UNIT 2 SAMPLING

LEARNING OBJECTIVES

After reading this unit a student will learn -

- Different procedure of sampling which will be the best representative of the population;

13.2.1 INTRODUCTION

There are situations when we would like to know about a vast, infinite universe or population. But some important factors like time, cost, efficiency, vastness of the population make it almost impossible to go for a complete enumeration of all the units constituting the population. Instead, we take recourse to selecting a representative part of the population and infer about the unknown universe on the basis of our knowledge from the known sample. A somewhat clear picture would emerge out if we consider the following cases.

In the first example let us share the problem faced by Mr. Basu. Mr. Basu would like to put a big order for electrical lamps produced by Mr. Ahuja's company "General Electricals". But before putting the order, he must know whether the claim made by Mr. Ahuja that the lamps of General Electricals last for at least 1500 hours is justified.

Miss Manju Bedi is a well-known social activist. Of late, she has noticed that the incidence of a particular disease in her area is on the rise. She claims that twenty per cent of the people in her town have been suffering from the disease.

In both the situations, we are faced with three different types of problems. The first problem is how to draw a representative sample from the population of electrical lamps in the first case and from the population of human beings in her town in the second case. The second problem is to estimate the population parameters i.e., the average life of all the bulbs produced by General Electricals and the proportion of people suffering form the disease in the first and second examples respectively on the basis of sample observations. The third problem relates to decision making i.e., is there enough evidence, once again on the basis of sample observations, to suggest that the claims made by Mr. Ahuja or Miss Bedi are justifiable so that Mr. Basu can take a decision about buying the lamps from General Electricals in the first case and some effective steps can be taken in the second example with a view to reducing the outbreak of the disease. We consider tests of significance or tests of hypothesis before decision making.

13.2.2 BASIC PRINCIPLES OF SAMPLE SURVEY

Sample Survey is the study of the unknown population on the basis of a proper representative sample drawn from it. How can a part of the universe reveal the characteristics of the unknown universe? The answer to this question lies in the basic principles of sample survey comprising the following components:

(a) Law of Statistical regularity

(b) Principle of Inertia

(c) Principle of Optimization

(d) Principle of Validity

(a) According to the law of statistical regularity, if a sample of fairly large size is drawn from the population under discussion at random, then on an average the sample would posses the characteristics of that population.

Thus the sample, to be taken from the population, should be moderately large. In fact larger the sample size, the better in revealing the identity of the population. The reliability of a statistic in estimating a population characteristics varies as the square root of the sample size. However, it is not always possible to increase the sample size as it would put an extra burden on the available resource. We make a compromise on the sample size in accordance with some factors like cost, time, efficiency etc.

Apart from the sample size, the sample should be drawn at random from the population which means that each and every unit of the population should have a pre-assigned probability to belong to the sample.

(b) The results derived from a sample, according to the principle of inertia of large numbers, are likely to be more reliable, accurate and precise as the sample size increases, provided other factors are kept constant. This is a direct consequence of the first principle.

(c) The principle of optimization ensures that an optimum level of efficiency at a minimum cost or the maximum efficiency at a given level of cost can be achieved with the selection of an appropriate sampling design.

(d) The principle of validity states that a sampling design is valid only if it is possible to obtain valid estimates and valid tests about population parameters. Only a probability sampling ensures this validity.

13.2.3 COMPARISON BETWEEN SAMPLE SURVEY AND COMPLETE ENUMERATION

When complete information is collected for all the units belonging to a population, it is defined as complete enumeration or census. In most cases, we prefer sample survey to complete enumeration due to the following factors:

(a) **Speed:** As compared to census, a sample survey could be conducted, usually, much more quickly simply because in sample survey, only a part of the vast population is enumerated.

(b) **Cost:** The cost of collection of data on each unit in case of sample survey is likely to be more as compared to census because better trained personnel are employed for conducting a sample survey. But when it comes to total cost, sample survey is likely to be less expensive as only some selected units are considered in a sample survey.

(c) **Reliability:** The data collected in a sample survey are likely to be more reliable than that in a complete enumeration because of trained enumerators better supervision and application of modern technique.

