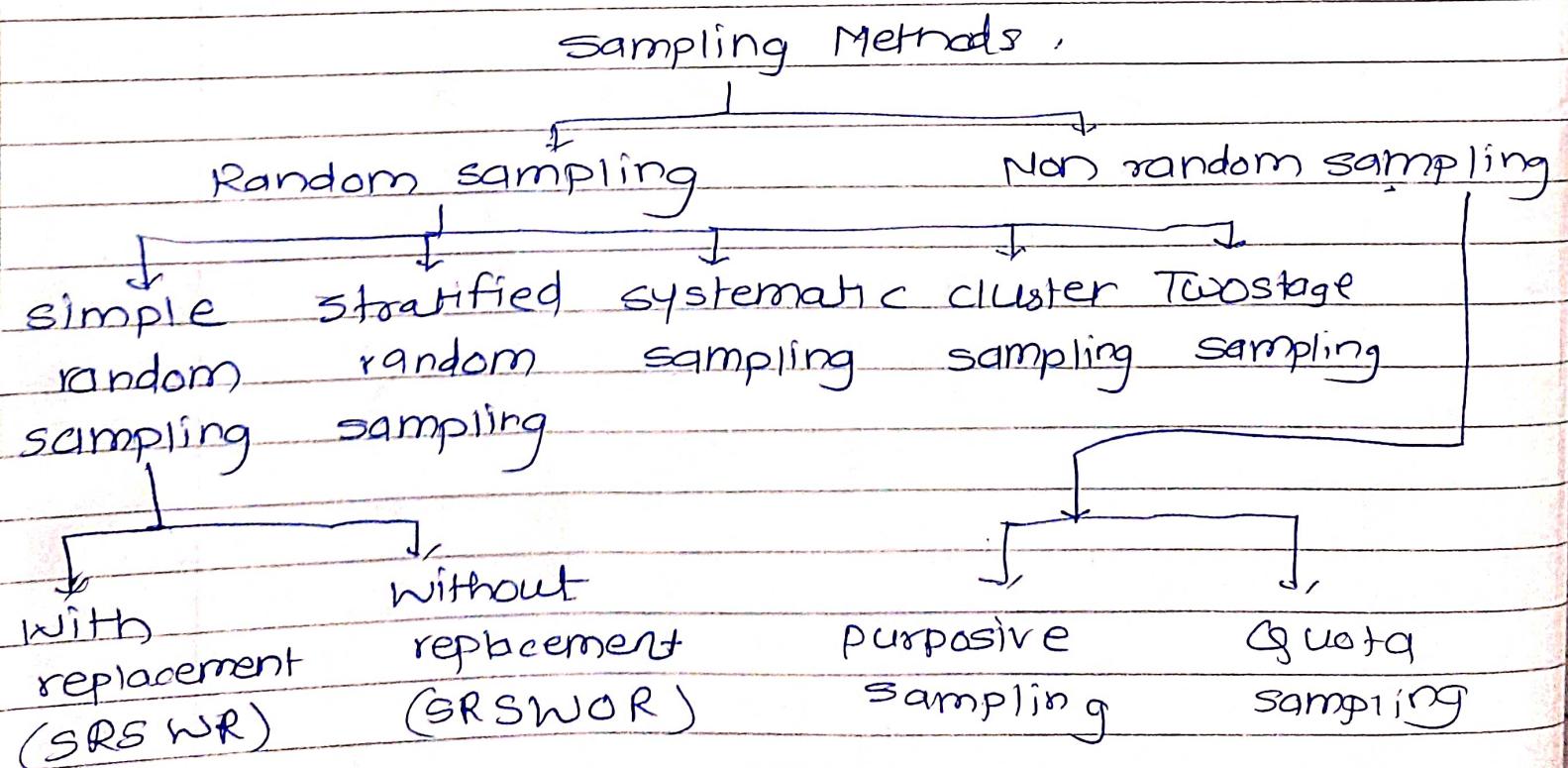


## Methods of sampling

A success of sampling method mainly depends upon proper selection of sampling methods. Different sampling methods are in practise. A sampling method which suits the purpose is selected. Sampling methods are mainly classified into two classes viz (i) non random sampling (ii) random sampling (probability sampling). We discuss some popularly used random sampling methods.

