people of interest from whom the researcher needs to obtain information.

Element (sampling unit)

- one unit from a population

Sampling

- The selection of a subset of the population

Sampling Frame

- Listing of population from which a sample is chosen

Census

- A study of the entire population

Survey

- A study of the sample

Sampling terminology

Representativeness

- One important consideration in sampling is that the sample must be **representative** of the population from which it is drawn.

Being **representative** means:
to be **typical** of a population, that is, to reflect the **characteristics** of the population being studied. (Kerlinger (1973).

Sampling terminology

Generalisability

To **generalise** means to apply conclusions reached from studying the subjects in a sample to the population from which the sample was drawn. The researcher concludes that the results of the study sample are the same as would have been if every member of the entire population had been studied.

Studying the entire population

When to study the entire population

- When the entire size of the population is small
- When there is more time for the project
- When the resources (human and material) available for the project are adequate.
- When the sole objective of the study is to make a complete count of the population.

Need for sampling

Why is it necessary to sample?

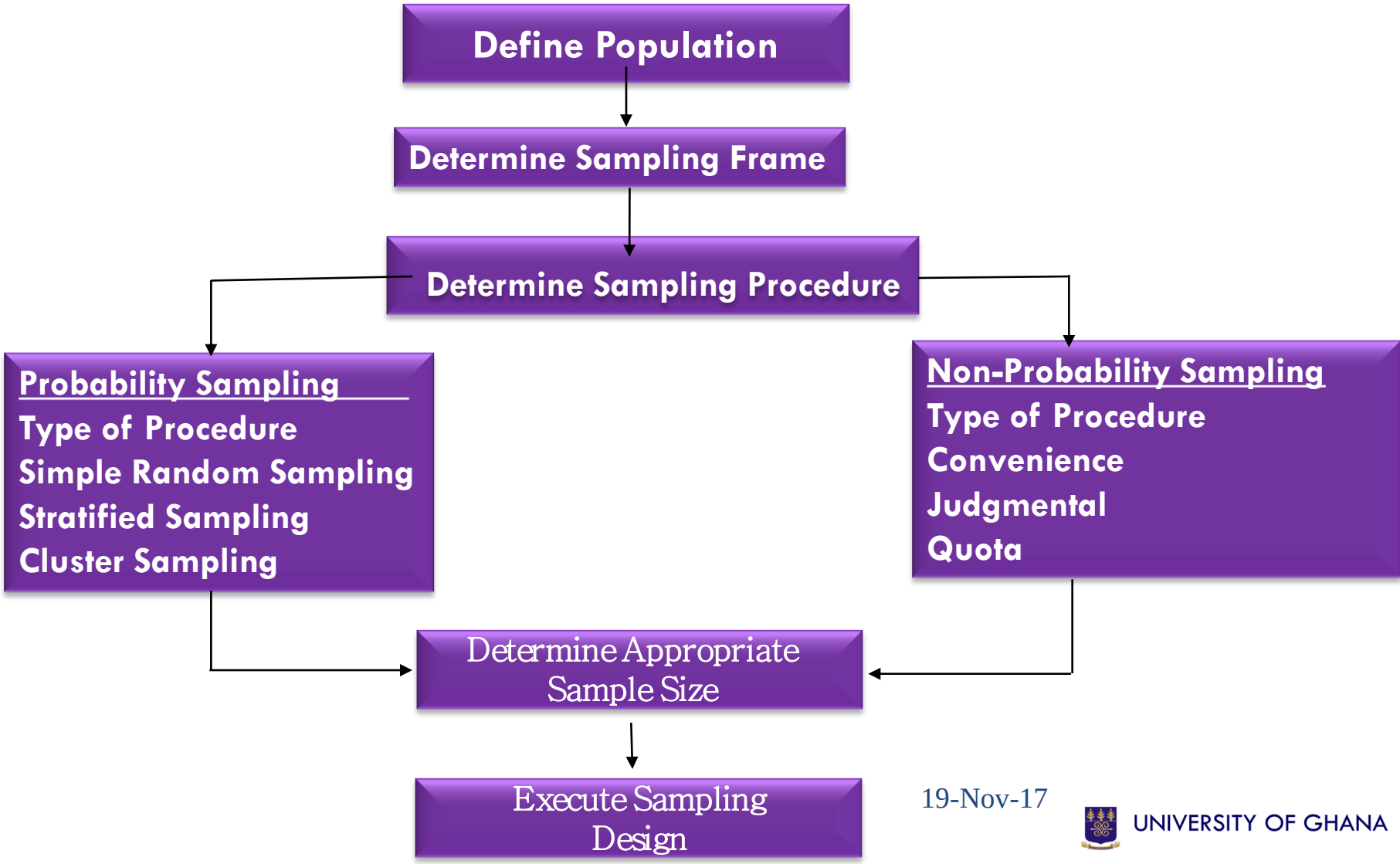
- Costly to study the entire population
- A sample may provide you with the needed information quickly.
- Studying a sample is also sometimes likely to lead to the same results.
- In a few cases, it would also be impossible to use the entire population to know or test something.

