b) Optimization :

By the precision of the sampling results, we mean how closely we can reproduce from a sample the results which could be obtained if we should take a complete count of census under the same condition. The precision is judged by the variance of the estimators concerned.

Efficiency of sample survey is measured by the reciprocal of the sampling variance of the estimator. Cost is measured by expenditure incurred in terms of money or man hours. The principle of optimizati ensure that a sampling strategy to be preferred which gives highest ~~peci~~ precisions for a given cost of the survey or the minimum cost for a specified level of precision.

Types of Population

In the first place the population may be either finite or infinite. By a finite population we shall mean a population which contains a finite number of members. Such, for instants, is the population of height of 500 boys in a college or a population of books in a college library. Similarly by an infinite ~~number of members~~ population, we shall mean a population containing an infinite number of members. Such for instant, is the population of pressure of various points of the atmosphere,

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of, the population of yields of a particular crop of at various points in an agricultural field. In many cases the number of members in a population is so large as to be practically infinite. E.g: the human population of India or population of veasible stars.

Secondly, a population may be either existent or hypothetical. The population of complete existent object will be called an existence population. But the population may also be hypothetically constructed. E.g: the outcome of the tossing of the coin an infinite number of times, represents a hypothetical population of heads and tails. Here the population of heads and tails is to be conceived of as having no existence in reality but only an imagination.

Types of Sampling:

Sampling is first broadly classified as subjective and objective. Any type of sampling which depends on the personal judgement of the sampler himself is called judgement sample. Here the judgement of the person selecting the sample is significant for different persons will judge differently. There is no objective method of prefering one judgement to another.

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The judgement sampling has two important limitatio
— one is the difficulty of describing the proper
emphasis to the various factors affecting sampl
designs. What is lacking, is a theory that will
integrate a desirable allocation of resources to
such factors of sample designer. Some guidence
is required for evaluating the various factors
entering into the design and contributing to t
sampling error and for selecting the best one o
a number of alternating designs. The second
limitation is the inability to measure the preca
of the sample results and no objective basis
is known for measuring the amount of confide
which can be placed in the sample estimate

Objective sampling is further subdivided as non
probablistic, probablistic and mixed. In non-
probablistic objective sampling, there is a fixe
sampling rule but there is no probability
attached to the mode of selection. Eg: selecting
every tenth individual from a list starting
with the first or selecting every tenth line in
a potato field. If however the selection of t
first individual is made in such a manner
that each of the first tenth get same equa
chance of being selected, it becomes a case of
mixed sampling — partly probablistic and partly

non-probabilistic. On the other hand if for each individual there is a definite preassigned probability of being selected, the sampling is said to be ~~probabili~~ probabilistic.

Probabilistic sampling is also called random sampling if in particular each individual of the population has an equal chance of being selected. Then the sampling is called un-restricted random sampling or simple random sampling. Simple random sampling is said to be with or without replacement. According as any individual once selected is returned to the population or not returned before the next drawing is made.

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Technique of Random Sampling

The technique of random sampling is of fundamental importance in the application of statistics, since the whole sampling theory is based on the assumption of random sampling, the essence of which is that each of the individuals included in the population has an equal chance of being selected.

The first attempt towards drawing a random sample may be made by lottery. This is done →

by constructing a minicture population which can be handled easily, and then drawing individuals from it, each time suffling it thorrowly before the next drawing is made. In practice a ticket may be prepared for each sampling unit bearing its identification mark, say by putting all the ticket its serial number, and these tickets may be placed in similar containers, usually small metallic cylinders and thrown into a rotating drum, in which they are thorrowly mixed or randomized before each drawing. Similarly we can draw a random sample of houses by taking a pack of cards as similar as possible, making each card corresponds to one distinct house by writting on it the number of the house in the street and then drawing a sample of cards, each time suffling the cards before the next drawing is made.

But it should be realized that these methods lack the property of strict randomness. First it is not practically possible to have cards or cylinders of exactly similar shape, size and weight.

Secondly, the writting of numbers with ink may weight the cards differently. Furthermore the practical difficulties in preparing such a miniature population, when the population size is large are immense and lack of care may often ~~paid to~~ lead to non-random samples.

These difficulties can be overcome, if we have a series of random numbers [i.e., a series in which the digits 0 & 9 occur randomly]. The problem of constructing the miniature population will then reduce to attaching to each unit of the population and ordinal numbers: we can then choose a number of digits from any part of the series which is already randomized, and hence get a random sample. It is this possibly that has ~~lead~~ led to the construction of random sampling number series.

Random Sampling Number Series

Definition :

A random sampling number series is an arrangement which may be looked upon either as linear or as rectangular, in which each

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place has been filled in with one of the digits 0 ~ 9. The digit occupying any place is selected at random from these ten digits and independently of the digits occuring in other positions.

Advantage of Random sampling Numbers : *

1) If we use random sampling numbers for drawing random samples, we need not construct a miniature population. Also the numbering of the sampling units can be done in any convenient manner.

2) Randomization of numbers being done once for all, the tedious process of randomization of the miniature population [through suffling or rotating etc] each time before the next drawing is made is not necessary. Any part of the series can be used for a random sample of numbers and the problem is simply to interprete these numbers in terms of individuals of the population.

3) A random sampling number series can be used for any enumerable population, so that a

series of random numbers has a wide range of application.

** Procedure of drawing a random sample using a random number series :

1) Suppose the population size is N and N is a n-digit number.

2) Draw random numbers from 0 to $(10^n - 1)$, i.e, select n digited random numbers, starting blindly from any row and any column from the random number table, then proceeding row wise and columnwise.

3) Suppose M is the highest n-digit multiple of N. Then discard the random numbers, from (M+1) to $(10^n - 1)$ and 0.

4) Divide the drawn random number by N. The remainder ~~of~~ obtained stand for the selected unit number, i.e, if remainder is 3, unit 3 of the population is selected. '0.' remainder stands for the N^{th} ~~digi~~ unit.

5) The ~~proed~~ procedure will be repeated until our desired number of sample is obtained. If the samples are asked to be done without replacement, then an unit will be rejected, if it occurs again

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