- i) simple random sampling
- ii) stratified sampling
- iii) systematic sampling
- iv) cluster sampling
- v) Two stage sampling

We use the following diagram to display various sampling methods.



## 1. simple random sampling :- (SRS)

It is the easiest & most commonly used method of sampling. In this method each element of population is given same chance of getting selected in the sample. If the population consists of  $N$  elements then prob. of selecting any element at any draw is  $\frac{1}{N}$ .

Further there are two types of SRS due to slight difference in procedure of selecting the elements.

### a) simple random sampling with replacement (SRSWR)

In this method, first element is selected at random from the population. It is recorded or studied completely & then replaced back in the population. Afterwards  $2^{nd}$  element is selected. This process is continued till a sample of required size is selected. In this method population size remains the same at every draw.

This method of sampling is called as SRSWR. One of the serious drawback of this method is that, the same element may be selected more than once in the sample.

### (b) simple random sampling without replacement (SRSWOR)

There is another procedure of selecting elements in which elements are selected at random but those are not replaced back in the population. This method of selecting sample is called as SRSWOR. In this method population size goes on decreasing at each draw. The drawback of getting same element selected more than once is overcome in SRSWOR.

#### Illustrations of SRSWOR

I suppose a lot of 500 articles is submitted for inspection to determine the proportion of defective articles one can use SRSWOR.

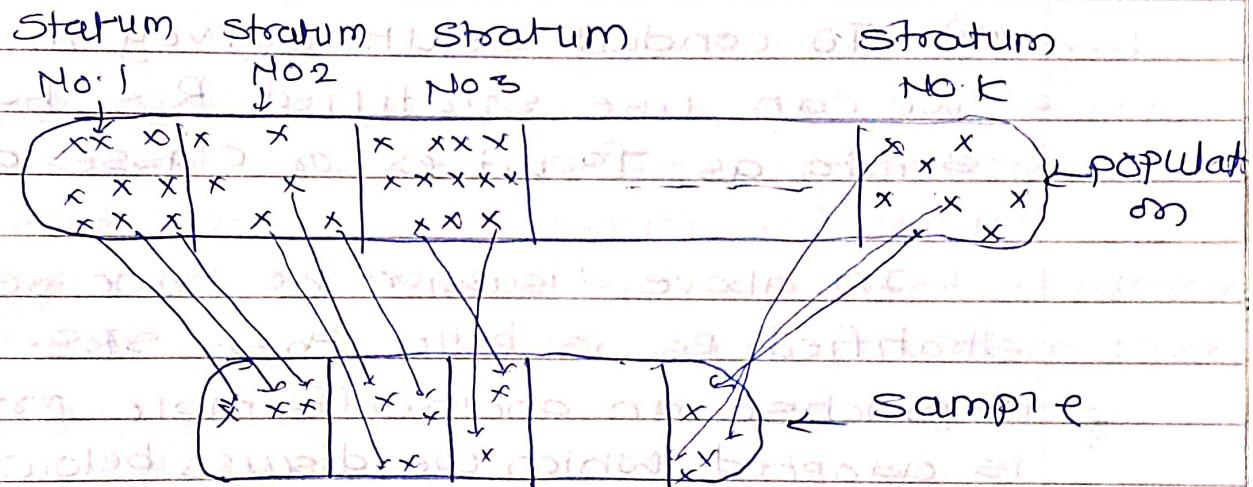
II) In order to conduct a socio economic survey of a certain village we can take SRSWOR & find per capita income of a village.

III) In order to test average petrol consumption of a lot of scooter manufacturer a SRSWOR or SRSWR can be used.

SRSWOR is widely used due to its simplicity & convenience. However it suffers from some drawbacks such as it may not be proper & representative when population is heterogeneous, widely spread. Some part of population may not represented in simple random sample at all. In order to avoid these problems some other sampling methods are in use.

## 2. Stratified random sampling:

If the population is not homogeneous SRS is not very effective. So entire population is divided into several homo. groups called as strata. A simple random sample of a suitable size is selected from each stratum & then combining these sampled observations we can form a sample. The sample thus formed is called as stratified random sample.



A properly designed stratified random sampling gives better results than SRS. Moreover this method is more suitable from administrative point of view.

