

Name Key
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Algebra 2GT

Research Design and Hypothesis Testing Review

1. A researcher wishes to determine if there is a relationship between where teens from age 14-18 live and the amount of time they spend on social media. She wishes to determine whether teens in rural, suburban, or urban schools spend more time on Facebook, Twitter or Instagram.

a. Is this research a Survey, an Observational Study or an Experiment? Justify your answer.

Survey - if asking questions

pbs study - if recording time

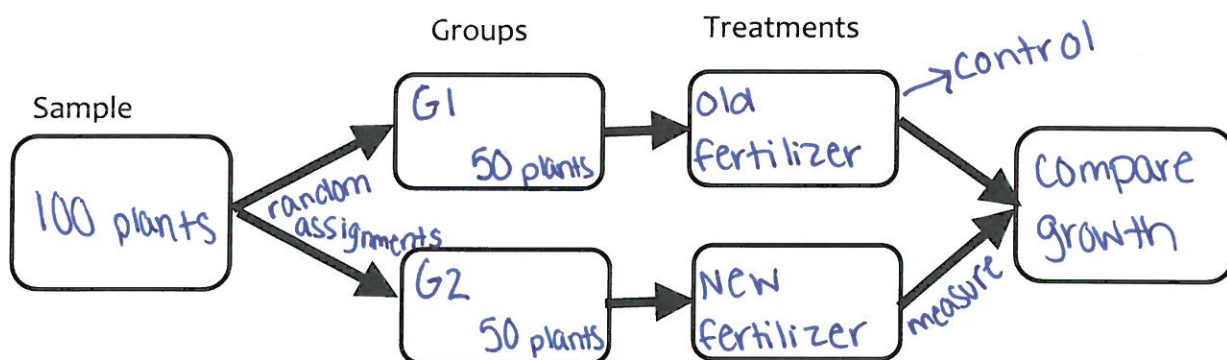
b. Which sampling method is most appropriate for this research? Justify your answer. Be sure to include at least one other sampling method and the reason you did not select it.

Stratified Random Sample

- we want our sample to compare rural, suburban + urban teens

2. Researchers at a local University are designing an experiment to determine the effects of a new fertilizer on the growth of plants. They have identical plants in the greenhouse that have been numbered from 1 to 100.

a. Complete the General experimental design diagram for this experiment.



b. How can the researchers implement Control (1st principle of Experimental Design)?

By comparing the old fertilizer with new fertilizer they are using control. Also they could make sure plants get equal amounts of each fertilizer, the same amount of sun, water, etc.

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c. How can the researchers implement Randomization (2nd principle of Experimental Design)?

First the researchers may have selected the 100 plants randomly. Then they are using a random # generator to assign them to groups

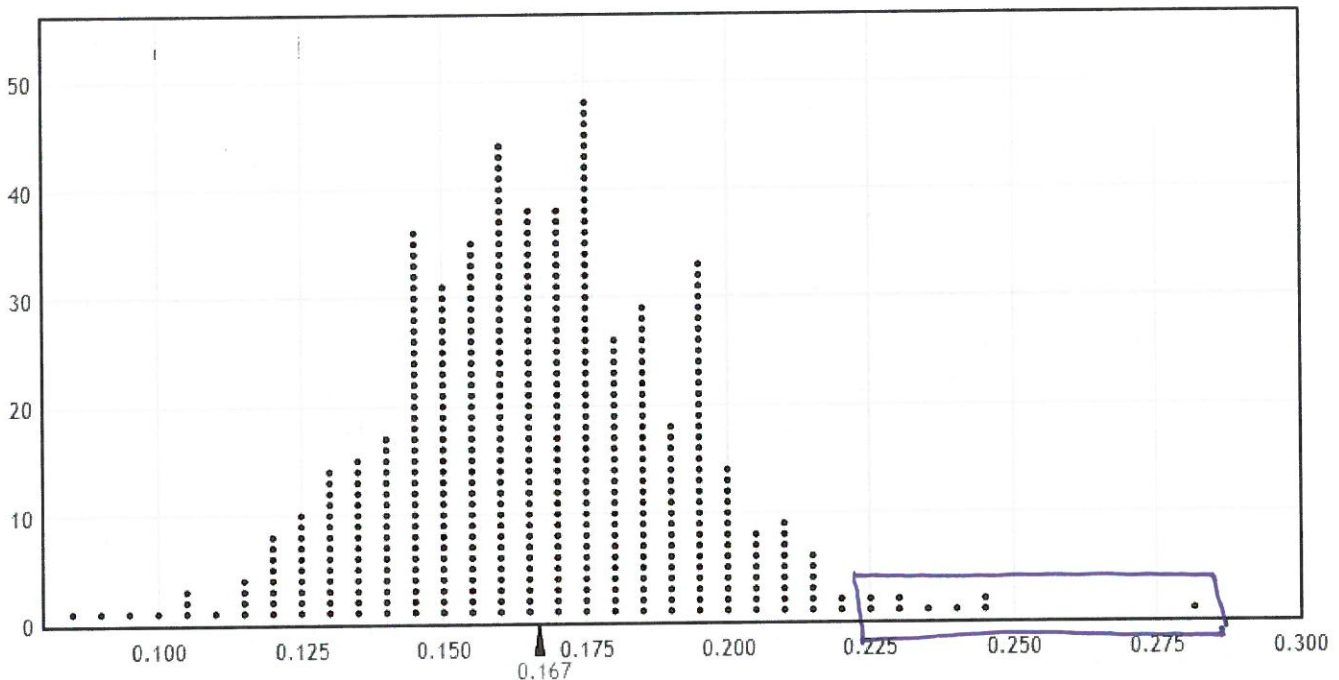
d. How can the researchers implement Replication (3rd principle of Experimental Design)?