(d) **Accuracy:** Every sampling is subjected to what is known as sampling fluctuation which is termed as sampling error. It is obvious that complete enumeration is totally free from this sampling error. However, errors due to recording observations, biases on the part of the enumerators, wrong and faulty interpretation of data etc. are prevalent in both sampling and census and this type of error is termed as non-sampling errors. It may be noted that in sample survey, the sampling error can be reduced to a great extent by taking several steps like increasing the sample size, adhering to a probability sampling design strictly and so on. The non-sampling errors also can be contained to a desirable degree by a proper planning which is not possible or feasible in case of complete enumeration.

(e) **Necessity:** Sometimes, sampling becomes necessity. When it comes to destructive sampling where the items get exhausted like testing the length of life of electrical bulbs or sampling from a hypothetical population like coin tossing, there is no alternative to sample survey.

However, when it is necessary to get detailed information about each and every item constituting the population, we go for complete enumeration. If the population size is not large, there is hardly any merit to take recourse to sampling. If the occurrence of just one defect may lead to a complete destruction of the process as in an aircraft, we must go for complete enumeration.

13.2.4 ERRORS IN SAMPLE SURVEY

Errors or biases in a survey may be defined as the deviation between the value of population parameter as obtained from a sample and its observed value. Errors are of two types.

I. Sampling Errors

II. Non-Sampling Errors

Sampling Errors : Since only a part of the population is investigated in a sampling, every sampling design is subjected to this type of errors. The factors contributing to sampling errors are listed below:

(a) Errors arising out due to defective sampling design: Selection of a proper sampling design plays a crucial role in sampling. If a non- probabilistic sampling design is followed, the bias or prejudice of the sampler affects the sampling technique thereby resulting some kind of error.

(b) Errors arising out due to substitution: A very common practice among the enumerators is to replace a sampling unit by a suitable unit in accordance with their convenience when difficulty arises in getting information from the originally selected unit. Since the sampling design is not strictly adhered to, this results in some type of bias.

(c) Errors owing to faulty demarcation of units: It has its origin in faulty demarcation of sampling units. In case of an agricultural survey, the sampler has, usually, a tendency to underestimate or overestimate the character under consideration.

(d) Errors owing to wrong choice of statistic: One must be careful in selecting the proper statistic while estimating a population characteristic.

(e) Variability in the population: Errors may occur due to variability among population units beyond a degree. This could be reduced by following somewhat complicated sampling design like stratified sampling, Multistage sampling etc.

Non-sampling Errors

As discussed earlier, this type of errors happen both in sampling and complete enumeration. Some factors responsible for this particular kind of biases are lapse of memory, preference for certain digits, ignorance, psychological factors like vanity, non- responses on the part of the interviewees wrong measurements of the sampling units, communication gap between the interviewers and the interviewees, incomplete coverage etc. on the part of the enumerators also lead to non-sampling errors.

13.2.5 SOME IMPORTANT TERMS ASSOCIATED WITH SAMPLING

Population or Universe

It may be defined as the aggregate of all the units under consideration. All the lamps produced by "General Electricals" in our first example in the past, present and future constitute the population. In the second example, all the people living in the town of Miss Manju form the population. The number of units belonging to a population is known as population size. If there are one lakh people in her town then the population size, to be denoted by N, is 1 lakh.

A population may be finite or infinite. If a population comprises only a finite number of units, then it is known as a finite population. The population in the second example is obviously, finite. If the population contains an infinite or uncountable number of units, then it is known as an infinite population. The population of electrical lamps of General Electricals is infinite. Similarly, the population of stars, the population of mosquitoes in Kolkata, the population of flowers in Mumbai, the population of insects in Delhi etc. are infinite population.

Population may also be regarded as existent or hypothetical. A population consisting of real objects is known as an existent population. The population of the lamps produced by General Electricals and the population of Miss Manju's town are example of existent populations. A population that exists just hypothetically like the population of heads when a coin is tossed infinitely is known as a hypothetical or an imaginary population.