### Illustrations of stratified RS:

- To estimate annual income per family we divide the population into homogeneous groups such as families' with yearly income below Rs. 20,000/-, bet<sup>n</sup> Rs 20000/- to 50,000/-, bet<sup>n</sup> 50,000/- - Rs 1 lac & above Rs. 1 lac afterwards we use stratified

random sampling taking above groups as strata

- ii) Suppose the proportion of defective articles is to be estimated in manufacturing process. Then one can use stratified random sampling by taking strata's production in different shifts.
- iii) In order to estimate crop yield we can divide the field under cultivation in plots which are equally fertile considered as strata.
- iv) To conduct health survey in a college we can use stratified RS by considering strata as faculties or classes or sex etc.

In above discussion we have seen how stratified RS is better than SRS. However in practise an another simple procedure is adopted which we discuss below.

### 3. Systematic Sampling

To draw a systematic sample size  $n$ , sampling units are numbered 1 to  $N$ , where  $N$  is pop<sup>n</sup> size. In this method we divide pop<sup>n</sup> in  $n$  equal parts according to serial numbers. Suppose each of the part includes  $k$  units (we assume  $N = nk$ )

Note that 1<sup>st</sup> group will contain units bearing serial nos. 1 to  $k$ , 2<sup>nd</sup> group will contain units bearing serial nos.  $k+1$  to  $2k$  & so on. Then we select a no.

a no. at random from 1 to  $k$ . suppose this is  $j$  then  $j$ th unit in serial order From each group is taken. Thus it will form a sample of size  $n$  which is called as systematic sampling. If  $j$ th unit is selected then systematic sample will include  $j$ th,  $(j+k)$ th,  $(j+2k)$ th ...  $j + (n-1)k$ th observations from original data

eg: —

If the sample size 15 from 150 units is to be drawn, we need to make 15 groups each of size 10. Thus here  $N = 150$ ,  $n = 15$ ,  $k = 10$ . We need to select one unit from 1<sup>st</sup> group. Suppose 3<sup>rd</sup> unit gets selected at random. Then other 14 units will be automatically selected. Those will be bearing serial no. 13, 23, 33, ..., 143.

Entire sample can be selected by selecting every  $k$ th unit after the unit selected from the 1<sup>st</sup> group. thus only one unit drawn at random from 1<sup>st</sup> group determines random sample.

Illustrations: —

i) suppose a committee of  $n=6$  students is to be selected from classes of  $N=60$  students. Then we can make 6 groups each of  $k=10$  students using their roll no. we select a student at random from 1<sup>st</sup> group.

If 7<sup>th</sup> student is selected then from each of the next groups, we select j<sup>th</sup> student. Thus systematic sample will include the students with roll No. 7, 17, 27, 37, 47, 57.

Population									
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60

one of the systematic  
selected students be Sample.

(b) To select houses for survey we can use house no., in this case systematic sample is preferred.

Generally systematic sampling gives better results than SRS. It is easier to implement than stratified sampling. However there two drawbacks which are given below.

i) systematic sample may not be proper representative if pop<sup>n</sup> has hidden periodicities eg: suppose sales during a year are available. If we take sales of every seventh day in a sample, the sample may contain