1. A + B = 18 + 20 = 38/2 = 19.0 years;
2. A + C = 18 + 23 = 41/2 = 20.5 years;
3. A + D = 18 + 25 = 43/2 = 21.5 years;
4. B + C = 20 + 23 = 43/2 = 21.5 years;
5. B + D = 20 + 25 = 45/2 = 22.5 years;
6. C + D = 23 + 25 = 48/2 = 24.0 years.

TOPIC THREE

SAMPLING DESIGN PROCESS

Sampling Design Process



Sampling Design Process

1. Defining the target population

- It addresses the question "Ideally, who do you want to survey?" i.e. those who have the information you are seeking. What are their characteristics. Who should be excluded?

- It involves
  - defining population units
  - setting population boundaries

Sampling Design Process

2. Determine the Sampling Frame

Obtaining a "list" of population

- List of Students who eat at Time Out?
- List of Level 400 Mathematics Major Students?
- List of Students of Pentecostal Union
- University Mailing List
- List of all Households in Accra
- List of Streets in East Legon
- List of all Multinational Companies in Ghana

Sampling Design Process

Problems with list

- Omissions
- Ineligibles
- Duplications

TOPIC FOUR

SAMPLE SELECTION METHODS I (PROBABILITY / RANDOM SAMPLING

- Probability Sampling –(All participants have equal chance of being included in the sample)
  - –simple random sampling
  - –systematic sampling
  - –stratified sampling
  - –cluster sampling

Sample selection methods I (Probability / random sampling

Probability sampling

- An objective procedure in which the probability of selection is nonzero and is known in advance for each population unit.
- It is also called random sampling.
- Ensures information is obtained from a representative sample of the population
- Sampling error can be computed
- Survey results can be projected to the population
- More expensive than non-probability samples

Sample selection methods I (Probability / random sampling

- Population members are selected directly from the sampling frame
- Equal probability of selection for every member (sample size/population size)
- 400/10,000 = .04
- Use random processes to generate the sample. Eg Fish Bowl Technique; Table of Random Numbers; Computer Generated Random Numbers

Sample selection methods I (Probability / random sampling

Selecting a Sampling Design

Objective: To select *n* units out of *N* such that each ${}_{N}C_{n}$ has an equal chance of being selected

Procedure: Use a table of random numbers, a computer random number generator, or a mechanical device to select the sample

Sample selection methods I (Probability / random sampling

Example 1: **Using the Fish Bowl Technique**

If the HOD wants to use the **fishbowl technique**, (an example of a mechanical devise) to select 30 out of 120 level 300 students for an award. He will do the following:

Sample selection methods I (Probability / random sampling

1. Write the names of all the 120 students, (elements of the population which is the sampling frame), on slips of paper.
2. Place the slips of paper in a bow, box, hat, or similar container.
3. He will then mix up the slips of paper thoroughly, close his eyes, and then dip his hand into the container and pick out a slip.
4. The name of the candidate is recorded. He continues this process until he selects his sample of 30.

Sample selection methods I (Probability / random sampling

Example 2: **Using a Table of Random Numbers**

1. The HOD will first of all assign a serial number to every Level 300 student from 1 to 120. Candidate 1 becomes 001; candidate 2 is numbered 002; candidate 8 is numbered 008; candidate 48 is numbered 048 and so on.
2. He will then close his eyes, open a page of a **table of random numbers,** place his finger at any point.
3. The number on which the finger has been placed is recorded as the first member of the sample.
4. He will then move his finger vertically or horizontally and pick the rest

