

5 for 5

Then Free Response 2002 #2

Does listening to music improve GPA?



Some students at your school claim that listening to music while studying will help improve their GPA. Design a study to help discover if this claim is true.

Here are four proposed studies for investigating the question of the day. Suppose we found that the mean GPA of students who listen to music is significantly lower than the mean GPA of students who didn't listen to music. What conclusions could we make? Can we generalize and can we determine causation?

1. Get all the students in your statistics class to participate in a study. Ask them whether or not they study with music on and divide them into two groups based on their answer to this question.

Random sample? No Random assignment? No

Conclusion: For students in this class, there is a correlation b/t listening to music and lower GPA

\* No Inference about pop OR Causation

		Were individuals randomly assigned to groups?	
		Yes	No
Were individuals randomly selected?	Yes	Inference about the population: YES Inference about cause and effect: YES	Inference about the population: YES Inference about cause and effect: NO
	No	Inference about the population: NO Inference about cause and effect: YES	Inference about the population: NO Inference about cause and effect: NO

2. Select a random sample of students from your school to participate in a study. Ask them whether or not they study with music on and divide them into two groups based on their answer to this question.

Random sample? yes Random assignment? No

Conclusion: For all students from your school, there is a correlation b/t listening to music + ↓ GPA \* Inference about population

3. Get all the students in your statistics class to participate in a study. Randomly assign half of the students to listen to music while studying for the entire semester and have the remaining half abstain from listening to music while studying.

Random sample? No Random assignment? yes

Conclusion: For students in stat class, listening to music while studying caused a ↓ GPA. \* Inference about causation

4. Select a random sample of students from your school to participate in a study. Randomly assign half of the students to listen to music while studying for the entire semester and have the remaining half abstain from listening to music while studying.

Random sample? YES Random assignment? YES

Conclusion: For all students @ school, listening to tunes caused ↓ GPA

\* Inference about pop & cause

**Important Ideas**

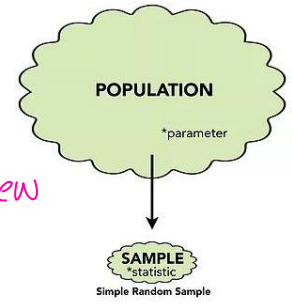
**Data Ethics**

- ① Confidential
- ② Informed consent
- ③ Institutional Review

**Inference**

Random sample  
- Infer/generalize to whole pop

Random Assign  
- Allow to generalize about cause and effect



1. When an athlete suffers a sports-related concussion, does it help to remove the athlete from play immediately? Researchers recruited 95 athletes seeking care for a sports-related concussion at a medical clinic and followed their progress during recovery. Researchers found statistically significant evidence that athletes who were removed from play immediately recovered more quickly, on average, than athletes who continued to play.

NO RA OR RS

(a) What conclusion can we draw from this study? Explain your answer.

All athletes in this study recovered more quickly when removed from play.

(b) Would it be ethical to conduct an experiment to answer this question? Explain.

No → you can't assign athletes to continue playing after they're injured.

2. Can eating nuts during pregnancy help children avoid nut allergies? Researchers studied over 8000 children who were born in the early 1990s to mothers who were part of the Nurses' Health Study II. Children whose mothers ate the most nuts during pregnancy (at least five times per week) were significantly less likely to develop nut allergies than children whose mothers ate the least amount of nuts during pregnancy (less than once per month).

(a) Does this study show that eating nuts during pregnancy causes a reduced risk of nut allergies in children?

No, not Random Assignment

(b) Would it be ethical to conduct an experiment to answer this question? Explain.

No → the babies R receiving treatment and they can't get informed consent

3. A researcher wants to conduct a study to test whether listening to soothing music for 20 minutes helps to reduce diastolic blood pressure in patients with high blood pressure, compared to simply sitting quietly in a noise-free environment for 20 minutes. One hundred patients with high blood pressure at a large medical clinic are available to participate in this study. Before the experiment, the researcher will record each patient's blood pressure.
- (a) The researcher knows there are some lurking variables that could affect the results of the study. Suggest a variable that could be used to block the patients into groups to reduce the affects of lurking variables. Justify your suggestion.
- (b) Describe how to implement a block design for this experiment using the blocking scheme you suggested in part b.

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## Free Response Practice

1998 3 (only a + b)

a) \* make 6 treatment groups look as alike as possible except for treatment

\* Randomly allocate 3600 butterflies to groups of 600 for each location (A-F). Each BF can be assigned a unique # and then randomly generate #'s (no repeats) to select 600 for A, 600 for B and so on.

\* systematically  $\Rightarrow$  assign marking locations A thru F to create 6 groups of bf until all 3600 are separated.

b) Make 6 possible outcomes, each w/ probability of  $\frac{1}{6}$ , maybe throw a die (6-sided). Assign one # to each letter, such as A=1, B=2, etc. Toss die and assign marking location sequentially until all 3600 are dispersed.