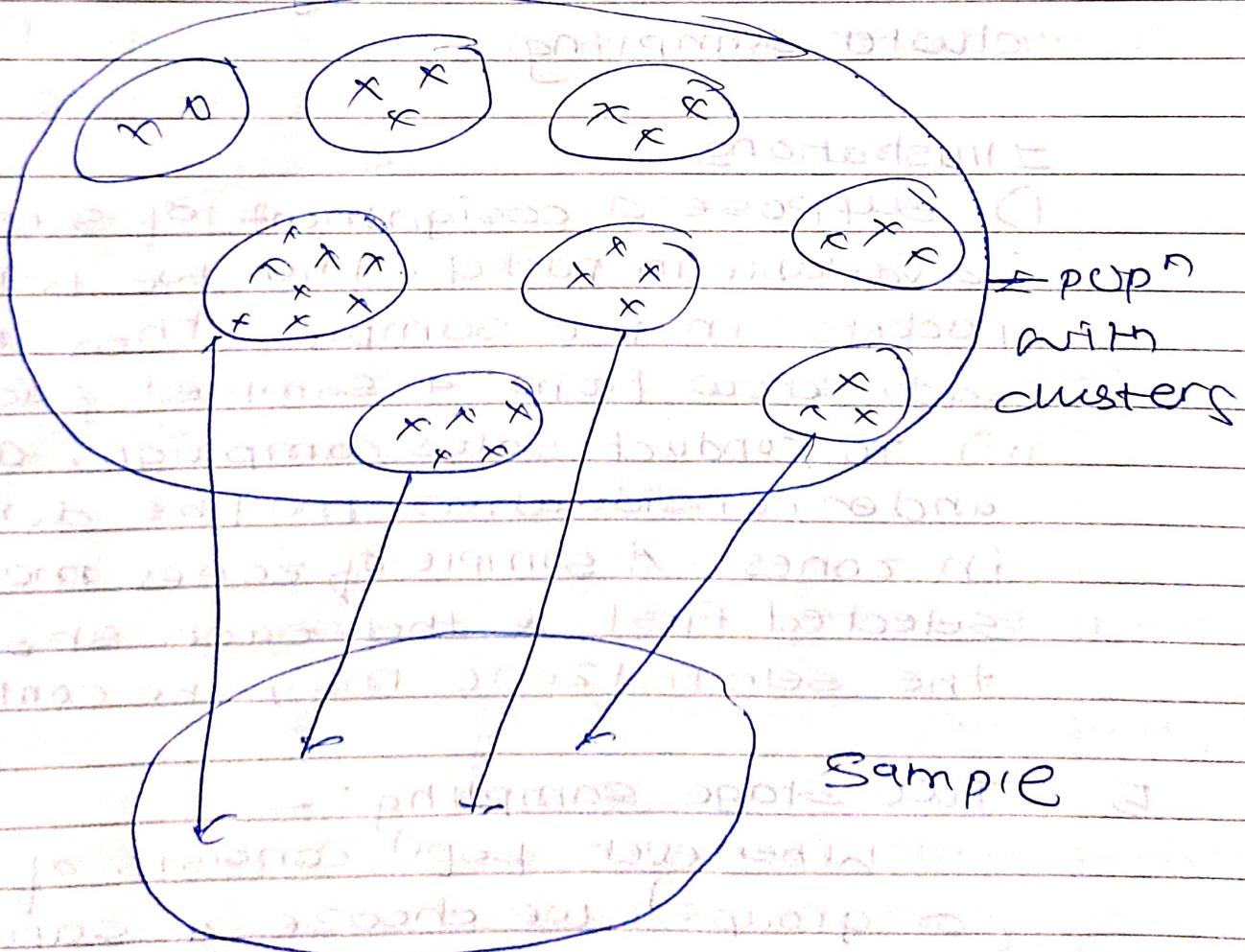
on sundays on which sales might be high

- ii)  $N \neq n$ , sample size does not remain fixed.

#### 4. Cluster Sampling:

Sometimes population consists of several groups which are convenient to use as sampling units. These groups are called as clusters.

In cluster sampling we consider cluster as sampling unit & choose simple random samples of clusters.



e.g. In order to conduct a survey of a village we can take family as a

a unit & then we collect information of each member in family rather than collecting information of individuals. In this case family plays a role of cluster.

Note:-

- 1) Smaller the size of cluster better will be results.
- 2) If the area under pop<sup>n</sup> is subdivided in small area segments as clusters then same sampling procedure is called as area sampling instead of cluster sampling.

Illustrations:-

- 1) Suppose a consignment of screws is available in packet. Then we will select packets in the sample. Then inspect each screw from a sampled packet.
- 2) To conduct sales campaign, area under consideration may be divided in zones. A sample of zones may be selected first & then each shop in the selected zone may be contacted.