Sample selection methods I (Probability / random sampling

Table of Random Numbers

A	B	C	D	E	F	G	H	I
057	526	429	223	637	088	670	428	020
545	090	009	153	265	230	144	011	007
010	018	005	017	008	671	148	647	160
973	570	863	012	386	666	104	035	107
112	025	173	623	249	004	448	475	443
742	418	079	005	611	473	246	738	003
361	033	213	187	051	055	756	274	080
806	019	721	569	109	030	521	338	043

Sample selection methods I (Probability / random sampling

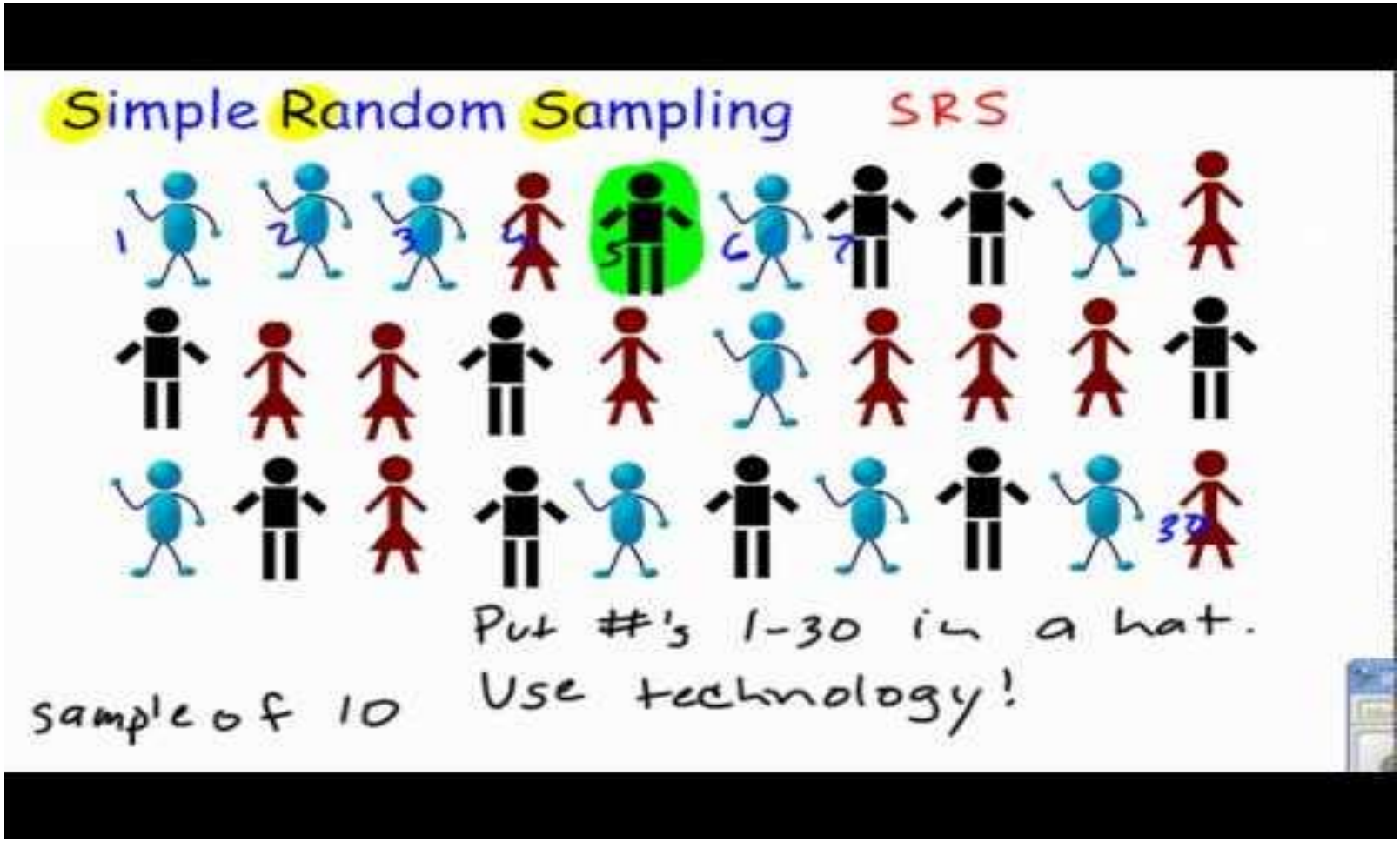
SAMPLING FRAME

The group of customers you have the ability to contact with your survey

SAMPLE

The group of customers you actually contact with your survey and who actually fill it out

