

Statistical Reasoning
Unit 6 Quiz Review

Name:

- 1) Placebos are the best way to blind subjects from knowing whether they are receiving the treatment or not. (placebos are administered to ensure all groups receive the same conditions)
- 2) What is the purpose of double-blinding? Why is it so important?

The purpose of double-blinding is to ensure that those who could influence the results (participants) and those who evaluate the results do not affect the outcome of an experiment

- 3) What are the four principals of experimental design? Are any of these principals not required?

- 1: control
- 2: randomization
- 3: replication
- 4: blocking (not necessary)

- 4) A researcher wants to compare the performance of three types of pain relievers in volunteers suffering from arthritis. Because people of different ages may suffer arthritis of varying degrees of severity, the subjects are split into two groups: under 60 and over 60. Subjects in each group are randomly assigned to take one of the medications. Twenty minutes later they rate their levels of pain. This experiment...

- a) has one factor (age) blocked by type of medication
- b) has one factor (medication) blocked by age
- c) uses matched pairs
- d) has two factors, medication and age
- e) is completely randomized

↑
splitting into groups based on pre-existing conditions (gender, age, grade, etc) is blocking

- 5) Which is important in designing a good experiment?

- i. Randomization in assigning subjects to treatments. ✓
- ii. Control of potentially confounding variables. ✓
- iii. Replication of the experiment on a sufficient number of subjects. ✓

- a) i and ii b) i and iii c) i, ii, and iii d) ii and iii e) i only

6) A researcher identified 100 men over forty who were not exercising and another 100 men over forty with similar medical histories who were exercising regularly. She followed the men for several years to see if there was any difference between the groups in the rate of heart attacks. This is a(n):

- a) completely randomized experiment
- b) block design experiment
- c) matched pairs experiment
- d) observational study

no treatments are being imposed so not an experiment

7) Ceramics engineers are testing a new formulation for the material used to make insulators for power lines. They will try baking the insulators at four different temperatures, followed by either slow or rapid cooling. They want to try every combination of the baking and cooling options to see which produces insulators least likely to break during adverse weather conditions.

a) Identify the explanatory variable(s).

baking temp. ; cooling speed/method

b) Identify the response variable.

likelihood of breaking during adverse weather cond.

c) How many treatments are there? List them all.

- temp 1 + slow cooling
- temp 1 + rapid cooling
- temp 2 + slow cooling
- temp 2 + rapid cooling
- temp 3 + slow cooling
- temp 3 + rapid cooling
- temp 4 + slow cooling
- temp 4 + rapid cooling

8) A headline in a local newspaper announced "Video game playing can lead to better spatial reasoning abilities." The article reported that a study found "statistically significant differences" between teens who play video games and teens who do not, with teens who play video games testing better in spatial reasoning. Do you think the headline was appropriate? Explain.

No, these results are likely from an observational study, not an experiment, so a cause-and-effect relationship cannot be determined

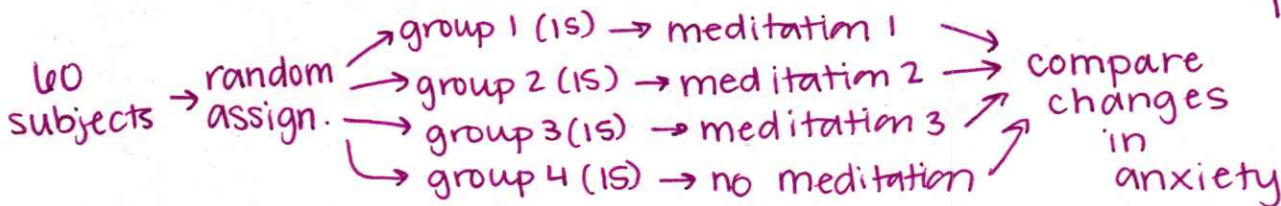
Vocabulary

Explanatory variable, Response variable, Lurking variable, Control group, Nonadherers, Refusals, Dropouts, Treatment, Block design, Double-blind experiment, Matched-pair experiment

Short Answer:

1. A company wants to test whether meditation techniques lower anxiety levels. The experimenter interviewed 60 subjects and assessed their levels of anxiety. The subjects than were randomly separated into 3 different groups, each learning a different meditation technique. The subjects performed mediation regularly for one month and then were re-assessed for their anxiety levels. The results were statistically significant.

- (a) Is this an observational or experimental study? *experiment → treatment is being imposed*
- (b) Should there have been a control group? If so, what lurking variables could have confounded *imposed*
- (c) Draw a diagram to represent the study. *Yes, jobs or times of yr could be lurking variables*



(d) Describe the subjects, the explanatory variable, the response variable, and the treatment for this study.