Sample

A sample may be defined as a part of a population so selected with a view to representing the population in all its characteristics selection of a proper representative sample is pretty important because statistical inferences about the population are drawn only on the basis of the sample observations. If a sample contains n units, then n is known as sample size. If a sample of 500 electrical lamps is taken from the production process of General Electricals, then n = 500. The units forming the sample are known as "Sampling Units". In the first example, the sampling unit is electrical lamp and in the second example, it is a human. A detailed and complete list of all the sampling units is known as a "Sampling Frame". Before drawing sample, it is a must to have a updated sampling frame complete in all respects before the samples are actually drawn.

Parameter

A parameter may be defined as a characteristic of a population based on all the units of the population. Statistical inferences are drawn about population parameters based on the sample observations drawn from that population. In the first example, we are interested about the parameter "Population Mean". If x a denotes the a th member of the population, then population mean m, which represents the average length of life of all the lamps produced by General Electricals is given by

$$\mu = \frac{\sum_{a=1}^{n} x_a}{N} \qquad (13.2.1)$$

Where N denotes the population size i.e. the total number of lamps produced by the company. In the second example, we are concerned about the population proportion P, representing the ratio of the people suffering from the disease to the total number of people in the town. Thus if there are X people possessing this attribute i.e. suffering from the disease, then we have

$$P = \frac{X}{N} \qquad (13.2.2)$$

Another important parameter namely the population variance, to be denoted by s^2 is given by

$$\sigma^2 = \frac{\sum (X_a - \mu)^2}{N} \qquad (13.2.3)$$

Also we have SD = $\sigma = \sqrt{\frac{\sum (X_a - \mu)^2}{N}}$ (13.2.4)

Statistics

A statistic may be defined as a statistical measure of sample observation and as such it is a function of sample observations. If the sample observations are denoted by $x_1, x_2, x_3, \ldots\ldots\ldots\ldots x_n$, then a statistic T may be expressed as $T = f(x_1, x_2, x_3, \ldots\ldots\ldots\ldots x_n)$

A statistic is used to estimate a particular population parameter. The estimates of population mean, variance and population proportion are given by

$$\bar{x} = \hat{\mu} = \frac{\sum x_i}{n} \qquad (13.2.5)$$

$$S_2 = \hat{\sigma}^2 = \frac{\sum \left(x_i - \bar{x}\right)^2}{n} \qquad (13.2.6)$$

and p = $p = \hat{P} = \frac{x}{n}$ (13.2.7)

Where x, in the last case, denotes the number of units in the sample in possession of the attribute under discussion.

Sampling Distribution and Standard Error of a Statistic

Starting with a population of N units, we can draw many a sample of a fixed size n. In case of sampling with replacement, the total number of samples that can be drawn is and when it comes to sampling without replacement of the sampling units, the total number of samples that can be drawn is $^{N}c_{n}$.

If we compute the value of a statistic, say mean, it is quite natural that the value of the sample mean may vary from sample to sample as the sampling units of one sample may be different from that of another sample. The variation in the values of a statistic is termed as "Sampling Fluctuations".

If it is possible to obtain the values of a statistic (T) from all the possible samples of a fixed sample size along with the corresponding probabilities, then we can arrange the values of the statistic, which is to be treated as a random variable, in the form of a probability distribution. Such a probability distribution is known as the sampling distribution of the statistic. The sampling distribution, just like a theoretical probability distribution possesses different characteristics. The mean of the statistic, as obtained from its sampling distribution, is known as "Expectation" and the standard deviation of the statistic T is known as the "Standard Error (SE)" of T. SE can be regarded as a measure of precision achieved by sampling. SE is inversely proportional to the square root of sample size. It can be shown that

$$SE\left(\bar{x}\right) = \frac{\sigma}{\sqrt{n}} \text{ for SRS WR}$$

$$= \frac{\sigma}{\sqrt{n}} \cdot \sqrt{\frac{N-n}{N-1}} \quad \text{for SRS WOR} \quad (13.2.8)$$

Standard Error for Proporation

$$SE\,(p) = \sqrt{\frac{Pq}{n}} \quad \text{for SRS WR}$$

$$\sqrt{\frac{Pq}{n}}\ \sqrt{\frac{N-n}{N-1}} \quad \text{for SRS WOR} \quad (13.2.9)$$

SRSWR and SRSWOR stand for simple random sampling with replacement and simple random sampling without replacement.