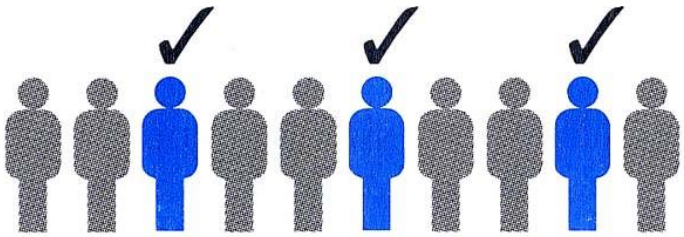
Sample selection methods I (Probability / random sampling



Sample selection methods I (Probability / random sampling

Selecting a Systematic Sample

- Order all units in the sampling frame and number them from 1 to *N*
- Choose a random starting place from 1 to *N* and then sample every kth units after that



Sample selection methods I (Probability / random sampling

Systematic Random Sample

1.Number the units in the population from 1 to N

2. Decide on the n (sample size) that you want or need

3. Calculate interval size (k) = N/n = the interval size

4. Randomly select an integer between 1 and k

5. Then take every kth unit

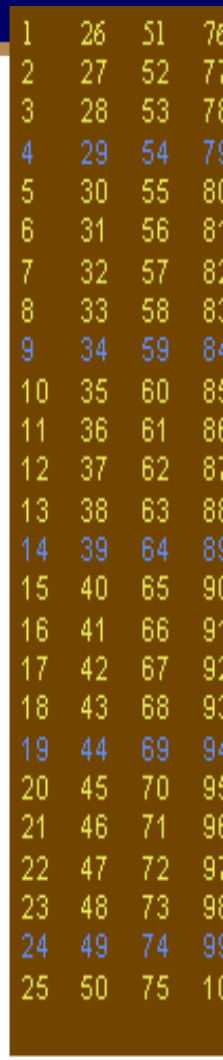
N = 100

want n = 20

N/n = 5

select a random number from 1-5: chose 4

start with #4 and take every 5th unit



Sample selection methods I (Probability / random sampling

Stratified Random Sampling

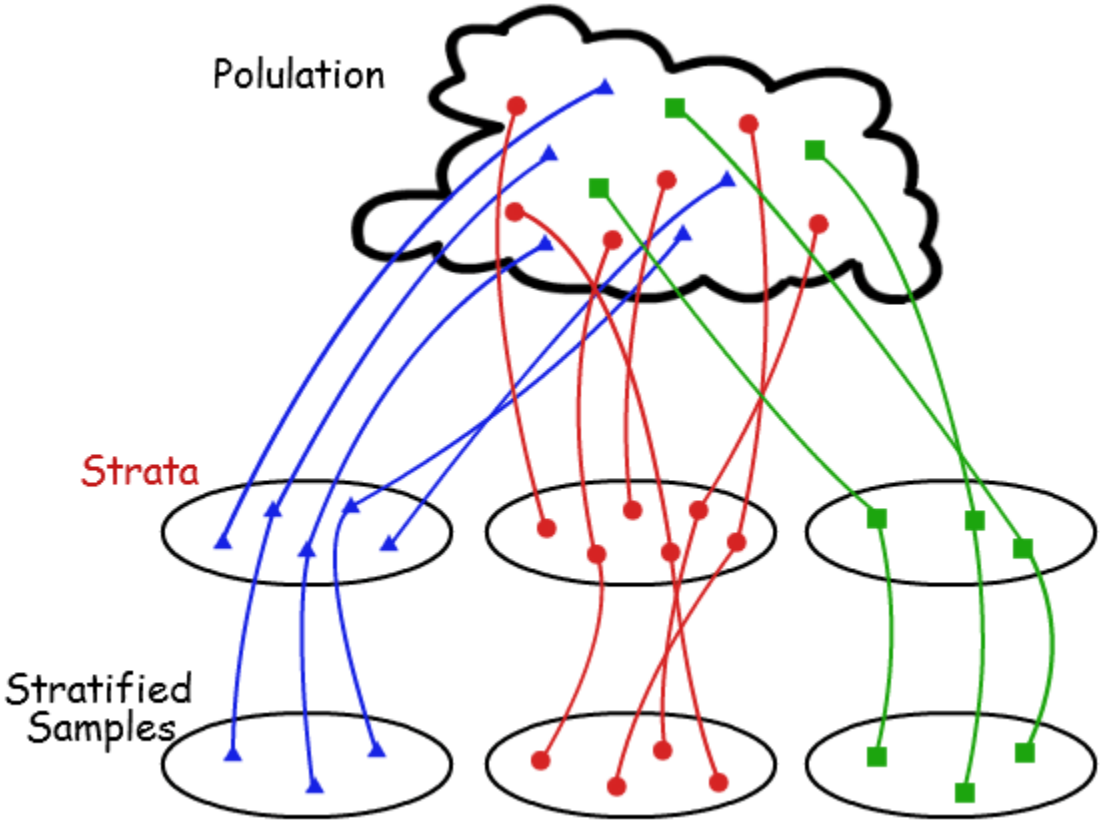
- Stratified sampling involves dividing the population into **homogeneous** groups, and then conducting a simple random sampling in each group.
- First of all, elements in the population (that is in the sampling frame) are distinguished according to their value on some relevant characteristic such as:

