

## CLUSTER SAMPLING

- ✓01. The following list shows average area ( $\bar{Y}_i$  in hectare) under wheat per village and the cluster size ( $M_i$ ) for each of the 52 clusters of villages:

Cluster No. (i)	$M_i$	$\bar{Y}_i$	Cluster No. (i)	$M_i$	$\bar{Y}_i$	Cluster No. (i)	$M_i$	$\bar{Y}_i$	Cluster No. (i)	$M_i$	$\bar{Y}_i$
1	20	12	14	32	11	27	21	14	40	12	15
2	17	10	15	25	14	28	25	12	41	35	4
3	22	14	16	22	22	29	52	11	42	13	12
4	25	9	17	24	21	30	23	9	43	25	12
5	30	8	18	12	24	31	24	9	44	54	11
6	32	12	19	24	15	32	21	21	45	12	9
7	12	10	20	31	16	33	32	16	46	19	9
8	58	11	21	25	18	34	34	13	47	22	7
9	23	8	22	25	10	35	41	10	48	23	14
10	26	15	23	41	9	36	21	8	49	35	6
11	24	17	24	26	8	37	22	8	50	35	9
12	47	21	25	36	11	38	27	7	51	25	8
13	51	9	26	28	22	39	36	9	52	21	7

- (a) Find the sampling variance of the estimator ( $\bar{Y}_c$ ) of average area ( $\bar{Y}$ ) under wheat per village on the basis of 10 sampled clusters selected without replacement.
- (b) If the average cluster size would have been 27, the within cluster variance  $\sigma_w^2$  is 9.668, what will be the sampling variance of the estimator ( $\bar{y}$ ) of average area under wheat per village with direct SRSWOR sample of  $10 \times 27$ , i.e. of 270 villages?
- (c) Select 10 clusters using SRSWOR, estimate  $\bar{Y}$  and estimate the variance of the estimator on the basis of the data collected.

02. To estimate the proportion (P) of households having small-scale family business in a locality of 35200 households have been divide into 176 clusters. 31 clusters have been selected at random (SRSWOR) and the number of households having small-scale family business and the corresponding cluster size ( i.e., the number of households in the cluster, shown within brackets) have been obtained for each selected cluster. The data are given below:

57(213), 28(145), 47(98), 22(137), 7(40), 65(200), 112(330), 20(62), 75(250), 8(51), 10(36), 29(120), 38(201), 19(105), 15(75), 27(150), 70(300), 30(121), 37(120), 17(58), 20(40), 60(147), 127(301), 29(90), 22(80), 36(105), 18(100), 110(300), 31(100), 16(50), 51(235).

Obtain an estimate of the required proportion and of the variance of the estimator.

03. Following is a sampling frame regarding study of household size:

Village	Number of Households	Size of Households
1	17	7 5 5 4 6 2 3 5 5 6 5 4 4 4 5 3 3
2	18	6 5 4 5 4 5 6 5 3 5 4 4 5 3 3 5 6 4
3	26	6 6 3 5 3 4 5 5 4 4 4 3 7 5 4 6 2 5 5 6 1 5 5 4 6 3
4	18	6 3 6 3 6 3 4 5 4 4 4 5 6 3 5 1 3 5
5	24	5 4 6 5 4 5 6 5 4 4 7 6 6 5 4 4 5 6 3 4 3 3 5 3
6	17	3 4 4 6 5 7 3 5 4 6 4 5 4 5 3 3 6
7	20	6 4 4 5 4 5 6 4 3 5 4 6 5 5 2 2 4 5 4 3
8	24	5 3 3 7 4 4 6 6 4 5 3 7 6 4 5 6 3 5 1 3 5 4 4 6
9	24	5 3 3 7 4 4 6 6 4 5 3 7 5 6 6 3 5 2 7 5 4 3 1 6
10	22	4 5 6 5 4 4 7 6 6 5 4 4 5 6 3 4 3 3 5 3 5 4
11	15	5 4 5 6 5 4 4 7 6 6 5 4 4 5 6

- (i) Select a sample of 3 villages by SRSWOR.
- (ii) On the basis of the data, obtain an estimate of  $\bar{Y}$  (average size per household) and the variance of the estimator used.