The factor $\sqrt{\frac{N-n}{N-1}}$ is known as finite population correction (fpc) or finite population multiplier and may be ignored as it tends to 1 if the sample size (n) is very large or the population under consideration is infinite when the parameters are unknown, they may be replaced by the corresponding statistic.

Illustrations

Example 13.2.1: A population comprises the following units: a, b, c, d, e. Draw all possible samples of size three without replacement.

Solution: Since in this case, sample size (n) = 3 and population size (N) = 5. the total number of possible samples without replacement = $^5c_3 = 10$

These are abc, abd, abe, acd, ace, ade, bcd, bce,bde,cde.

Example 13.2.2: A population comprises 3 member 1, 5, 3. Draw all possible samples of size two

(i) with replacement

(ii) without replacement

Find the sampling distribution of sample mean in both cases.

Solution: (i) With replacement :- Since n = 2 and N = 3, the total number of possible samples of size 2 with replacement = $3^2 = 9$.

These are exhibited along with the corresponding sample mean in table 15.1. Table 15.2 shows the sampling distribution of sample mean i.e., the probability distribution of $\overline{x}$.

Table 13.2.1

All possible samples of size 2 from a population comprising 3 units under WR scheme

Serial No.	Sample of size 2 with replacement	Sample mean ($\overline{x}$)
1	1, 1	1
2	1, 5	3
3	1, 3	2
4	5, 1	3
5	5, 5	5
6	5, 3	4
7	3, 1	2
8	3, 5	4
9	3, 3	3

Table 13.2.2

Sampling distribution of sample mean

$\overline{x}$	1	2	3	4	5	Total
P	1 / 9	2 / 9	3 / 9	2 / 9	1 / 9	1

(ii) without replacement: As N = 3 and n = 2, the total number of possible samples without replacement = $^NC_2 = {}^3C_2 = 3$.

Table 13.2.3

Possible samples of size 2 from a population of 3 units under WOR scheme

Serial No	Sample of size 2 without replacement	Sample mean ($\bar{x}$)
1	1 , 3	2
2	1 , 5	3
3	3 , 5	4

Table 13.2.4

Sampling distribution of mean

:	2	3	4	Total
P:	1 / 3	1/3	1/3	1

Example 13.2.3: Compute the standard deviation of sample mean for the last problem. Obtain the SE of sample mean applying 15.8 and show that they are equal.

Solution: We consider the following cases:

(i) with replacement :

Let U = $\bar{x}$ The sampling distribution of U is given by

U:	1	2	3	4	5
P:	1/9	2/9	3/9	2/9	1/9

E (U) $= \Sigma P_i U_i$

$= 1/9\times1 + 2/9\times2 + 3/9\times3 + 2/9\times4 + 1/9\times5 = 3$

E (U^2) $= \Sigma P_i U_i^2$

$= 1/9\times1^2 + 2/9\times2^2 + 3/9\times3^2 + 2/9\times4^2 + 1/9\times5^2$

$= 31/3$

$\therefore v(\bar{x}) = v(U) = E(U^2) - [E(U)]^2$

$= 31/3 - 3^2$

$= 4/3$

Hence SE= $\frac{2}{\sqrt{3}}$ (1)

Since the population comprises 3 units, namely 1, 5, and 3 we may take $X_1 = 1, X_2 = 5, X_3 = 3$

The population mean (m) is given by

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

$$= \frac{1+5+3}{3} = 3$$

and the population variance $\sigma^2 = \frac{\sum (X_a - \mu)^2}{N}$

$$\frac{(1-3)^2 + (5-3)^2 + (3-3)^2}{3} = 8/3$$

Applying 15.8 we have, $SE_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{8}{\sqrt{3}} \times \frac{1}{\sqrt{2}} = \frac{2}{\sqrt{3}}$ (2)

Thus comparing (1) and (2), we are able to verify the validity of the formula.