army rank:(Generals, Captains, Privates etc)
or **gender**: (male , female) or
socio-economic status: (upper, middle and lower class).

- Next, elements are sampled randomly from within these strata: so many generals, so many captains, etc.

Sample selection methods I (Probability / random sampling

Stratified Random Sampling



Sample selection methods I (Probability / random sampling

Stratified Random Sampling

1. Proportional Stratified Sampling

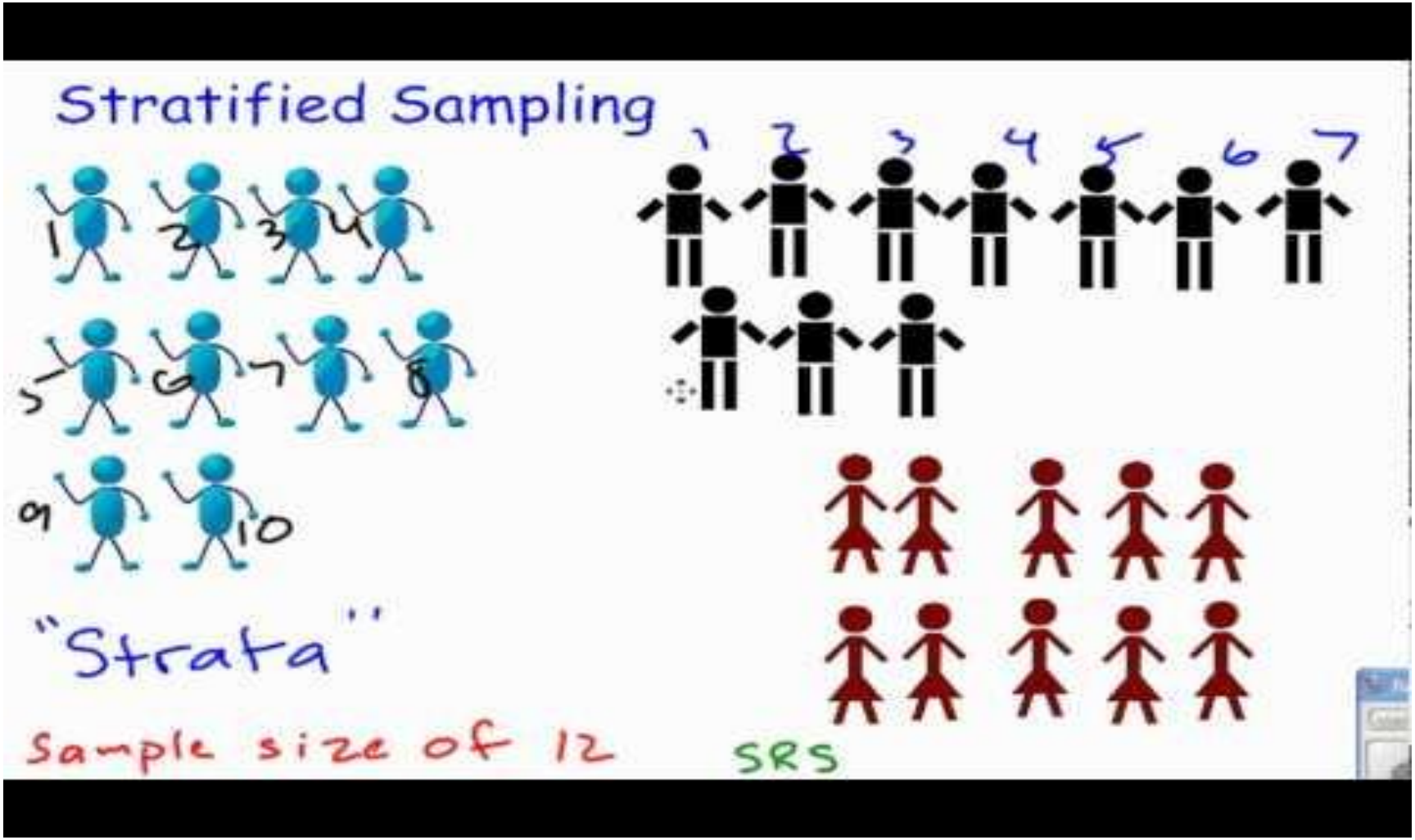
2. Non-Proportional Stratified Sampling

Sample selection methods I (Probability / random sampling

Proportional Stratified Sampling

The sample size in each stratum is proportional to the stratum size in the population

Sample selection methods I (Probability / random sampling



Sample selection methods I (Probability / random sampling

Steps in selecting a proportional stratified sample

1. Identify all elements or sampling units in the sampling population
2. Decide on the different strata (**k**) into which you want to stratify the population
3. Place each element into the appropriate stratum
4. Number every element in each stratum separately
5. Decide on the total sample size (**n**)

Sample selection methods I (Probability / random sampling

Steps in selecting a proportional stratified sample.

6. Determine the proportion (**p**) of each stratum in the study population = (Elements in the stratum divided by the total population size)

7. Determine the number of elements to be selected from each stratum

8. Select the required number of elements from each stratum by simple random sample technique or systematic sampling technique.

Sample selection methods I (Probability / random sampling

Example: Select a proportional sample of **30** from a student population of **120** (comprising 80 males and 40 females).

- Population 120 students
- Number of strata =2 (male and female)
- Sample size (n) = 30
- Proportion of males in population = 80 / 120 = 2/3
- Proportion of females in population = 40 /120 = 1/3
- No. of males to be selected = 2/3 x 30 = (20 Males)
- No. of females to be selected = 1/3 x 30 = (10 Females)

Non-Proportional Stratified Sampling

The sample size in each stratum is NOT proportional to the stratum size in the population

– Used if …

1) some strata are too small
2) some strata are more important than others
3) some strata are more diversified than others

Sample selection methods I (Probability / random sampling

1. Equal number of elements is selected for each group.

This means that:

2. Elements are selected in numbers that do not reflect their proportions in the population.

In our example, the HOD may select a **non-proportional sample** by picking **15** males and **15** females.

