



Grade 7/8 Math Circles
February 17, 2021
Random Sampling - Problem Set

1. For each scenario, identify the population and sample.
 - (a) A toothpaste company randomly selects 10 dentists from a province's registry of dentists to ask if they would recommend their company's toothpaste.
 - (b) A food safety inspector randomly checks the temperature of 20 meals that exit the restaurant kitchen during the hour from 6–7pm to see if they have been cooked to a safe temperature.
 - (c) A fast food company randomly selects 10 of their own restaurants each month. They then interview all of the employees at that location about their work environment.
 - (d) A hockey equipment manufacturer wants to learn about who is buying their equipment online, so with every tenth purchase, they ask the customer a few simple questions before checking out.

2. For each scenario, identify the parameter and statistic.
 - (a) During an election, journalists survey voters as they exit the polls to find that 40% of those people were voting for the Purple Party. However, on the news that night, the final vote count declares that only 35% of voters voted for the Purple Party.
 - (b) A quality control inspector randomly selected 50 cans of soda from a factory production line and found that on average, they weighed 410 grams. However, while loading up a pallet for shipping, the factory worker noticed that they only weighed 404 grams on average.
 - (c) A party planner asked their client how many of the 500 people eating at their banquet were vegetarian. Since their guest list wasn't finalised, they told the

party planner that 2 of their 10 special guests requested vegetarian meals. Based on this information, the party planner ordered 100 vegetarian meals and 400 non-vegetarian meals. However, at the end of the night, 75 guests informed the staff that they were disappointed that there wasn't a vegetarian meal prepared for them.

3. For each scenario, identify what kind of random sampling method is being used.
 - (a) A new cereal brand divides a country up by postal code and selects 200 areas to test for their brand's popularity.
 - (b) For a live bingo game, balls with every possible number are placed in a tumbler to be scrambled up. At the beginning of each turn, the caller randomly chooses a ball and calls out the number.
 - (c) Each week, one employee at a restaurant is randomly selected to be surveyed about their working environment.
 - (d) A group of researchers wants to learn about the impact of climate change on farmers. They randomly select farmers from each state to survey proportionally based on how much land there is in the state, so that more farmers are surveyed in bigger states, and less in smaller states.
 - (e) A farmer wanted to check on their corn crops, so they divided their land up with a grid and randomly chose 5 areas to go to inspect their plants.

4. What are the strata being used? Calculate how many individual units from each of the strata should be included in a sample of size 200.

age	# in population	# in sample
11	90	?
12	270	?
13	480	?
14	360	?
total	1200	200

5. What are the strata being used? If the number of individual units from each of the strata is included in the sample as indicated, how many individuals from each strata are in the population?

shoe size	# in sample	# in proportion
5	2	?
6	6	?
7	19	?
8	13	?
9	8	?
total	48	1008

6. You've been tasked to collect a sample of soil from some farmland to test for nutrients and give the land a score based on those tests. A map of the farm has been given to you, with the land already divided into a 6×6 gride of 36 squares. To generate a score for the land, you test soil from the centre of 6 of the grid squares, and the sum of those 6 scores is the overall score for the land.

By using the random number generator linked here: <https://www.calculatorsoup.com/calculators/statistics/random-number-generator.php>, find a score for the land using a sample created using:

- simple random sampling, by selecting 6 squares to test.
- stratified sampling, using the rows as strata and selecting a square from each stratum.
- stratified sampling, using the columns as strata and selecting a square from each stratum.
- cluster sampling, using the rows as clusters and selecting one cluster to test.
- cluster sampling, using the columns as clusters and selecting one cluster to test.
- What you have calculated are statistics using different sampling methods. Compare them to a parameter score of 32. What do you notice about the scores you generated with the different methods from (a) to (e)? Are some of them closer or further away from 32? (We only know the parameter because we created the question!)
- Remember the difference between when stratified sampling vs. cluster sampling works. (You can find the information at the end of the lesson.) After inspecting

the diagram, do you notice anything that makes some of the methods more appropriate than others? Which methods make the most sense? Does this match up with your results from (f)?

A diagram of the entire farmland with the scores of each grid square is below. Again, it's important to remember that in real life, you wouldn't actually have all of this information about the population—only what you learn from your sample!

		north						
		1	2	3	4	5	6	
	1	9	8	6	4	4	2	
	2	8	6	8	5	3	1	
	3	9	7	6	5	4	1	
west	4	9	7	5	6	4	2	east
	5	8	8	5	4	2	4	
	6	8	6	7	5	3	3	
		south						

- To figure out the best strategy to sell strawberries, you decide to estimate the mean weight of strawberries in your field by taking a random sample. What could be an appropriate way to create a random sample here? Why? What are potential problems to your method? Can you think of more methods?