Because the researchers have made sure there are 50 plants in each group, they are using replication. But they also might repeat the experiment.

e. The greenhouse has both sunny areas and shady areas. How can blocking (4th principle of Experimental Design) be implemented?

First 50 plants could be placed in a sunny area and 50 in shady areas. Then they could be randomly assigned a fertilizer.

3. A circular spinner is divided into 8 different colored sectors. James spun the spinner 200 times and recorded that the arrow landed on the purple sector 45 times out of the 200 spins. To determine if the spinner is a fair simulation, James used a computer to generate the number of times the arrow lands on the purple sector in 200 spins of a fair spinner equally divided into 8 different colored sectors. The results of 1,000 trials of the simulation are shown below.



$$\hat{p} = \frac{45}{200} = .225$$
$$P(\hat{p} > .225) = \frac{9}{1000} = .009$$

$$H_0: p = .125$$
$$H_A: p > .125$$

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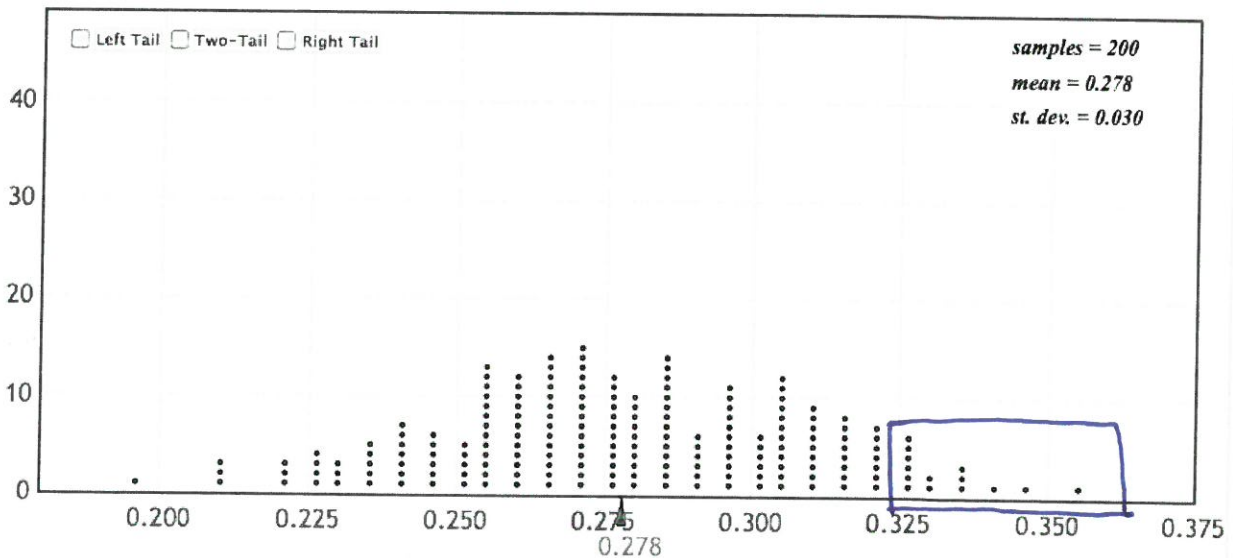
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Based on the results shown on the previous page, should Carrie conclude that there is evidence that the spinner is not fair?

- A. No, because a proportion of 0.225 or less is not unusual.
- B. No, because the distribution is approximately normal.
- C. Yes, because 0.9% of the proportions were 0.225 or higher.
- D. Yes, because a proportion of 0.17 was most frequent outcome.