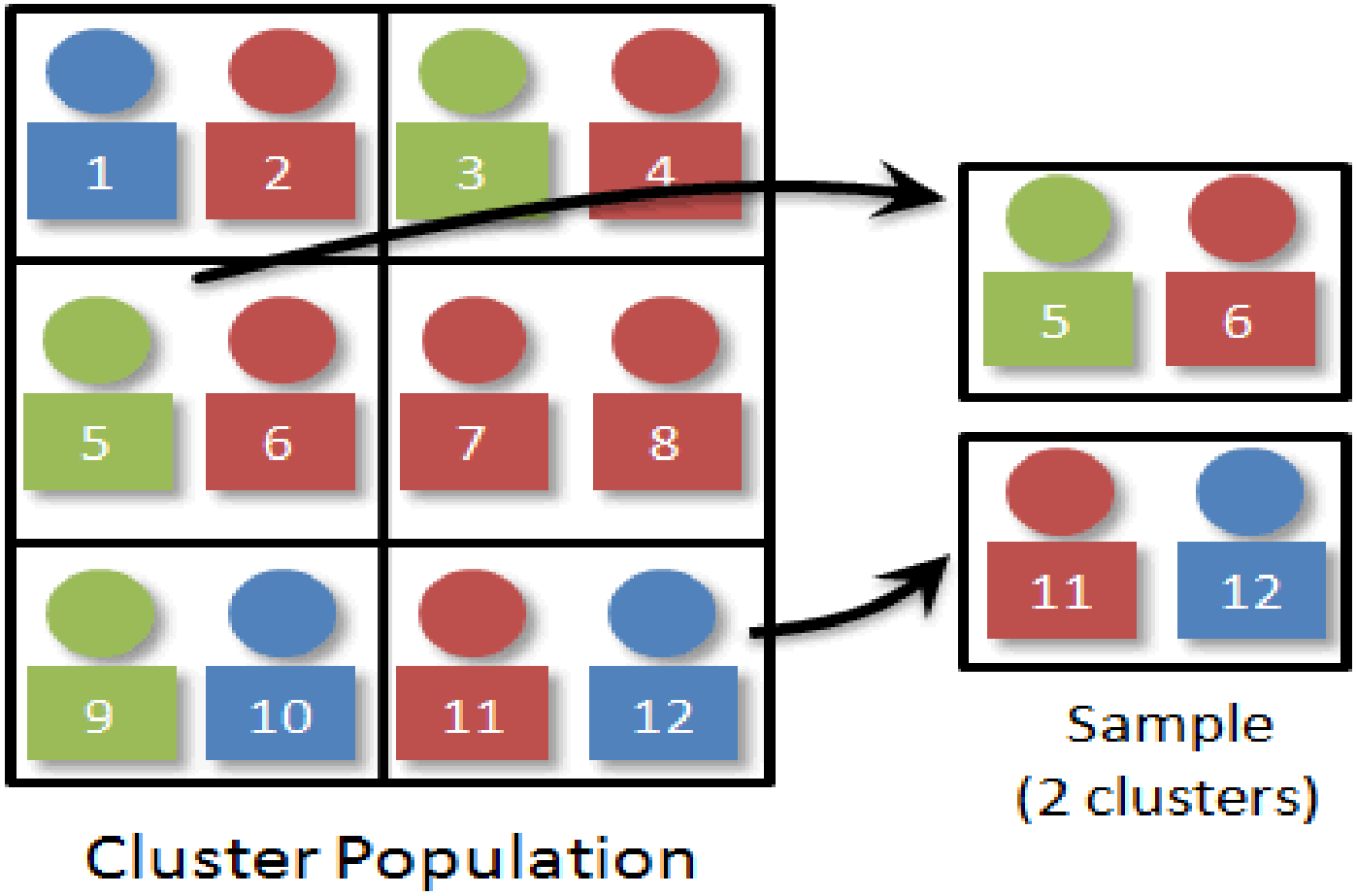
In this case males are underrepresented in the sample given that there are **80** males as against **40** females in the population.

Sample selection methods I (Probability / random sampling

Cluster Sampling

- Frequently used for large-scale surveys involving geographical '**clusters**' . The logic behind it is that, it is possible to get a good enough sample by focusing on naturally occurring clusters of the particular thing that the researcher wishes to study.
- Clusters of population units are selected at random and then all or some randomly chosen units in the selected clusters are studied.
- Steps:
  - Population is divided into clusters. Ideally, each cluster adequately represents the population.
  - A simple random sample of a few clusters is selected.
  - All or some randomly chosen units in the selected clusters are studied.

Sample selection methods I (Probability / random sampling



Sample selection methods I (Probability / random sampling

- By focusing on such clusters the researcher can save a great deal of time and money that would have otherwise been spent on travelling to and fro visiting research sites scattered throughout the length and breadth of a very wide geographical area.
- The selection of clusters for research follows the principles of probability sampling. The aim is to get a representative cluster, and the means of getting it rely on random choices of stratified sampling.
- Can be cost effective without compromising the principles of random selection and the laws of probability. (Descombe, 1998).

Sample selection methods I (Non Probability / random sampling

Cluster or Area Random Sampling

Divide population into clusters (usually along geographic boundaries)

randomly sample clusters

measure units within sampled clusters

TOPIC FOUR

SAMPLE SELECTION METHODS II (NON-PROBABILITY SAMPLING)

Sample selection methods II (Non-Probability)

- Subjective procedure in which the probability of selection for some population units are zero or unknown before drawing the sample.
- information is obtained from a non-representative sample of the population
- Sampling error can not be computed
- Survey results cannot be projected to the population

Sample selection methods II (Non-Probability)

Types of Non-Probability Sampling

Convenience Sampling

This is considered the weakest form of sampling because it does nothing to control bias. In this procedure, participants are recruited as they become available or because they happen to be convenient for the researcher. Such samples are often limited to personal contacts of the researchers or to people who happen to be available at meetings or in organisations or in a particular place and time.