(ii) without replacement :

In this case, the sampling distribution of V = is given by

V:	2	3	4
P:	1/3	1/3	1/3

$E(\bar{x}) = E(V) = 1/3 \times 2 + 1/3 \times 3 + 1/3 \times 4$

$= 3$

$V(\bar{x}) = Var(V) = E(v^2) - [E(v)]^2$

$= 1/3 \times 2^2 + 1/3 \times 3^2 + 1/3 \times 4^2 - 3^2$

$= 29/3 - 9$

$= 2/3$

$$\therefore SE_{\bar{x}} = \frac{2}{\sqrt{3}}$$

Applying 13.2.8, we have

$$SE_{\bar{x}} = \frac{\sigma}{\sqrt{n}} \cdot \sqrt{\frac{N-n}{N-1}}$$

$$= \frac{8}{\sqrt{3}} \times \frac{1}{\sqrt{2}} \times \frac{8}{\sqrt{3}} \times \frac{1}{\sqrt{2}} \times \sqrt{\frac{3-2}{3-1}} = \frac{2}{\sqrt{3}}$$

and thereby, we make the same conclusion as in the previous case.

13.2.6 TYPES OF SAMPLING

There are three different types of sampling which are

I. Probability Sampling

II. Non – Probability Sampling

III. Mixed Sampling

In the first type of sampling there is always a fixed, pre assigned probability for each member of the population to be a part of the sample taken from that population . When each member of the population has an equal chance to belong to the sample, the sampling scheme is known as Simple Random Sampling. Some important probability sampling other than simple random sampling are stratified sampling, Multi Stage sampling, Multi Phase Sampling, Cluster Sampling and so on. In non- probability sampling , no probability attached to the member of the population and as such it is based entirely on the judgement of the sampler. Non-probability sampling is also known as Purposive or Judgement Sampling. Mixed sampling is based partly on some probabilistic law and partly on some pre decided rule. Systematic sampling belongs to this category. Some important and commonly used sampling process are described now.

Simple Random Sampling (SRS)

When the units are selected independent of each other in such a way that each unit belonging to the population has an equal chance of being a part of the sample, the sampling is known as Simple random sampling or just random sampling. If the units are drawn one by one and each unit after selection is returned to the population before the next unit is being drawn so that the composition of the original population remains unchanged at any stage of the sampling then the sampling procedure is known as Simple Random Sampling with replacement. If, however, once the units selected from the population one by one are never returned to the population before the next drawing is made, then the sampling is known as sampling without replacement. The two sampling methods become almost identical if the population is infinite i.e. vary large or a very large sample is taken from the population. The best method of drawing simple random sample is to use random sampling numbers.

Simple random sampling is a very simple and effective method of drawing samples provided (i) the population is not very large (ii) the sample size is not very small and (iii) the population under consideration is not heterogeneous i.e. there is not much variability among the members forming the population. Simple random sampling is completely free from Sampler's biases. All the tests of significance are based on the concept of simple random sampling.

Stratified Sampling

If the population is large and heterogeneous, then we consider a somewhat, complicated sampling design known as stratified sampling which comprises dividing the population into a number of strata or sub-populations in such a way that there should be very little variations among the units comprising a stratum and maximum variation should occur among the different strata. The stratified sample consists of a number of sub samples, one from each stratum. Different sampling scheme may be applied to different strata and , in particular, if simple random sampling is applied for drawing units from all the strata, the sampling procedure is known as stratified random sampling. The purpose of stratified sampling are (i) to make representation of all the sub populations (ii) to provide an estimate of parameter not only for all the strata but also and overall estimate (iii) reduction of variability and thereby an increase in precision.

There are two types of allocation of sample size. When there is prior information that there is not much variation between the strata variances. We consider "Proportional allocation" or "Bowely's allocation where the sample sizes for different strata are taken as proportional to the population sizes. When the strata-variances differ significantly among themselves, we take recourse to "Neyman's allocation" where sample size vary jointly with population size and population standard deviation i.e. $n_i \mu N_iS_i$. Here n_i denotes the sample size for the i^{th} stratum, N_i and S_i being the corresponding population size and population standard deviation. In case of Bowley's allocation, we have $n_i \mu N_i$.

