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## TWO-STAGE SAMPLING

01. Following table gives the yield (gm.) of barley for each of the 50 plots [plot-size=10 sq. yd.]:

195	180	158	139	139	168	145	166	110	171
187	174	172	191	155	169	139	144	130	146
157	182	209	136	153	160	142	179	125	149
189	108	118	149	178	171	151	227	127	148
147	178	189	141	173	187	167	128	139	152

Treat each column as a first stage unit (fsu), each consisting of 5 second stage units (ssu) and find the variance of  $\bar{y} = \sum_{i=1}^n \bar{y}_i$ , where  $n$  is the number of fsu's selected,  $\bar{y}_i$  is the sample mean per ssu in the  $i^{\text{th}}$  selected fsu. Take  $n=4$  and number ( $m$ ) of ssu's selected from each selected fsu=2.

02. At an experimental station, there are 100 fields sown with wheat. Each field was divided into 16 plots of equal size ( $1/16^{\text{th}}$  hectare). Out of 100 fields, 10 were selected by SRSWOR. From each selected field, 4 plots were chosen by SRSWOR. The yields in kg/plot are given below:

Selected Field	1	2	3	4	5	6	7	8	9	10
Plots	Yield(kg)									
1	4.32	4.16	3.06	4.00	4.12	4.08	5.16	4.40	4.20	4.28
2	4.84	4.36	4.24	4.84	4.68	3.96	4.24	4.72	4.66	4.36
3	3.96	3.50	4.76	4.32	3.46	3.42	4.96	4.04	3.64	3.00
4	4.04	5.00	3.12	3.72	4.02	3.08	3.84	3.98	5.00	3.52

- (i) Estimate the yield of wheat per hectare for the experimental station along with its standard error.
- (ii) How can one estimate obtained from a simple random sample of 40 plots be compared with the estimate obtained in (i)?
- (iii) Obtain optimum  $n$  and  $m$  under cost function  $100=4n+mn$   
where  $n$ = number of first stage units (fsu's) drawn by SRSWOR  
 $m$ = number of second stage units (ssu's) drawn by SRSWOR from each sampled fsu.

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 (Sample size 3, 4, 5 respectively)