Sample selection methods II (Non-Probability)

Judgment / purposive Sampling

It might sometimes become necessary to obtain information from specific targets, that is, specific types of people who will be able to provide the desired information, either because they are the only ones who can provide that information, or because they conform to some criteria set by the researcher.

Sample selection methods II (Non-Probability)

- In this procedure, the researcher uses his judgement and knowledge of the field to identify persons whom he considers to be leaders and experts in this area. One of the first things the researcher is likely to do is to verify that the respondent does in fact meet the criteria for being in the sample.

Types of Non-Probability Sampling

Snowball Sampling

With this approach the researcher initially contacts a few potential subjects and then asks them whether they know anybody with the same characteristics that he is looking for.

Quota Sampling

- The population is divided into cells on the basis of relevant control characteristics.
- A quota of sample units is established for each cell.
  - 50 women, 50 men
- A convenience sample is drawn for each cell until the quota is met.

(similar to stratified sampling)

TOPIC FIVE

DETERMINING THE SAMPLE SIZE

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Sample selection methods II (Non-Probability)

Determining Sample

Factors to Consider When Determining Sample Size

1. Cost and time

- Sample size is almost invariably controlled by cost and time. Although researchers may wish to use a large sample for a survey, the economics of such a sample are usually restrictive. Research at any level is very expensive, and these costs have great influence on a project.
- The general rule is to use as large a sample as possible within the economic constraints of the study. If a small sample is forced on a researcher, the results must be interpreted accordingly, that is, with caution regarding generalisation. (Descombe, 1999).

Sample selection methods II (Non-Probability)

2. Likely response rate

- Descombe (1998) has noted that a survey rarely achieves a response from every contact. Especially when using postal questionnaires and the like, the rate of response from those contacted, is likely to be very low.
- As far as sample size is concerned, the important thing for the researcher to consider is that the number in the original sample may not equal the number of responses that are finally obtained. The researcher needs to predict the kind of response rate he or she is likely to achieve, based on the kind of survey being done, and build into the sample size an allowance for non-responses.

Sample selection methods II (Non-Probability)

- Agreeing with Descombe, Fraenkel and Wallen(2000) advise that researchers should always select a larger sample than is actually required for a study, since non-response must be compensated for. They note that subjects drop out of research studies for one reason or another, and allowances must be made for this in planning the sample selection.

3. Heterogeneous population

- If a variable of interest to the researcher varies widely in a population it is advisable to pick a higher than lower percentage sample of the population.

Sample selection methods II (Non-Probability)

4. The accuracy of the results

- Any sample, by its very nature, might produce results which are different from the 'true' results based on a survey of the total population. Inevitably, there is an element of luck in terms of who gets included in the sample and who gets excluded, and this can affect the accuracy of the findings which emerge from the sample
- Two different samples of 100 people, chosen from the same population and using the same basic method, will produce results that are likely to be slightly different. (Freankel and Wallen, 2000).

Sample selection methods II (Non-Probability)

- It is generally acknowledged that, the larger the sample used the better. The larger a sample becomes, the more representative of the population it becomes and so the more reliable and valid the results based on it will become. (Babbie, 1999).
- It has been pointed out, however, that a large unrepresentative sample is as meaningless as a small unrepresentative sample, so researchers should not consider numbers alone. Quality is always more important in sample selection than mere size. (Babbie, 1999).

Sample selection methods II (Non-Probability)

5. Careful planning

- A well selected random sample, does yield results whose amount of error can be reliably estimated through statistical techniques, and so can be as useful, as those of larger samples whose members were not properly randomly selected
- By this principle, the researcher should exercise a great deal of patience and effort in planning and choosing the members of his sample, as well as in the choice of data collecting instruments.

Sample selection methods II (Non-Probability)

- Where this has been done, what seems to have been lost through studying a low percentage of the population can be regained through very good and systematic data collection procedures (Descombe, 1999)

6. Learning form others

- Consulting the work of other researchers provides a base from which to start. If a survey is planned and similar research indicates that a representative sample of 400 has been used regularly with reliable results, a sample larger than 400 may be unnecessary.

END OF LECTURE

Sample questions for consideration

1. What is the difference between a population and element and a sample
2. Why do large random sample tend to be representative of the population from which they are drawn from.
3. Match each items in the first column with the corresponding item in the second column

• **Proportional** • **Stratified sampling** • **Non proportional stratified sampling**	**A research study.** **Between income groups** **If research study that proposes to describe the population as a whole**