## 5. Two stage sampling:-

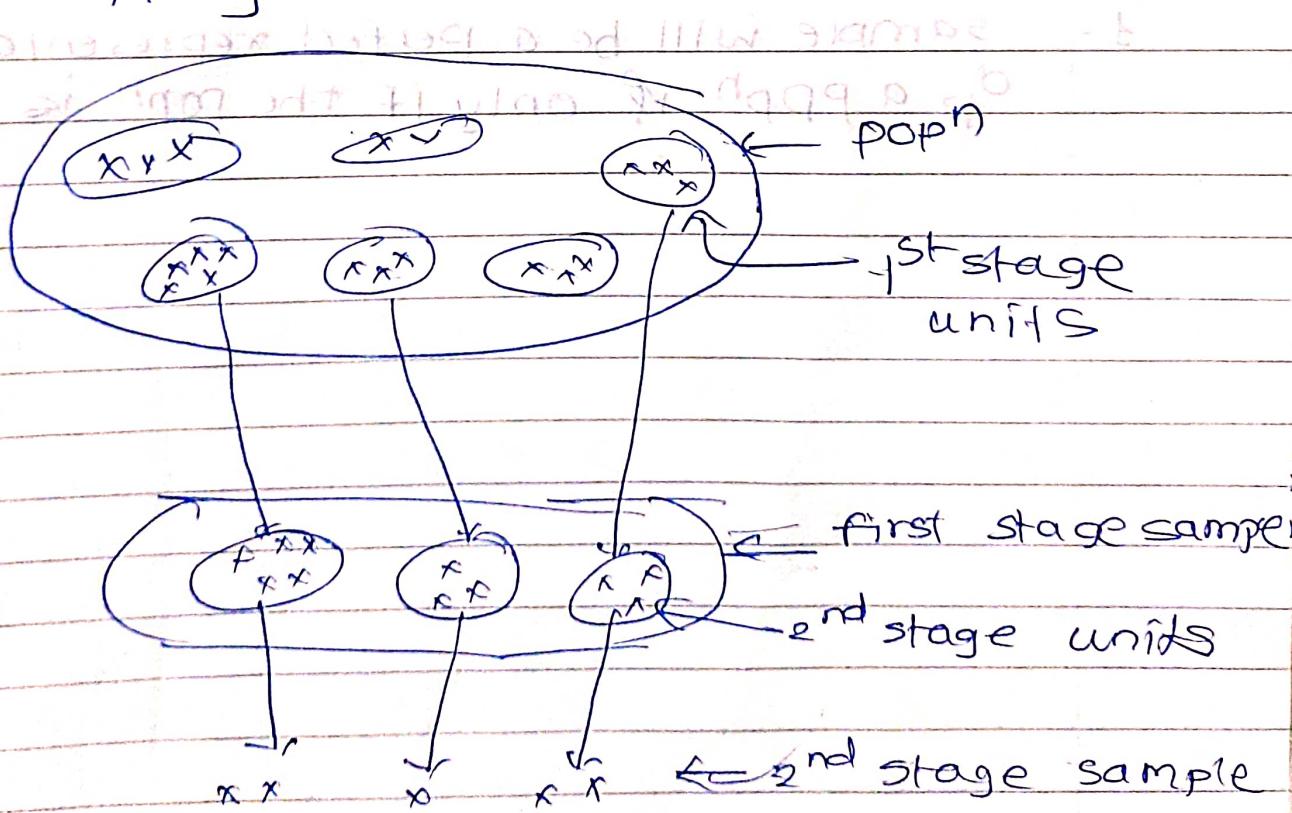
Whenever pop<sup>n</sup> consists of clusters (or groups) we choose a sample taking cluster as a sampling unit. Further from each of the selected cluster we draw a sample of elements (in the clusters) instead of including entire

cluster. The procedure of sampling is called as two stage sampling or subsampling.

In this procedure clusters are sampling units at 1<sup>st</sup> stage or primary units & these units become population for 2<sup>nd</sup> stage of sampling. Elements within the 1<sup>st</sup> stage units becomes Sampling units at 2<sup>nd</sup> stage, these units are preferred to as sub-units

Remark:- If bubble most error

If two stage procedure is generalised further it is called as multistage sampling



## Illustrations :-

- i) For conducting health survey, we may consider districts as 1<sup>st</sup> stage units. We choose some districts in this stage of sampling, later a sample of village from each district.
- ii) In the crop survey we can divide the entire field under consideration in various regions. We take a sample of regions first and then we select farms from selected regions.

## Limitations of Sampling :-

- i) Sample will be a perfect representative of a population only if the popn is homo. Eg in case of testing human blood, a few drops are enough as a sample.
- ii) If sampling units (ie elts in sample) are drawn in scientific method then sample is a good representative of population.
- iii) Sampling is reliable if the sample size is adequate.
- iv) If the population is not too large & there are no restrictions over resources in terms of money or time, census would give better results.