2006 (5)

a) ~~Growth nutrients (A, B, C)~~ (P)

All 6 options ~~Salinity levels (low or high)~~ (P)  
6 combos

E 1 → A → low    3 → B → low    5 → C → low  
2 → A → high    4 → B → high    6 → C → high

b) 10 shrimps in 12 tanks

E each treatment goes to 2 tanks

Randomly assign the tanks a # from 1-12 and using Random # generator or TD  
Then each # is assigned a treatment. <sup>tumble digit</sup>  
Sort #s from small to large. (NO repeats)

1 → A → low → First + 2nd smallest #s

2 → A → high → 3rd + 4th #s

3 → B → low → 5th + 6th #s

4 → B → high → 7th + 8th #s

5 → C → low → 9th + 10th #s

6 → C → high → 11th + 12th #s

c) Reduce source of variation, tanks of shrimp.

By eliminating variation, we can better isolate variability due to other factors (nutri. + salinity)  
Easier to see treatment effects.

d) limit scope of inference. Ideally, you would find a combo of treatments leads to most growth for all shrimp but only able to look @ tiger shrimp.

2011 (3)

- a) Randomly assign a # from 1 to 9 for each floor. Select a Random # and survey all 4 apts on that floor. Generate another Random # from 1 to 9, no repeats and survey all 4 apts on that floor.

b) When using cluster, you have the chance of getting no apts w/ children. That cluster lasts longer. Strat → more representative of both types.

2019

②

a) treatments: 0 mL/L, 1.25 mL/L, 2.5 mL/L, 3.75 mL/L fungus mixtures

experimental units: 20 individual containers

Response: # of insects that are still alive in each container after a week of spraying them

b) Yes, the containers that get the 0mL/L fungus spray. The insects will not get any of the fungus. Researchers will have a baseline to compare other insects to.

c) Randomly assign each of the 20 containers from 1 to 20. Use a random # generator to get 5 integers, ignoring repeats. The first 5 get assigned to 0mL/L. Then generate 5 more # (ignoring repeats and already used numbers) for the 1.25 mL/L. Use the same process for the 2.5 mL/L and the last 5 get 3.75 mL/L.



# 5 for 5

## Practice Test A for Review

1) C 2) B 3) D 4) C 5) B

6) E 7) D 8) C 9) A 10) D

11) a) There were treatments given to the subjects (aspirin + alcohol, alcohol only)

b) Exp → aspirin consumption

Resp → blood alcohol content

c) Matched pairs

each person did both, so they are their own matched pair

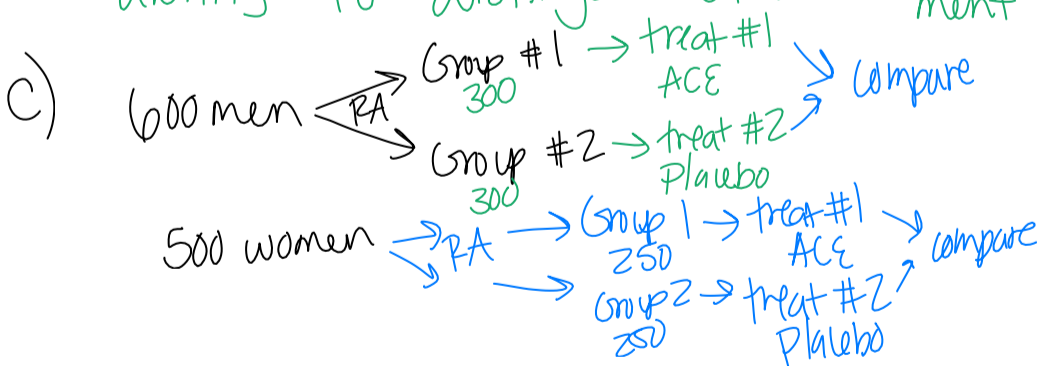
d) Significantly means that the difference found in the subjects BAC level b/w 2 treatments was large enough that it was unlikely to happen by chance

e) Each subject was their own control. Drank alcohol alone or alcohol/aspirin. Compare BAC, researchers were able to see the impact of aspirin.

12) a) Randomized block by gender

Reduce impact of diff b/w men/women

b) larger # subjects, greater Replication  
Decreases variability, increase our ability to distinguish effects of treatment



Block by gender. Block 1 - 600 men, Block 2 - 500 women

Assign within each block a # from 001 to 600 for men and 001 to 500 for women. Choose 3 digit numbers that are distinct from a random number generator until 300 men are in each group and 250 women are in each group. Group 1 for both would be the treatment group (ACE) and group 2 for each would be the placebo. Compare the changes in blood pressure between the two groups.

13. a) wording of question bias - it is possible that the use of constitutional right can lead people to change their answer for the question, so the 91% would be an overestimate of support.

b) non-response bias - not everyone who bakes is home during the week, so when they call those houses, they won't get an answer. Also those houses they do get will have more time to bake if they are home during the day, so the estimate of 50% would be an overestimate.