1. Consider a population of 6 units with values 1, 2, 3, 4, 5, 6. Write down all the possible samples of 2 without replacement from this population & verify that sample is an unbiased estimate of population mean. Also calculate it’s sample variance and verify that this variance is less than variance obtained from sampling with replacement.
2. In selecting 3 units in S.R.S.W.O.R; from a population having 6 units with values 1, 5, 8, 12, 15, 19. Show that the sample mean is an unbiased estimator of the population mean; by enumerating all possible samples. Calculate it’s sampling variance & verify that it agrees with the formula for variance of sample mean.
3. The number of diseased plants of 9 plants in 40 areas as is in the following table –

1 4 1 2 5 1 1 1 7 2 3 3 2 2 3 1 2 7 2 6 3 5 3 4 5 1 4 6 4 1 4 2 6 5 3 4 1 7 3 6

Take a random sample of size 10 W.O.R

1. Find the average number of diseased plants & estimate the population total.
2. Estimate the variance of samples.
3. Signatures of practitioners were collected in 676 sheets. Each sheet had enough space for 42 signatures, but on many sheets, lesser number of signatures had been collected. Number of signatures per sheet, was counted on a random sample of 50 sheets with the results as shown in the table.

**No. of signatures Frequency**

|  |  |
| --- | --- |
| 42 | 23 |
| 41 | 4 |
| 36 | 1 |
| 32 | 1 |
| 29 | 1 |
| 27 | 2 |
| 23 | 1 |
| 19 | 1 |
| 16 | 2 |
| 15 | 2 |
| 14 | 1 |
| 10 | 1 |
| 11 | 1 |
| 9 | 1 |
| 7 | 1 |
| 6 | 3 |
| 5 | 2 |
| 4 | 1 |
| 3 | 1 |

Estimate mean to the practitioners & hence estimate the total no. of signatures.

1. From a list of 3042 names & addresses, a S.R.S of 200 names showed on investigation that 38 were wrong. Estimate total number of addresses needing correction in the list & also find the standard error of the estimate.
2. A random sample of 170 boys from 8502 boys in an area, showed that 21 had some nutritional deficiency.
   1. Estimate proportion of nutritional deficient boys & it’s S.E
   2. Total no. of nutritionally deficient boys & S.E of estimate.
3. By complete enumeration of 430 units, it was found that mean was 19 and variance was 85. With S.R.S; how many units must be taken to estimate the population mean with 10% margin of error & 95% confidence coefficient.
4. In a population of 1000 units, the population variance was 100. What should be the size of the sample taken from it so that 99% of the sample mean differs from population mean by not more than 0.5?
5. A sample of 30 students is to be drawn from a population consisting of 300 students belonging to 2 colleges A & B. The means & S.D’s of their marks are given below –

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Total Number of students** | **Mean** | **S.D** |
| A | 200 | 30 | 10 |
| B | 100 | 60 | 40 |

How would you draw the sample using proportional allocation technique. Hence, obtain the variance of estimate of the population mean & compare it’s efficiency with S.R.S.W.O.R

1. Stratified sample of 50 units gives the following estimate stratum mean & variances.

**Stratum No. N(i) n(i) y(i) bar s(i)^2**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1 | 30 | 5 | 35 | 40 |
| 2 | 50 | 10 | 40 | 55 |
| 3 | 60 | 15 | 40 | 80 |
| 4 | 60 | 20 | 55 | 140 |

Estmate the variance within the whole population. Estimate the sampling variance of the estimated population mean.

1. A population of size 800 is divided into 3 strata, their sizes & S.D are given below –

**Strata No Size S.D**

|  |  |  |
| --- | --- | --- |
| 1 | 200 | 6 |
| 2 | 300 | 8 |
| 3 | 300 | 12 |

A stratified random sample of size 120 is to be drawn from the above population. Determine the size of samples from the 3 strata in case of proportional allocation & Neyman’s allocation.

1. The following table presents summary of data for complete census of all the 2010 forms in a region.

Calculate the sampling variance of the estimated area under wheat for the region from a sample of 150 forms.

1. If forms are selected by method S.R.S.W.stratification
2. If forms are selected by method of S.R.S within each stratum & allotted in proportion to
   1. No. of forms in each stratum [N(i)]
   2. Product N(i)S(i).

