

Teaching Resources Review and Presentation

Student-Centred Resource

This is a program that I have written to accompany a worksheet activity for the Preliminary Mathematics General Course. This program and worksheet are available from this page:

- <http://mesprylum.xyz/math2/sampler.html>

Specifically, I address the Data and Statistics strand and the outcome:

- MGP-10 justifies a response to a given problem using appropriate mathematical terminology.

, and content from DS1 Statistics and society, data collection and sampling

- distinguish between the following sample types: random, stratified and systematic, and determine the appropriateness of each type for a given situation
- relate sample selection to population characteristics

The worksheet itself provides the best description of the activity, but students are asked to use an application that demonstrates a simple example of a population and sample. The population is a field containing particles distributed randomly, and the samples are subsets of this field. The density of the field is sampled in each of these subsets, and the standard deviation of these results is compared with the actual population density.

The student has the opportunity to experiment with various values of the population density and relative sample size, and is led to discover that:

- the larger a sample, the more reliable it is as a representation of attributes of the population,
- the sample size required to achieve such reliability increases as the population's variance is increased (in this case, as the structure or two-point correlation in the random field is increased), and that
- the sampling strategy should be adapted to suit the characteristics of the population.

This resource gives students the opportunity to visualise a population and a sample, and to experiment with numerical values to discover statistical concepts for themselves. It is envisaged that this activity would be given to the students to work with and ask for guidance as necessary; this is an exercise in discovery learning.

The intended audience is a Mathematics General class, and should be simple enough for the students to use. There is no cost, I have written the code and compiled the program.

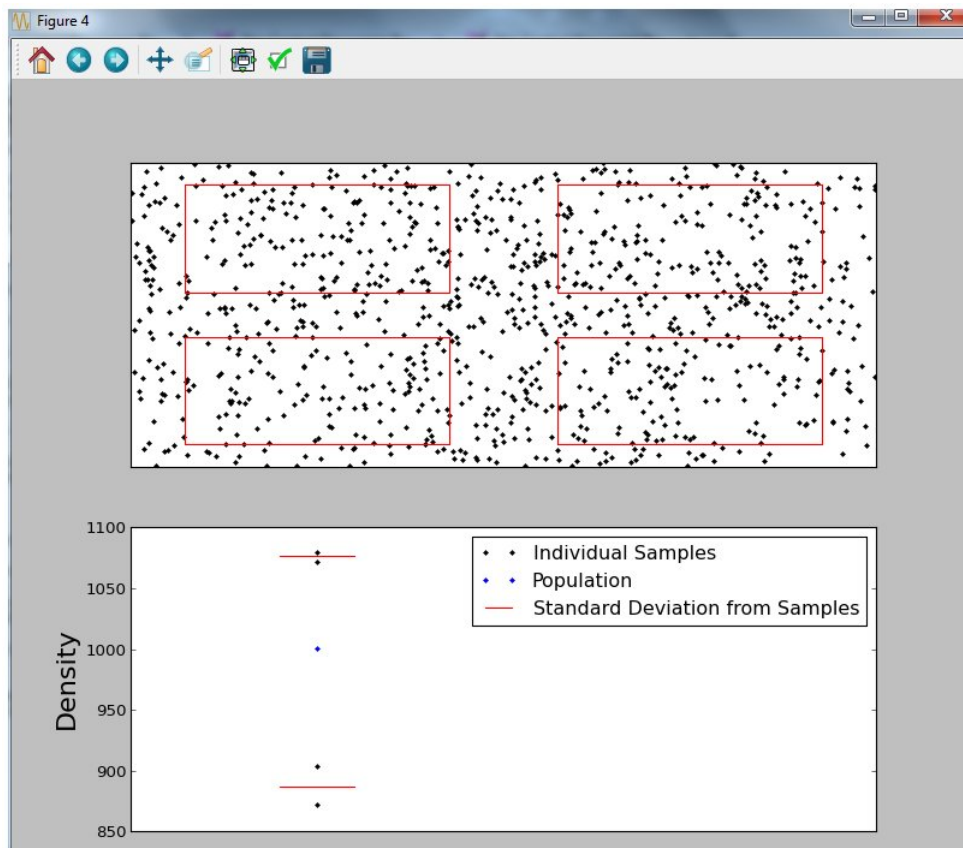


Figure 1: A screenshot of the program's output. The population is the whole random field in the top panel while the samples are the red squares. The lower panel compares the sample densities with that of the population.

Worksheet to Accompany An Activity to Demonstrate Some Basic Principles of Statistical Sampling

1. Run the program, "sampler", by double-clicking on the "sampler" application.
2. When prompted, enter 0.05 as the total fraction of the population sampled, 200 as the density of the population and 0 as the structure parameter.
3. Repeat with these values several times. How reliable are the samples at estimating the population density?
4. Repeat by increasing the density of the population. What do you notice, and why?
5. Repeat by increasing the sample size. What do you notice, and why?
6. This time increase the structure parameter.
 - What effect does this have on the distribution of particles in the population?
 - How does this affect the reliability of the samples at estimating the population density?
 - Are our samples random, systematic or stratified? Are we using the best sampling strategy? Why/why not?