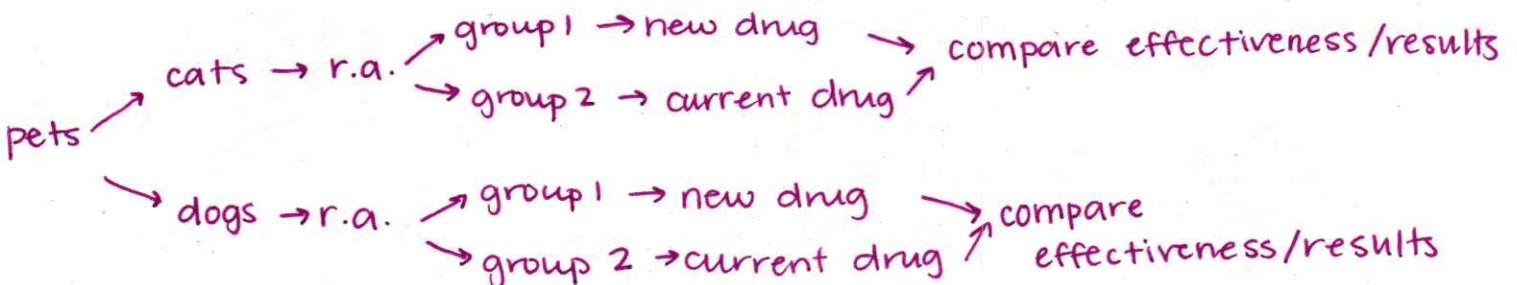
Subjects: *60 people in the study*
Explanatory: *meditation technique learned*
Response: *change in anxiety level*
Treatment: *med. tech. 1, med. tech. 2, med. tech. 3, no med.*

(e) What does "statistically significant" mean?

The results are unlikely to happen by chance

2. An experiment is to be conducted to determine if a new medicine for dogs and cats is more effective than the current drug on the market. There is a concern that dogs and cats will react differently to the drug.

- (a) What type of design method would be best to use? *block design*
- (b) Create a diagram that shows the sample design.



3. Which brand of laundry detergent gets stains out of white clothes better – Brand A or Brand B? All clothes are washed on hot. An experiment is conducted with white T-shirts, all of which contain grass stains.
- (a) What type of design method is used? *comparative randomized experiment*
- (b) Can this study be blinded? Explain.

Yes → people can be given the detergent but not told what brand it is but this is unnecessary

- (c) Would a control group be necessary? Explain.

No → we want to know how Brand A compares to Brand B and there should be no lurking variables so we can just compare the 2 brands

4. In the above example, suppose we wanted to also measure what water temperature – hot, warm, cold - works best in addition to the detergents.

- (a) Could this experiment be blinded? *No → people must know what water temp they are assigned*

- (b) Create a diagram to describe all the treatments that can take place.

	Hot	Warm	Cold
Brand A	Treat. 1	Treat. 2	Treat. 3
Brand B	Treat. 4	Treat. 5	Treat. 6

1) The journal Circulation reported that among 1900 people who had heart attacks, those who drank an average of 19 cups of tea a week were 44% more likely than non-drinkers to survive at least 3 years after the attack.

a) Is this an example of an observational study or an experiment?

observational study → they observed the habits and life span of people who had heart attacks

b) Does it provide evidence that drinking tea leads to a longer lifespan after a heart attack (i.e. cause-and-effect)?

no → observational studies CANNOT provide evidence of a cause & effect relationship

2) A farm-product manufacturer wants to determine if the yield of a crop is different when the soil is treated with three different types of fertilizers. Fifteen similar plots of land are planted with the same type of seed but are fertilized differently. At the end of the growing season, the mean yield from the sample plots is compared.

a) Identify the:

