Problem Set B- Date

DRAWING OF RANDOM SAMPLES

1. Draw a random sample of 5 villages from a group of 337 villages of West Bengal by (i) SRSWR, (ii) SRSWOR.

2. Following is a distribution of students in the five classes of a school:

CLASS	STUDENT STRENGTH
I	45
II	32
III	27
IV	35
V	19

Draw a random sample of 10 students from the school.

3. Draw a random sample of 7 days from a given leap year.

4. For a Honours class of 16 students, the marks attained in paper I of Hons. Subject are:
67,52,84,59,30,80,67,72,55,48,59,80,39,67,82,52.
Select a random sample of 5 students from the Class.
(i) Estimate the average marks.
(ii) Find the relative standard error and an estimate of it.

5. Following table gives the scores of **45** students in an examination :

38	27	19	51	42	20	30	26	22
14	24	30	02	26	26	12	43	11
10	13	35	27	06	34	40	24	37
40	24	37	30	42	22	21	15	23
20	40	26	48	15	02	12	19	33

Draw a random sample of size **15** students (a) with replacement and (b) without Replacement. In each case, find an estimate of the standard error of the sample mean.

6. Draw a random sample of size **8** from **231** iron balls having distribution of weight (in m.g.) as detailed below :

Weight (m.g.).	25.8	25.9	26.0	26.1	26.2	Total
Frequency	45	49	67	42	28	231

7. Locate 7 random points in a rectangular area of size x square meter.
[Use coordinates correct to cm.]

8. Plot 5 random points inside a circle of radius 50 cm. (coordinates are to be correct up to two places of decimals .)

Contd. ... 2

9. Draw a random sample of 10 from the students for whom the following frequency distribution of marks in Mathematics and Statistics have been obtained :

Marks in Statistics	Marks in Mathematics					
	40 – 50	50 – 60	60 – 70	70 – 80	80 – 90	90 – 100
30 – 40	6	2	–	–	–	–
40 – 50	4	8	4	2	–	–
50 – 60	20	24	36	12	6	2
60 – 70	7	28	26	24	8	3
70 – 80	–	8	16	20	6	6

10. Draw a random sample of size ... from a binomial (**m** = , **p** =) distribution .

11. Draw a random sample of size from a Poisson (λ =)-distribution .

12. Select a random sample of size **10** from a **N** (μ = , σ =)-distribution .

13. Insert **9** random points (co-ordinates in cm.) within the area bounded by the inequality $0.25\ x^2 + 0.04\ y^2 < 1$, both x and y being measured in meters.

14. Select 10 random point below the depth of 1 meter of a hemispherical pond of diameter 100 meter.

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PresiStat Problem Set Date . .

SYSTEMATIC SAMPLING

1. Following are the data on number of seedlings in a 80-feet bed :

Bed lengths in feet							
1 - 10	11 - 20	21 - 30	31 - 40	41 - 50	51 - 60	61 - 70	71 - 80
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
26	16	27	37	4	36	20	21
28	9	20	14	5	20	21	26
11	22	25	14	11	43	15	16
16	26	39	24	9	27	14	18
7	17	24	18	25	20	13	11
22	39	25	17	16	21	9	19
44	21	18	14	13	18	25	27
26	14	44	38	22	19	17	29
31	40	55	36	18	24	7	31
26	30	39	29	9	30	30	29

1) Find the variance of the mean of a systematic sample consisting of the seedlings in every 10 feet .Compare this with the variance of sample mean for an SRS of the same size.

2) Draw a systematic sample of size **n = 10** and estimate the population average of the number of seedlings on the basis of the sample drawn.

3) Draw a circular systematic sample with sampling interval **k = 13** and sample size **n = 10** and estimate the population average of the number of seedlings on the basis of the sample drawn.

2. In a locality of **120** households , those having kitchen gardens have the following holding numbers :

12 , 20 , 23 - 26 , 37 , 42 , 51 , 67 - 72 , 99, 101 , 107 , 112 - 114 , 119 .