Stratified sampling is not advisable if (i) the population is not large (ii) some prior information is not available and (iii) there is not much heterogeneity among the units of population.

Multi Stage Sampling

In this type of complicated sampling, the population is supposed to compose of first stage sampling units, each of which in its turn is supposed to compose of second stage sampling units, each of which again in its turn is supposed to compose of third stage sampling units and so on till we reach the ultimate sampling unit.

Sampling also, in this type of sampling design, is carried out through stages. Firstly, only a number of first stage units is selected. For each of the selected first stage sampling units, a number of second stage sampling units is selected. The process is carried out until we select the ultimate sampling units. As an example of multi stage sampling, in order to find the extent of unemployment in India, we may take state, district, police station and household as the first stage, second stage, third stage and ultimate sampling units respectively.

The coverage in case of multistage sampling is quite large. It also saves computational labour and is cost-effective. It adds flexibility into the sampling process which is lacking in other sampling schemes. However, compared to stratified sampling, multistage sampling is likely to be less accurate.

Systematic Sampling

It refers to a sampling scheme where the units constituting the sample are selected at regular interval after selecting the very first unit at random i.e., with equal probability. Systematic sampling is partly probability sampling in the sense that the first unit of the systematic sample is selected probabilistically and partly non- probability sampling in the sense that the remaining units of the sample are selected according to a fixed rule which is non-probabilistic in nature.

If the population size N is a multiple of the sample size n i.e. N = nk, for a positive integer k which must be less than n, then the systematic sampling comprises selecting one of the first k units at random, usually by using random sampling number and thereby selecting every kth unit till the complete, adequate and updated sampling frame comprising all the members of the population is exhausted. This type of systematic sampling is known as "linear systematic sampling ". K is known as "sample interval".

However, if N is not a multiple of n, then we may write N = nk + p, p < k and as before, we select the first unit from 1 to k by using random sampling number and thereafter selecting every kth unit in a cyclic order till we get the sample of the required size n. This type of systematic sampling is known as "circular systematic sampling."

Systematic sampling is a very convenient method of sampling when a complete and updated sampling frame is available. It is less time consuming, less expensive and simple as compared to the other methods of sampling. However, systematic sampling has a severe drawback. If there is an unknown and undetected periodicity in the sampling frame and the sampling interval is a multiple of that period, then we are going to get a most biased sample, which, by no stretch of imagination, can represent the population under investigation. Furthermore, since it is not a probability sampling, no statistical inference can be drawn about population parameter.

Purposive or Judgement sampling

This type of sampling is dependent solely on the discretion of the sampler and he applies his own judgement based on his belief, prejudice, whims and interest to select the sample. Since this type of sampling is non-probabilistic, it is purely subjective and, as such, varies from person to person. No statistical hypothesis can be tested on the basis of a purposive sampling.

UNIT II EXERCISE

Set A

Answer the following questions. Each question carries one mark.

1. Sampling can be described as a statistical procedure
   (a) To infer about the unknown universe from a knowledge of any sample
   (b) To infer about the known universe from a knowledge of a sample drawn from it
   (c) To infer about the unknown universe from a knowledge of a random sample drawn from it
   (d) Both (a) and (b).
2. The Law of Statistical Regularity says that
   (a) Sample drawn from the population under discussion possesses the characteristics of the population
   (b) A large sample drawn at random from the population would posses the characteristics of the population
   (c) A large sample drawn at random from the population would possess the characteristics of the population on an average
   (d) An optimum level of efficiency can be attained at a minimum cost.
3. A sample survey is prone to
   (a) Sampling errors (b) Non-sampling errors
   (c) Either (a) or (b) (d) Both (a) and (b)

