At a large industrial site, many drums of industrial solvent have been buried in the past. A survey is to be conducted in order to try and attempt to determine how many drums have been buried at the site. The drums are shown in the figure (represented by the small circles). In order to conduct the survey, the site has been partitioned into a grid of 100 squares (also shown in the figure). Additionally, the site has been partitioned into four strata (denoted by the thick lines). It is thought that the distribution of the drums differs among the four stratum. For instance, the stratum in the bottom left corner is nearest the plant and it is thought that there will be a higher density of drums there than in the other strata.

For your homework assignment, estimate the total number of drums at the site and the standard error of the total estimate using three different sampling designs described below.

In each case, obtain a sample of size n = 20.

1. Obtain a simple random sample. Briefly describe how you obtained your sample. List the sampling units obtained and the corresponding number of drums at each of the selected sites. Give the estimated total and its standard error.

2. Obtain a stratified random sample. Allocate the n = 20 observations according to a proportional allocation. Be sure to indicate which sampling units are obtained and list the corresponding data. Compute the estimated total and its standard error using the stratified random sampling formulas.

3. Compare stratified random sample, cluster sample, two stage sample, and write down their estimates for total in population, and the estimated variance for total. This question does not need any data information.