We're Watching You Learning Task

Name _____ Date_____

STANDARDS ADDRESSED IN THIS TASK:

MGSE9-12.S.IC. 1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

MGSE9-12.S.IC. 2 Decide if a specified model is consistent with results from a given data-generating process, e.g. using simulation.

MGSE9-12.S.IC. 3 Recognize the purpose of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.

Standards for Mathematical Practice

1. **Construct viable arguments and critique the reasoning of others**
2. **Model with mathematics**

There are two approaches to collecting data in statistics – observational studies and experiments. In observational studies, researchers observe characteristics from samples of an existing population and use the information collected to make inferences about the population. In an observational study, the researcher gathers data without trying to influence responses or imposing any controls on the situation. In an experiment, researchers gather data by imposing a treatment and observing responses.

- There are several key steps involved in designing an observational study.

  1. Determine the focus of the study. What is the variable of interest? What information is needed to answer the main question of interest?
  2. Develop a plan to collect data. How will subjects be observed?
  3. Determine the most appropriate sampling method and select the sample.
  4. Collect the data.
  5. Describe and interpret the data using appropriate statistical procedures and graphs.
  6. Report the findings of the study.

The basic principles of experimental design are

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1. **Randomization** – Experimental units/subjects should be randomly assigned to treatment groups;

2. **Control** - Experimenters need to control any lurking variables, generally by comparing multiple treatment groups;

3. **Replication** – The experiment should involve many experimental units/subjects.

Use the information above as well as what you have learned in class to explore the following situations.

1. A local community has just installed red light cameras at its busiest intersection. The police department hopes that the cameras will encourage drivers to be more careful and that incidents of drivers running red lights at this intersection will decrease. Design an observational study that the police department could use to determine if the installation of the traffic light has had the deserved effect.

a. What is the focus of the study? What is the variable of interest?

b. Determine the data collection plan.

c. Funds are limited and there are only a few days to conduct the study. What is the most appropriate sampling method?

d. The police chief also wonders if there is a difference in driver behavior at different times of day. Can you incorporate this concern into your sampling method?

2. A few years ago, a study was conducted at Johns Hopkins hospital in Boston to see if exposure to ultrasound could affect the birth weight of a baby. Investigators followed unborn babies and their mothers until their birth and notes their birth weight. A comparison was made between the birth weight of those babies exposed to ultrasound and those babies not exposed to ultrasound. Whether an ultrasound was used on the baby was a decision made by the mother's doctor, based on medical justification. Was this study an experiment or an observational study? Explain. List any possible confounding variables in this study. *(source: Chris Franklin, University of Georgia)*

3. Suppose the faculty of a Statistics department at a large university wanted to look at how students in the introductory Statistics courses might perform on exams under different environmental conditions. They decided to consider the effect of the size of the classroom (a

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smaller classroom where there are just enough seats for the students versus a large classroom where the students can spread out with an empty seat between each student). When the next exam is given in one section of the introductory Statistics course, 60 students will be randomly assigned to one of the treatments. The scores on the exam will then be compared. *(source: Chris Franklin, University of Georgia)*

a. Is this study an experiment or observational study. Explain.

b. Name the explanatory variable.

c. Name the response variable.

d. How many treatments will this study compare? Name the treatments

e. Diagram a completely randomized design for this study.

4. You want know if talking on a hands-free cell phone distracts drivers. Forty college students "drove" in a simulator equipped with a hands free cell phone. The car ahead brakes: how quickly does the subject respond?

a. What are the experimental units?

b. What is the explanatory variable?

c. What are the treatments?

d. What is the response variable?

e. Outline the design of the *above experiment.*

5. You want to determine the best color for attracting cereal leaf beetles to boards on which they will be trapped. You will compare four colors: blue, green, white and yellow. You plan to count the number of beetles trapped. You will mount one board on each of 16 poles evenly spaced in a square field.

a. What are the experimental units?

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b. What is the explanatory variable?

c. What are the treatments?

d. What is the response variable?

e. Outline the design of the above experiment.

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