

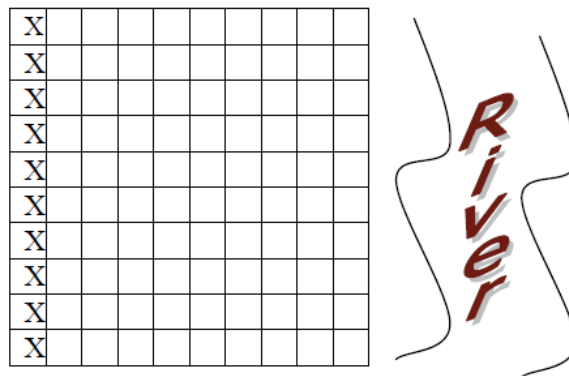
An Exercise in Sampling: Rolling Down the River

A farmer has just cleared a new field for corn. It is a unique plot of land in that a river runs along one side. The corn looks good in some areas of the field but not others. The farmer is not sure that harvesting the field is worth the expense. He has decided to harvest 10 plots and use this information to estimate the total yield. Based on this estimate, he will decide whether to harvest the remaining plots.

Part I.

A. Method Number One: Convenience Sample

The farmer began by choosing 10 plots that would be easy to harvest. They are marked on the grid below:

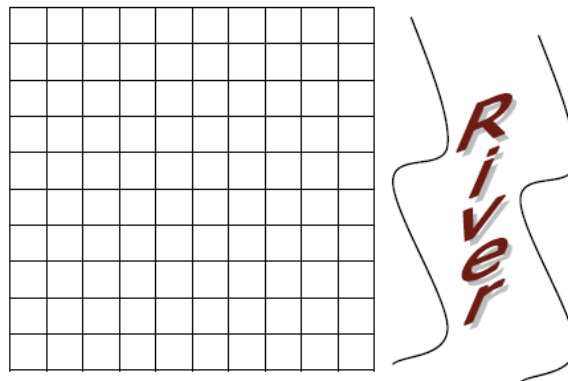


Since then, the farmer has had second thoughts about this selection and has decided to come to you

You will still be allowed to pick 10 plots to harvest early. Your job is to determine which of the following methods is the best one to use – and to decide if this is an improvement over the farmer's original plan.

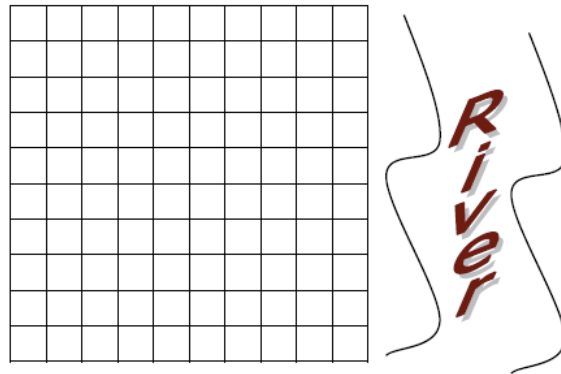
B. Method Number Two: Simple Random Sample

Use your calculator or a random number table to choose 10 plots to harvest. Mark them on the grid below, and describe your method of selection.



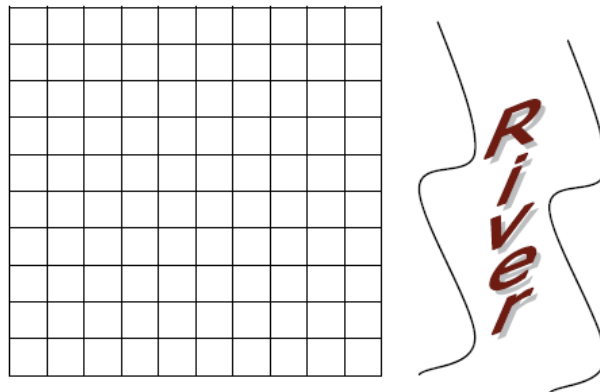
C. Method Number Three: Stratified Sample

Consider the field as grouped in vertical columns (called strata). Using your calculator or a random number table, randomly choose one plot from each vertical column and mark these plots on the grid.