Also find sample sizes of each stratum for a. & b.

Also obtain gain in efficiency resulting from the latter 2 procedures of sampling as compared with unstratified simple random sampling.

**Stratum No. Farm size No. of forms Avg. area of wh/farm S.E under wh/Farm**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1 | 0 - 40 | 394 | 5.4 | 8.3 |
| 2 | 41 – 80 | 461 | 16.3 | 13.3 |
| 3 | 81 – 120 | 391 | 24.3 | 15.1 |
| 4 | 121 – 160 | 334 | 34.5 | 19.8 |
| 5 | 161 – 200 | 169 | 42.1 | 24.5 |
| 6 | 201 – 240 | 113 | 50.1 | 26. 0 |
| 7 | 240 above | 148 | 63.8 | 35.2 |

1. A sample survey is undertaken to estimate mean annual income of forms in an area. The forms are stratified according to their principal product. A census conducted earlier gave the info –

**Type of farm No. of farms Mean annual Income S.D**

|  |  |  |  |
| --- | --- | --- | --- |
| Sheep | 161 | 10946 | 2236 |
| Wheat | 195 | 6402 | 2614 |
| Diarine | 274 | 2228 | 606 |
| Others | 382 | 2458 | 230 |

For the sample of 12 farms, compute sample sizes in each stratum under proportional & Neyman’s allocation. Also compare the precisions of these methods with that of S.R.S.

1. The data in the below table; are for small artificial population which exhibits a fairly steady raising trend. Each column represents a systematic sample & the rows of the strata. Compare the precision of systematic sampling, S.R.S & stratified random sample. Data for 10 systematic samples with n = 4; k = 10 given below –   
   **n Strata 1 2 3 4 5 6 7 8 9 10**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 1 | 0 | 1 | 1 | 2 | 5 | 4 | 7 | 7 | 8 | 6 |
| 2 | 2 | 6 | 8 | 9 | 10 | 13 | 12 | 15 | 16 | 16 | 17 |
| 3 | 3 | 18 | 19 | 20 | 20 | 24 | 23 | 25 | 28 | 29 | 27 |
| 4 | 4 | 26 | 30 | 31 | 31 | 33 | 32 | 35 | 37 | 38 | 38 |

1. Given below are the daily milk (litres) records of the 1st lactation of a specified cow belonging to a herd maintained at the government cattle farm.

**PLEASE CHECK N.B FOR VALUES**

Find the sample mean of the systematic sampling at 10 days interval of recording.   
Hence estimate an unbiased total milk yield. Also, find the efficiency of systematic sampling w.r.to corresponding S.R.S in estimating the location yield of the cow.

1. A pilot sample survey for study of cultivation practice & yield of Guava was conducted by IASRI in Ahemabad district of Uttar Pradesh. From a village out of total of 412 trees, 15 clusters of size 4 trees each were selected & yield in kg’s were recorded & given below.

**Cluster No. 1st tree 2nd tree 3rd tree 4th tree**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1 | 5.53 | 4.84 | 0.69 | 15.79 |
| 2 | 26.11 | 10.93 | 19.08 | 11.18 |
| 3 | 11.08 | 0.65 | 4.21 | 7.56 |
| 4 | 12.66 | 32.52 | 16.92 | 37.02 |
| 5 | 0.87 | 3.56 | 4.81 | 57.54 |
| 6 | 6.40 | 11.68 | 40.05 | 5.15 |
| 7 | 54.21 | 34.63 | 52.55 | 37.96 |
| 8 | 1.94 | 35.97 | 29.54 | 25.98 |
| 9 | 37.94 | 47.07 | 16.94 | 28.11 |
| 10 | 56.92 | 17.67 | 26.24 | 6.77 |
| 11 | 27.59 | 38.10 | 24.76 | 6.53 |
| 12 | 45.98 | 5.17 | 1.17 | 6.53 |
| 13 | 7.13 | 34.35 | 12.18 | 9.86 |
| 14 | 14.23 | 16.89 | 28.93 | 21.70 |
| 15 | 3.53 | 40.76 | 5.15 | 1.25 |

Estimate the avg. yield in kg’s per tree of Goa in the village of Allahabad along with it’s S.E. Also, estimate it’s efficiency as compared to S.R.S.