**Practical Problems**

**Course -306**

1.The height(in cm) of 6 students of M.Sc., majoring in statistics from R U during 2016. The data, so obtained, are given below:

|  |  |  |
| --- | --- | --- |
| **Student** | **Name** | **Height(y)** |
| 1 | Alom | 168 |
| 2 | Asad | 175 |
| 3 | Momin | 185 |
| 4 | Ali | 173 |
| 5 | Ripon | 171 |
| 6 | Kalam | 172 |

1. Calculate population mean (), Variance () and mean square error(S2).
2. Enumerate all possible samples of size two by without replacement method.
3. Show that sample mean gives an unbiased estimate of the population mean and find its sampling variance.
4. Show that sample variance(s2) is an unbiased estimate of the population variance (S2).
5. Estimate of the variance of the unbiased estimator and show that

E(v())=V()

2. The following data represent the net area sown (in ’000 hectares) in different financial year since 1950-51 to 1993-94. The area sown are presented serially.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sl.No | Area  sown | Sl.No | Area  sown | Sl.No | Area  sown | | | Sl.No | Area  sown | | | Sl.No | Area  sown |
| 01 | 118746 | 10 | 132939 | 19 | 137313 | | | 28 | 141953 | | | 37 | 139578 |
| 02 | 119400 | 11 | 133199 | 20 | 138772 | | | 29 | 142981 | | | 38 | 134085 |
| 03 | 123442 | 12 | 135399 | 21 | 140267 | | | 30 | 138903 | | | 39 | 141891 |
| 04 | 126806 | 13 | 136341 | 22 | 138721 | | | 31 | 140002 | | | 40 | 142339 |
| 05 | 127845 | 14 | 136483 | 23 | 137144 | | | 32 | 141928 | | | 41 | 142999 |
| 06 | 129156 | 15 | 133120 | 24 | 142416 | | | 33 | 140220 | | | 42 | 141632 |
| 07 | 130848 | 16 | 136198 | 25 | 137791 | | | 34 | 142841 | | | 43 | 142645 |
| 08 | 129080 | 17 | 137232 | 26 | 141652 | | 35 | | 140892 | | 44 | | 142095 |
| 09 | 131828 | 18 | 138876 | 27 | 139476 | 36 | | | 140901 |  | | |  |

a) Select a SRSWOR sample of size n=10 years.

b) Estimate the average net area sown per year from the selected sample.

c) Estimate the variance of the estimate of the average net area sown.

d) Estimate the total area sown during study period.

e) Estimate the variance of the estimate of total area sown.

f) Comments on your overall findings.

3. All the 80 farms in a population are stratified by farm size. The expenditure on the insecticides used during last year by each farmer is presented in the table below:

**Table : Expenditure (in ’00 rupees) on insecticides used**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Larger farmers | | Medium farmers | | | | Small farmers | | |
| 75 | 76 | 55 | 40 | 51 | 28 | 35 | 31 | 26 |
| 65 | 79 | 45 | 38 | 55 | 47 | 28 | 38 | 32 |
| 86 | 62 | 35 | 33 | 41 | 61 | 36 | 42 | 18 |
| 57 | 92 | 30 | 43 | 48 | 35 | 40 | 33 | 16 |
| 45 | 50 | 42 | 53 | 54 | 31 | 25 | 29 |  |
| 69 | 48 | 38 | 37 | 36 | 23 | 18 | 25 |  |
| 48 | 77 | 40 | 52 | 44 |  | 28 | 35 |  |
| 60 | 60 | 36 | 39 | 47 |  | 32 | 26 |  |
| 55 | 64 | 48 | 46 | 39 |  | 13 | 30 |  |
| 66 | 58 | 46 | 42 | 41 |  | 19 | 37 |  |

a)Compute the overall population mean () and the population mean square (S2).

b)Select a stratified sample of 24 farmers by using (i) equal allocation (ii)proportional allocation and (iii)Neyman allocation. Work out the relative efficiency of stratified sample mean ()st based on each of the above mentioned allocation, with respect to the simple random sample mean ()srs for the same total sample size. Assume that the sampling is WOR.

4. There are 400 villages in a sub-division of a district. Thirty villages out of 400 villages are randomly selected to estimate the total cultivated land for jute in the district. The number of jute grower farmers(x) and amount of land cultivated(y in acres) for jute by these farmers are recorded by an inspection. It is noted that there are 2450 jute grower farmers in the study area. The information are given below:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sl.No. of villages | y | x | Sl.No. of villages | | y | x | Sl.No. of villages | y | x |
| 1 | 5.4 | 3 | 11 | | 6.2 | 3 | 21 | 20.2 | 5 |
| 2 | 10.6 | 5 | 12 | | 4.4 | 2 | 22 | 18.5 | 6 |
| 3 | 15.2 | 10 | 13 | | 8.5 | 5 | 23 | 12.2 | 4 |
| 4 | 12.7 | 8 | 14 | | 20.8. | 10 | 24 | 15.0 | 7 |
| 5 | 8.5 | 4 | 15 | | 24.0 | 10 | 25 | 8.2 | 2 |
| 6 | 10.0 | 4 | 16 | | 20.0 | 8 | 26 | 10.5 | 5 |
| 7 | 16.2 | 8 | 17 | | 18.8 | 6 | 27 | 12.6 | 8 |
| 8 | 15.5 | 6 | | 18 | 14.2 | 7 | 28 | 17.2 | 6 |
| 9 | 12.2 | 7 | | 19 | 11.3 | 12 | 29 | 5.6 | 2 |
| 10 | 10.5 | 3 | | 20 | 14.4 | 8 | 30 | 8.5 | 4 |

1. Estimate total land area cultivated for jute using ratio and regression methods of estimation.
2. Estimate the variance of your estimators using above two methods.
3. Calculate the gain in efficiency of ratio and regression estimators compared to simple estimator ().
4. Comment on your findings.

5.A pilot sample survey for study of cultivation practices and yield of guava was conducted by IASRI in India. From Umerpur Neerna village, out of a total of 412 bearing trees, 15 clusters of size 4 trees each were selected and yield(in kg) recorded as given below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Cluster** | **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 | 17.69 | 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 |

a)Estimate the average yield (in kg) per tree of guava in the Umerpur Neerna village along with standard error.

b) Estimate the intra cluster correlation coefficient between trees within clusters and efficiency of cluster sampling as compared to SRS sampling.

c) Comments on your findings.

6. A survey on pepper was conducted to estimate the number of pepper standards and production. For this, 3 clusters from 95 clusters were selected by SRSWOR method. The information on the number of pepper standards recorded is given below:

|  |  |  |
| --- | --- | --- |
| Cluster No. | Cluster size | No. of pepper standards |
| 1 | 12 | 41, 16, 19, 15, 144, 454, 212, 57, 28, 76, 119, 110 |
| 2 | 10 | 39, 70, 38, 37, 161, 38, 27, 219, 36, 128 |
| 3 | 07 | 252, 386, 92, 293, 115, 59, 120 |

a) Estimate total number of pepper standards along with its standard error, given the average cluster size for the population to be 10.

b) Find 95% confidence interval of population total.

c) Comments on your results.