

# Homework 1 (Quiz)

● Graded

Student

Anthony Wen

Total Points

14 / 14 pts

Question 1

(no title)

6 / 6 pts

✓ - 0 pts fully correct

- 0.5 pts a): incorrect or missing population
- 0.5 pts a): incorrect or missing cluster sampling scheme
- 0.5 pts a): incorrect or missing advantage
- 0.5 pts a): incorrect shortcoming
- 0.5 pts b): incorrect or missing population
- 0.5 pts b): incorrect or missing or unclear stratified sampling scheme
- 0.5 pts b): incorrect or missing advantage
- 0.5 pts b): incorrect or missing shortcoming
- 0.5 pts c): incorrect or missing population
- 0.5 pts c): incorrect or missing sampling scheme or provided the cluster or stratified sampling again
- 0.5 pts c): incorrect or missing advantage
- 0.5 pts c): incorrect or missing shortcoming

Question 2

(no title)

8 / 8 pts

✓ - 0 pts Fully correct

- 0.5 pts Did not record vehicle type
- 0.5 pts Did not record road type
- 0.5 pts Did not record brake pad type
- 0.5 pts Did not record stopping distance
- 1 pt Did not account for vehicle speed on each test
- 1 pt Did not consider the randomization of the assignment of brake pads
- 2 pts Did not specify any variables that staff should record for each individual test
- 2 pts Did not specify any other variables the staff should account for on each test
- 2 pts Did to specify how they should set the experimental conditions for each test
- 2 pts Did not specify key fundamentals of experimental design that you include in your experimental design
- 1 pt Each vehicle can only have one set of break pads installed
- 1 pt Incorrect number of vehicles used



## Q1

### 6 Points

Choose a profession or job (excluding doctor, as this were used as class examples) and complete the following. Note that some professions may make the following easier or more difficult to answer.

a) Identify a population of individuals with your job or profession (ex: medical doctors in North America or doctors working at the UW Medical Center) and describe a cluster sampling scheme for sampling people from that population. What pre-existing clusters can be used to sample for individuals in this profession? Identify at least one advantage and one shortcomings with this approach (and try to frame these to your specific example).

b) Identify a population of individuals with your job or profession and describe a stratified sampling scheme for sampling people in this profession. What pre-existing strata exist in the profession? Are there any shortcomings to this sampling approach? Identify at least one advantage and one shortcomings with this approach (and try to frame these to your specific example).

c) Identify a population of individuals with your job or profession and describe one other sampling scheme for sampling people in this profession. Identify at least one advantage and one shortcomings with this approach (and try to frame these to your specific example).

Note: You can use markdown formatting to **bold** parts of your response to help the grader identify core aspects of your answer. **Bold** text is produced with **\*\*two asterisks around the text like so\*\***

**\*\*Population: \*\*** Waiters/Waitress working at McDonalds in Seattle

**\*\*Cluster Sampling Scheme: \*\*** Seattle has different locations for different McDonalds restaurants open and at each location, they would have different sets of workers working there. Thus, we can treat each McDonalds location as its own cluster and randomly sample waiters/waitresses of a few clusters/McDonalds.

**\*\*Advantages for Cluster Sampling: Practicality and Efficiency \*\*** We won't be able to do random sampling since we do not know the entire population of McDonalds workers at Seattle but we do have the location of every McDonalds

restaurant in Seattle so it would be cost-effective and easier to sample based on this (instead of having to spend money and time to find a list of every worker at McDonalds in Seattle).

**\*\*Shortcomings for Cluster Sampling:** selected samples are not able to represent the entire population.\*\* For example, if the sampled locations of McDonalds were all located in the middle of Seattle, then the population of the entire Seattle would not be represented. This would make the data/outcome more biased.

**\*\*Stratified Sampling Scheme:** \*\* We could split all the McDonalds into strata based on their geographic location. For example, the McDonalds in more south of Seattle, more in the middle, more in the north, etc. Then, take proportionally based on each strata.

**\*\*Advantages for Stratified Sampling:** Ensures Representability\*\* it would be able to make sure all parts of Seattle are represented in the data collected, aka we would get responses from nearly all geographic locations.

