1. What do you mean by Stratification?Answer:

Stratification means division into layers. Division of the heterogeneous population into different sections or subgroups of more or less same characteristics is known as stratification.

2. Define Stratified random sample and Stratified random sampling.

Answer:

A Non homogeneous population is subdivided into various non overlapping subpopulations called strata, a definite number of sample units drawn from each stratum. A sample obtained by combining all these units called as Stratified Random Sample. And the technique is known as Stratified Random Sampling

3. What are primary reasons for using stratification?

Answer:

There are four primary reasons for using stratification:

- The subpopulations that form the strata are the domains of study or interest and thus we need to get separate estimates for each stratum. For eg: We may take separate samples for men and women because we are interested in making the separate inferences for subpopulations as well as comparing them.
- 2) The subpopulations or strata are such that different methods or sampling schemes may be suitable for different strata. For eg: If we

Are estimating the number of words in a text book we might take different samples from different sections ; the front matter, the main text, the references, and the index

3) The population is geographically diverse and hence the stratification is more suitable and thus stratification is a convenient way of organizing sampling and data collection

- 4) By employing stratification in a careful fashion we can get improved precision for our estimates of population quantities
- 4. When the stratification is more useful?

Answer:

Stratification is most useful when the stratifying variables are

- simple to work with,
- easy to observe, and
- closely related to the topic of the survey.

5. Explain the principal steps involved in Stratified random sampling.

Answer:

While applying stratified random sampling technique the procedure followed is given below.

a) The universe to be sampled is subdivided (or stratified) into groups which are mutually exclusive and include all items in the universe

b) A simple Random sample is then chosen independently from each group

This sampling procedure differs from simple random sampling in that in the latter the sample items are chosen at random from the entire universe. In stratified random sampling the sampling is designed so that a designated number of items is chosen from each stratum.

6. Write a note on characteristics used for stratification.

Answer:

As a general rule , strata are created on the basis of a variable known to be correlated with the variable of interest and for which information on each universe element is known. Strata should be constructed in a way which will minimize the differences among sampling units within strata and maximize difference among strata

For example: If we are interested in studying the consumption pattern of the people of Delhi , the city of Delhi may be divided into various parts (such as zones or wards) and from each part a sample may be taken at random. Before deciding about stratification we must have knowledge of the traits of the population. Such knowledge may be based upon expert judgment, past data, preliminary observations from pilot studies etc.

The purpose of stratification is to increase the efficiency of sampling by dividing a heterogeneous universe in such a way that i) there is a great homogeneity as possible within each stratum and (ii) a marked difference is possible between the strata.

7. How many strata should be constructed?

Answer:

Strata is nothing but the number of subgroups of the population (universe). The practical considerations limit the number of strata that is feasible, costs of adding more strata may soon outrun benefits. As a generalization more than six strata may be undesirable

8. How do you decide about the number of observations that should be taken from each stratum ?

Answer:

When deciding this question we can use either a proportional or a disproportional allocation. In proportional allocation one sample each stratum in proportion to its relative weight. In disproportional allocation this is not the case. With either approach, stratified sampling guarantees that every element in the population has a chance of being selected. It may be pointed out that proportional allocation approach is simple and if all one knows about each stratum is the number of items in that stratum, it is generally also the preferred procedure. In disproportional sampling the different strata are sampled at different rates. As a general rule when variability among observations within a stratum is high, one samples that stratum at a higher rate than for strata with less internal variation.

9. Stratified sampling is appropriate when the population is already divided into groups of different sizes. Justify

Answer:

Suppose that a physician's patients are divided into four groups according to age as shown in the table below.

	Age group	Percentage total	of
Composition of patients by age	Birth – 19 years	30	
	20-39 years	40	
	40-59 years	20	
	60 years and older	10	

The physician wants to find out how many hours his patients sleep. To obtain an estimate of this characteristic of the population he could take a random sample from each of the four age groups and give weight to the samples according to the percentage of patients in that group. This would be an example for stratified sample.

10. Stratified random sampling provides more representative sample. Explain

Answer:

In an un stratified random sample some strata may be overrepresented; others may be underrepresented while some may be excluded altogether. Stratified sampling ensures desired representation in the sample of the various strata in the population. It excludes the possibility of any essential group of population being completely excluded in the sample.

A properly constructed and executed stratified random sampling plan overcomes the draw back of purposive sampling and Simple Random sampling and still enjoys the virtues of both these methods by dividing the given universe into a number of homogeneous subgroups with respect to purposive characteristic and then using the technique of random sampling in drawing samples from each stratum.

A stratified random sample gives adequate representation to each strata or important section of the population or eliminates the possibility of any important group of the population being completely ignored. The stratified random sampling provides a more representative sample of the population and accordingly results in less variability as compared with other sampling designs.