4. The population of roses in Salt Lake City is an example of
   (a) A finite population (b) An infinite population
   (c) A hypothetical population (d) An imaginary population.
5. Statistical decision about an unknown universe is taken on the basis of
   (a) Sample observations (b) A sampling frame
   (c) Sample survey (d) Complete enumeration
6. Random sampling implies
   (a) Haphazard sampling (b) Probability sampling
   (c) Systematic sampling (d) Sampling with the same probability for each unit.
7. A parameter is a characteristic of
   (a) Population (b) Sample
   (c) Both (a) and (b) (d) (a) or (b)
8. A statistic is
   (a) A function of sample observations (b) A function of population units
   (c) A characteristic of a population (d) A part of a population.
9. Sampling Fluctuations may be described as
   (a) The variation in the values of a statistic
   (b) The variation in the values of a sample
   (c) The differences in the values of a parameter
   (d) The variation in the values of observations.
10. The sampling distribution is
   (a) The distribution of sample observations
   (b) The distribution of random samples
   (c) The distribution of a parameter
   (d) The probability distribution of a statistic.
11. Standard error can be described as
   (a) The error committed in sampling
   (b) The error committed in sample survey
   (c) The error committed in estimating a parameter
   (d) Standard deviation of a statistic.

12. A measure of precision obtained by sampling is given by
    (a) Standard error (b) Sampling fluctuation
    (c) Sampling distribution (d) Expectation.
13. As the sample size increases, standard error
    (a) Increases (b) Decreases
    (c) Remains constant (d) Decreases proportionately.
14. If from a population with 25 members, a random sample without replacement of 2 members is taken, the number of all such samples is
    (a) 300 (b) 625
    (c) 50 (d) 600
15. A population comprises 5 members. The number of all possible samples of size 2 that can be drawn from it with replacement is
    (a) 100 (b) 15
    (c) 125 (d) 25
16. Simple random sampling is very effective if
    (a) The population is not very large
    (b) The population is not much heterogeneous
    (c) The population is partitioned into several sections.
    (d) Both (a) and (b)
17. Simple random sampling is
    (a) A probabilistic sampling (b) A non- probabilistic sampling
    (c) A mixed sampling (d) Both (b) and (c).
18. According to Neyman's allocation, in stratified sampling
    (a) Sample size is proportional to the population size
    (b) Sample size is proportional to the sample SD
    (c) Sample size is proportional to the sample variance
    (d) Population size is proportional to the sample variance.
19. Which sampling provides separate estimates for population means for different segments and also an over all estimate?
    (a) Multistage sampling (b) Stratified sampling
    (c) Simple random sampling (d) Systematic sampling

20. Which sampling adds flexibility to the sampling process?
    (a) Simple random sampling (b) Multistage sampling
    (c) Stratified sampling (d) Systematic sampling

21. Which sampling is affected most if the sampling frame contains an undetected periodicity?
    (a) Simple random sampling (b) Stratified sampling
    (c) Multistage sampling (d) Systematic sampling

22. Which sampling is subjected to the discretion of the sampler?
    (a) Systematic sampling (b) Simple random sampling
    (c) Purposive sampling (d) Quota sampling.

23. If a random sample of size 2 with replacement is taken from the population containing the units 3,6 and 1, then the samples would be
    (a) (3,6),(3,1),(6,1)
    (b) (3,3),(6,6),(1,1)
    (c) (3,3),(3,6),(3,1),(6,6),(6,3),(6,1),(1,1),(1,3),(1,6)
    (d) (1,1),(1,3),(1,6),(6,1),(6,2),(6,3),(6,6),(1,6),(1,1)

24. If a random sample of size two is taken without replacement from a population containing the units a,b,c and d then the possible samples are
    (a) (a, b),(a, c),(a, d) (b) (a, b),(b, c), (c, d)
    (c) (a, b), (b, a), (a, c),(c,a), (a, d), (d, a) (d) (a, b), (a, c), (a, d), (b, c), (b, d), (c,d)

ANSWERS

Set A

1.	(c)	2.	(c)	3.	(d)	4.	(b)	5.	(a)	6.	(d)
7.	(a)	8.	(a)	9.	(a)	10.	(d)	11.	(d)	12.	(a)
13.	(b)	14.	(a)	15.	(d)	16.	(b)	17.	(a)	18.	(a)
19.	(b)	20.	(d)	21.	(d)	22.	(c)	23.	(c)	24.	(d)