Compare the precision of a one-in-eight systematic sample with an SRS for estimating the proportion of households having kitchen gardens .

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PresiStat

Date

Problem Set -

STRATIFIED RANDOM SAMPLING

1. A sample of 30 villages is drawn from a total of 300 villages belonging to two districts. The mean and standard deviation of population density of each of the villages are given below :

District	No.of villages	Mean(μ_i)	Standard deviation (σ_i)
1	200	32	11
2	100	61	42

What are the sample sizes in case of

i) proportional allocation ,

and ii) optimum allocation ?

In each case obtain the variance of estimator of the mean population density of all the villages and compare its efficiency with SRSWOR .

2. In a survey on the area under a crop a total of 186 villages of a district was divided into 4 strata according to the area of the villages. From each stratum an SRSWOR under proportional allocation was taken and the areas under the crop in the selected villages were noted. The following are the data obtained from the survey :

Stratum No. (h)	Stratum Size (N_h)	Sample size (n_h)	Area under the crop in the sample villages ('00 hectors)
1	72	8	14 , 12 , 8 , 11 ,12 ,10 , 13 ,16
2	53	5	27 , 20 , 21 , 22 , 30
3	35	4	36 , 47 , 52 , 61
4	26	3	92 , 105 , 82

Obtain an estimate of the total area under the crop in the district estimate the standard error of the estimator used.

3. The following data relate to the number of yearly enrolment in Teachers' Training Colleges stratified into 3 strata .Obtain the gain in precision due to stratification for estimating the average yearly enrolment per college .

Stratum No. (i)	N_i	n_i	$\bar{x}_i$	s_i^2
1	13	9	32.200	2.625
2	18	7	41.638	5.063
3	26	10	19.992	3.549

4. Following data show the stratification of all the farms in a country by farm-size as well as the average and standard deviation of acres of corn per farm in each stratum :

Farm size (acres)	Number of farms(N_h)	Average (μ_h)	Standard deviation (S_h)
- 40	394	5.4	8.3
41 - 80	461	16.3	13.3
81 - 120	390	24.5	15.1
121 - 160	335	34.3	19.8
161 - 200	171	42.1	14.5
201 - 240	115	50.2	5.9
241 -	150	64.0	11.6

For a sample of 100 farms ,compute the sample size for each stratum under i)proportional allocation and II) optimum allocation.

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PresiStat Date

Problem Set

RATIO AND REGRESSION METHODS

1. An eye-estimate of the weight of peaches on each tree in an orchard of 200 trees has been done and the total weight has been eye-estimated as 12,000 lbs. For a sample of 10 trees the eye-estimates and actual weights of the production of peach has been taken.

Sl. No. of trees (sample)	1	2	3	4	5	6	7	8	9	10
Actual weight (lbs.)	61	42	50	58	67	45	39	57	71	53
Eye-estimated weight (lbs.)	59	47	52	60	67	48	44	58	76	58

Compute the ratio- and regression-estimates of the total actual weight (lbs.) of peaches of all the 200 trees in the orchard and compare the precisions of the two estimates.

DOUBLE SAMPLING

01. Following figure relates to a study of a variable y(in kg.) together with an auxiliary variables x(in ft.) :

Population size (N) =12908 , $\bar{Y}$ = 782.5, $\bar{X}$ = 88.4, S_y^2=45.387, S_x^2 = 39.228 and S_{yx} = 36.116

First-phase sample size (n') =1528 and the sample mean ($\bar{x}'$) =85.7 ft.

Second-phase sample size (n) =100, the sample mean ($\bar{x}$) =86.99 ft., $\bar{y}$ = 769.68 kg and b= 2.881

a) Find an estimate of the population mean of y by ratio method and the variance of the estimator. Also find the relative error of the estimate.
b) Find an estimate of the population mean of y by the regression method and the variance of the estimator. Also find the relative error of the estimate.
c) Hence find a relative measure of precision of one method with respect to the other.

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^{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 filed was divided into 16 plots of equal size ($1/16^{th}$ 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.