**\*\*Shortcomings for Stratified Sampling:** \*\* It can be hard to implement as we need to know the exact geographic structure of Seattle to split them into good groups to sample and also some strata might be larger or smaller than the rest which causes some bias.

**\*\*Simple Random Sampling Scheme\*\*** We can compile a list of every waiter/waitress working at McDonalds and then randomly select a number of waiter/waitress from that list to sample.

**\*\*Advantages for Simple Random Sampling:** Unbiased \*\* Every one/individual in the sample has an equal chance of being selected so then it is easier to ensure a more unbiased sample.

**\*\*Shortcomings for Simple Random Sampling:** Efficiency\*\* To obtain a list of everyone that works for McDonalds would take a lot of time, effort, and money. It might even be impossible due to privacy reasons. Thus, creating a problem to do with the efficiency and resource expense on this scheme.

## Q2

8 Points

You are working for an automotive parts manufacturer, and are responsible for product testing new brake pad designs against the standard model. Specifically, you are tasked with testing if the new brake pad designs will improve vehicle stopping distances. You have 100 different vehicles to test on, ranging from small compact cars to large trucks. Similarly you have a well controlled indoor test track on which to conduct your experiments, that can simulate different road types (gravel, asphalt, and concrete). The break pads have been removed, and each vehicle can only have one set of break pads installed (new or old model), as swapping them is very time consuming.

Last minute you are called to a very important company meeting, and instructed to let your staff handle the experimental data collection. Unfortunately, though your staff are diligent and well intentioned, they do not have a good understanding of experimental design, and left to their own devices will do whatever it is they find easiest to complete the objectives set before them.

Give a set of instructions for your staff to follow to conduct a thorough experiment for assessing whether new brake pad designs improve stopping distances. Be sure to address at least each of the following points:

- Identify the variables that staff should record for each individual test.
- Identify other variables the staff should account for on each test
- Specify how they should set the experimental conditions for each test.
- Identify key fundamentals of experimental design that you include in your experimental design.

Note: You can use markdown formatting to **bold** parts of your response to help the grader identify core aspects of your answer. **Bold** text is produced with **\*\*two asterisks around the text like so\*\***

**\*\*1. Setting up the Experiment: \*\*** The general experiment procedure should be as follows: **\*\*a)\*\*** select the type of breaks each car is using, make sure there is a similar amount of big and small cars using the different types of breaks. For example, 25 small cars using old brakes, 25 using new, and the same for the big cars. **\*\*b) \*\*** test each vehicle on one type of ground before changing the type of ground that you are using. Specific test procedures and controls are written below. Remember to account for things like safety **\*\*c) \*\*** finishing recording all results and analyze data

**\*\* 2. Variables to Record:** **\*\*** Record the vehicle type, break type, road type that is used before each test. **\*\*Blind:** **\*\*** Make sure the driver does not know which type of break is being used to control the driver from applying too much.

**\*\*Control:** **\*\*** make sure the driver is the same, as people have different experiences and skill levels in their reaction time or know when to hit the brakes. Make sure all vehicles are in similar conditions to test the brakes. Make sure that they know when to start hitting the brakes. Ex: Hit the breaks when vehicle reach 30 miles per hour. Remember to record things like distance it took for vehicle to come to a stop, the drivers reaction time, pressure, or any variable that might want to be kept consistent throughout each test to ensure less biased data.

**\*\*3. Replication and other Experimental Design:** **\*\*** Test each vehicle multiple times to ensure replication of the test and also of the results. Remember to document everything (**\*\*Documentation\*\***). **\*\*Randomization\*\*** make sure that when selecting the cars for each brake type, the process is random enough, not the same type of cars on each brake, etc.

**\*\*4. Procedure of Each Test:** **\*\* \*\*I )** **\*\*** record all data mentioned, drive car to starting position **\*\*II)** **\*\*** driver starts car and then hit break when reaches certain speed **\*\*III)\*\*** record all the data like distance started breaking, when it actually reaches breakes etc. **\*\* IV)** **\*\*** repeat the test 4 more times for the same car and brake and record results **\*\*V)** **\*\*** switch cars and stuff and test again on same surface **\*\*VI)** **\*\*** switch surface to test on and repeat