subjects: 15 plots of land

explanatory variable: type of fertilizer

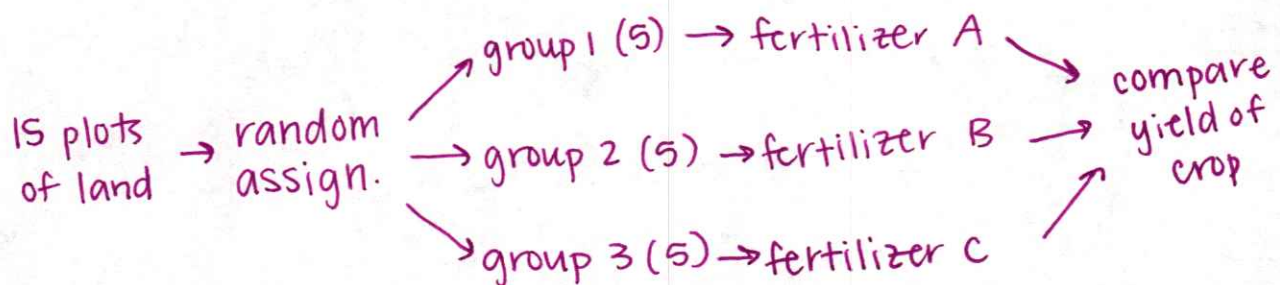
response variable: yield of crop

treatment: three types of fertilizer (Fertilizer A, B, C)

b) What type of experiment is being carried out?

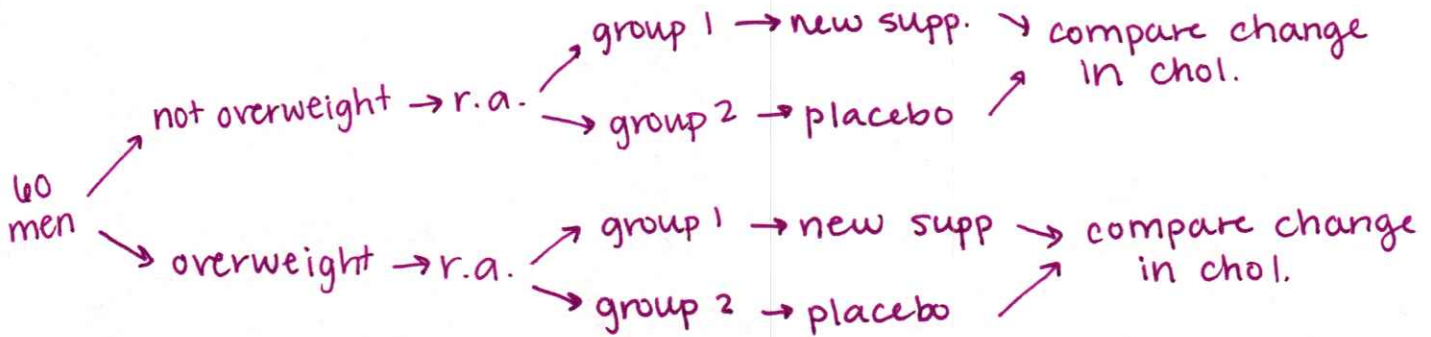
comparative randomized experiment

c) Draw a diagram to outline the design of the experiment.



3) You are participating in the design of a medical experiment to investigate whether a new dietary supplement will reduce the cholesterol level of middle-aged men. Sixty randomly selected men are available for the study. It is known that weight can affect cholesterol levels in men. What type of design would best work for this experiment? Create a diagram to outline the experiment.

Block design to account for weight



4) Vocabulary

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|----------|-------------------------------|--------------|--|
| <u>M</u> | 2. block design | X | experiment which studies the effectiveness of medical treatments on actual patients |
| <u>A</u> | 3. clinical trial | X | an experiment in which neither the subjects nor the people who work with them know which treatment each subject is receiving |
| <u>T</u> | 6. control group | X | a study which deliberately imposes some treatment on individuals in order to observe their responses |
| <u>B</u> | 8. double-blind experiment | X | a variable that has an important effect on the relationship among the variables in a study but is not one of the variables being studied |
| <u>C</u> | 9. experiment | X | a variable that we think explains or causes changes in the response variables |
| <u>F</u> | 10. explanatory variable | X | a dummy treatment with no active ingredients |
| <u>D</u> | 11. lurking variable | X | the individuals studied in an experiment |
| <u>N</u> | 12. matched pairs design | X | an observed effect so large that it would rarely occur by chance |
| <u>Q</u> | 13. nonadherers | X | a variable that measures an outcome or result of a study |
| <u>G</u> | 14. placebo | X | favorable response to a dummy treatment |
| <u>L</u> | 15. placebo effect | X | subjects are first grouped into similar traits and then randomization is carried out separately within each group |
| <u>J</u> | 17. response variable | X | experimental technique comparing pairs of subjects that are alike as much as possible when each receives a different treatment |
| <u>I</u> | 18. statistically significant | X | subjects who do not follow the experimental treatment |
| <u>H</u> | 19. subjects | X | any specific experimental condition applied to the subjects |
| <u>R</u> | 20. treatment | X | the group in an experiment which receives the placebo treatment or a treatment which is already on the market |