11. How the estimates obtained using stratified random sampling is of more precision than that of Simple Random sampling?

Answer:

In stratified random sampling since we divide the entire heterogeneous population into layers of homogeneous characteristics variations within the strata is minimized.As a consequence of the reduction in the variability within each stratum stratified random sampling provides more efficient estimates as compared with simple random sampling. For example: the sample estimate of the population mean is more efficient in both proportional and Neyman's allocation of the samples to different strata in stratified random sampling as compared with the corresponding estimates obtained in SRS

Sometimes it is desired to achieve different degrees of accuracy for different segments of the population. Stratified random sampling is the only sampling plan which enables us to obtain the results of known precision for each of the stratum.

12. The stratified samples are concentrated more geographically. Explain

Answer:

As compared with SRS the stratified samples would be more concentrated geographically. That is the units the units from different strata may be selected in such a way that all of them are localized in one geographical area. Accordingly time and money involved in collecting the data and interviewing the individuals may be considerably reduced and the supervision of the field work could be allotted with greater ease and convenience.

Sometimes the sampling problems may differ significantly in different parts of the population. In such situation the problem can be tackled effectively through stratified sampling by regarding each segment of the population as a different strata and approaching upon then independently during sampling

Example: Population under study consisting of

i) Literates and illiterates

ii) People living in institutions, hostels, hospitals etc and those living in ordinary homes. In such cases we can deal with the problem through Stratified Random Sampling by regarding the different parts of the population as stratum and tackling the problems of the survey within each stratum independently.

13. What are the demerits of Stratified Random sampling?

Answer:

1) As already pointed out the success of the stratified sampling depends on

- i) Effective stratification of the universe into homogeneous strata
- ii) Appropriate size of the samples to be drawn from each stratum

If Stratification if faulty the results will be biased. The error due to wrong stratification cannot be compensated even by taking large samples

The allocation of the sample sizes to different strata $\,$ requires an accurate knowledge of the population $\,$ size in each stratum $N_{\rm h}$, h =

1,2,..,k. Neyman's principle of Optimum allocation n_h proportional to N_hS_h requires addition knowledge of the variability or S.D of each strata . N_h and S_h are usually unknown and are the serious limitations of effective use of stratified random sampling

2) It is a very difficult task to divide the universe into homogeneous strata

3) If the strata are overlapping , unsuitable or disproportionate the selection of the samples may be biased. Such errors cannot be compensated even by taking large samples.

4) Disproportionate stratification requires weighting which again introduces selective factor in the sample and under weighing makes the sample unrepresentative

14. Explain the Stratified Random Sampling with SRSWR with an example.

Answer:

Using *stratified* sampling, divided the population is into homogeneous, mutually exclusive groups called strata, and then independent samples are selected from each stratum. Any of the sampling methods can be used to sample within each stratum. The sampling method can vary from one stratum to another. When SRSWR is used to select the sample within each stratum, the sample design is called *stratified simple* random sampling with replacement.

Example : Suppose you want to estimate how many high school students have part-time jobs at the national level and also in each province. If you were to select a simple random sample WR of 25,000 people from a list of all high school students in Canada (assuming such a list was available for selection), you would end up on average with just a little over 100 people from Prince Edward Island, since they account for less than half of a percent of the whole Canadian population.

This sample would probably not be large enough for the kind of detailed analysis you had in mind. Stratifying your list by province, again assuming that this information is available, and then selecting a sample size for each province would allow you to decide on the exact sample size needed for that specific province and then selecting the required samples from each province by SRSWR will give us more representative sample. Thus, in order to get good representation of Prince Edward Island, you would use a larger sample than the one allotted to it by the simple random sampling approach directly. 15. Explain the Stratified Random Sampling with SRSWOR with an example.

Answer:

Stratified Random samples without replacement are obtained by separating the population into mutually exclusive (only belong to one set) sets, or *stratas*, and then drawing *simple random samples* (a sample selected in a way that every possible sample with the same number of observation is equally likely to be chosen) without replacement from each stratum. Example : An Ontario school board wanted to assess student opinion on dropping Grade from the secondary school program. They decided to survey students from Elmsview High School. To ensure a representative sample of students from all grade levels, the school board used a stratified sampling technique.

In this case, the strata were the five grade levels (grades 9 to 13). The school board then selected a sample within each stratum. The students selected in this sample were extracted using SRSWOR making up a total sample of 100 students.

Stratified sampling WOR is preferable to With Replacement

to obtain a more precise estimate of the population mean. If the variation within a subpopulation is small in relation to the total population variance, the estimate of the population mean will be considerably more precise than a simple random sample WR of the same size.