D. Method Number Four: Stratified Sample

Consider the field as grouped in horizontal rows (also called strata). Using your calculator or a random number table, randomly choose one plot from each horizontal row and mark these plots on the grid.



OK, the crop is ready. Below is a grid with the yield per plot. Estimate the average yield per plot based on each of the four sampling techniques.

6	17	20	38	47	55	69	76	82	97
7	14	23	34	43	56	63	75	81	92
2	14	28	30	50	50	62	80	85	96
9	15	27	34	43	51	65	72	88	91
4	15	28	32	44	50	64	76	82	97
5	16	27	31	48	59	69	72	86	99
5	18	28	34	50	60	62	75	90	90
8	15	20	38	40	54	62	77	88	93
7	17	29	39	44	53	61	77	80	90
7	19	22	33	49	53	67	76	86	97



Sampling Method	Mean yield per plot	Estimate of total yield
Convenience Sample (farmer's)		
Simple Random Sample		
Vertical Strata		
Horizontal Strata		

Observations:

- 1) You have looked at four different methods of choosing plots. Is there a reason, other than convenience, to choose one method over another?
- 2) How did your estimates vary according to the different sampling methods you used?
- 3) Compare your results to someone else in the class. Were your results similar?
- 4) Pool the results of all students for the mean yields from the simple random samples and make a class boxplot. Repeat for means from vertical strata and from horizontal strata. Compare the class boxplots for each sampling method. What do you see?
- 5) Which sampling method should you use? Why do you think this method is best?
- 6) What was the actual yield of the farmer's field? How did the boxplots relate to this actual value?

Part II:

The farmer was very impressed with the results of your study and seeks to improve the yield of that part of the field the following year. Believing that irrigation is the answer, a new system was installed. The following year's yield was:

79	81	95	69	65	59	88	65	66	91
80	75	88	80	82	66	76	99	62	61
97	50	92	92	91	84	75	85	63	89
99	71	55	75	65	66	66	86	96	50
57	95	51	79	98	71	70	86	89	76
57	53	90	71	50	76	56	91	85	64
69	95	98	90	93	97	79	95	73	90
58	99	75	51	67	81	55	63	89	74
98	62	73	54	50	76	91	50	90	55
91	59	69	59	71	72	85	85	86	97



Redo your sampling using a SRS, vertical stratification, and horizontal stratification. Be certain to mark on the grids the plots you choose.

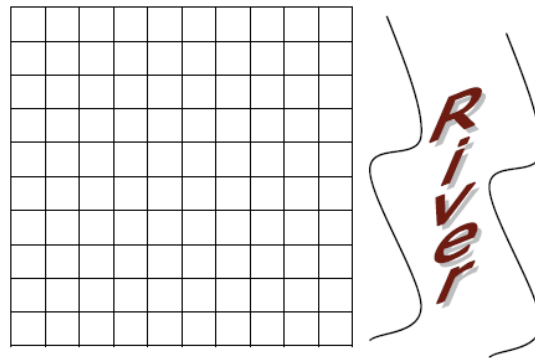
A. Simple Random Sample:



B. Stratified Sample (vertically):



C. Stratified Sample (horizontally):



Sampling Method	Mean yield per plot	Estimate of total yield
Simple Random Sample		
Vertical Strata		
Horizontal Strata		

Observations:

- 1) Compare the class boxplots of the sample means obtained from the SRS and the two methods of stratified sampling.
- 2) Based on the results of both activities, under what conditions is it more useful to use stratified sampling?
- 3) Based on the results of both activities, under what conditions is it more useful to use a simple random sample?

Source: Adapted from <http://schematyc.stat.ucla.edu/>