4. The National Safety Council released a statement that 28% of auto accidents are caused by cellphone use while driving. Your local police department reports that 32.5% of auto accidents in this area were caused by cellphone usage. A 200-trial simulation was run with the assumption that 28% of auto accidents are caused by cellphone usage. The results are shown in the dot plot below.



a. According to the simulation, how unusual is the occurrence that at least 32.5% of auto accidents are caused by cellphone usage?

$$P\text{-value} = P(\hat{p} \geq .325) = \frac{14}{200} = .07$$
 Somewhat Surprising

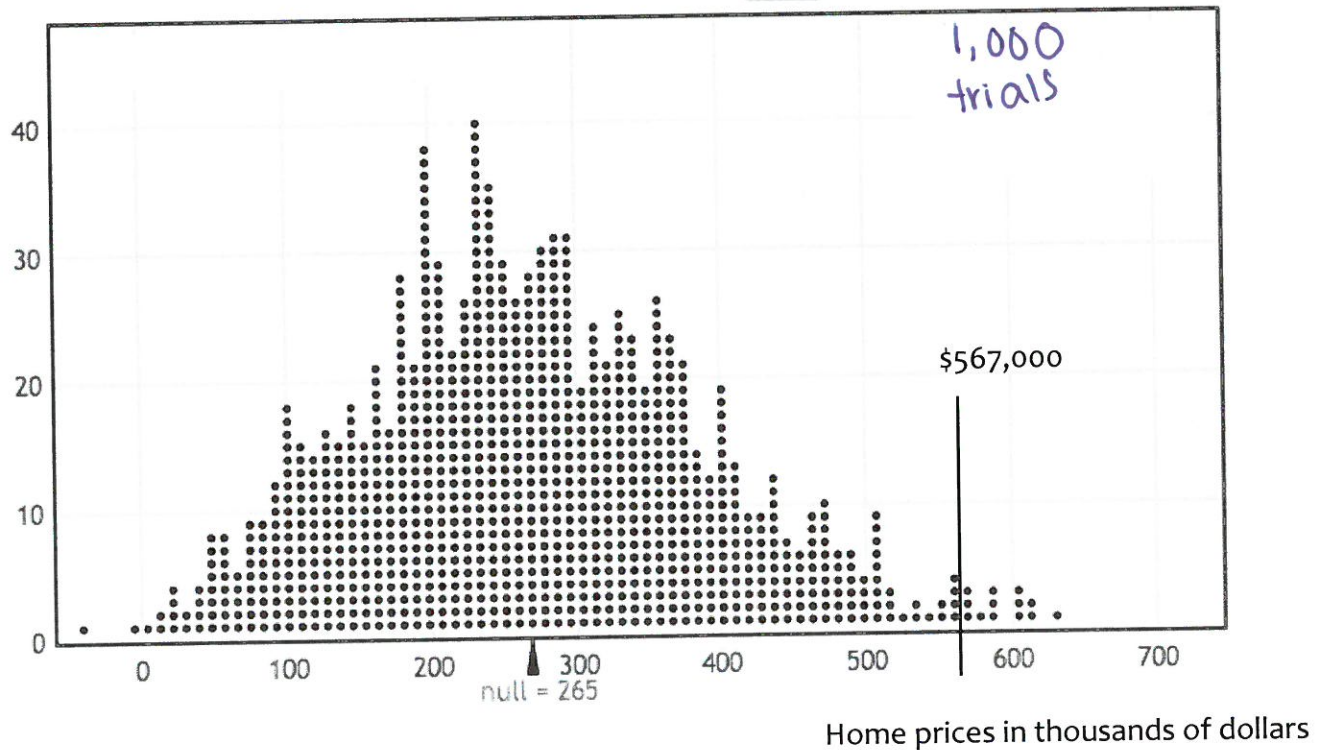
b. What (if anything) does this suggest about the percentage of auto accidents caused by cellphone use in this area?

Since this is somewhat surprising, the percentage of auto accidents caused by cell phone usage could be higher than 28%

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5. The mean home price in New York State has been reported as $\mu = \$265,000$ with a standard deviation of $\sigma = \$22,500$. An SRS of 36 homes located in New York state was taken and a mean home price of $\bar{x} = \$567,000$ was found. A simulation was run and 1000 samples of size 36 were generated. The results are shown in the graph below.



a. We want to know if our sample mean home price is surprisingly high. Write a null and alternate hypothesis.

$$H_0: \mu = 265,000$$

$$H_A: \mu > 265,000$$

mean home price is \$265,000

mean home price is higher than \$265,000

b. Based on the results of our simulation and if the true mean home price in New York State is \$265,000, how likely is it that we will get a sample mean of \$567,000 or higher? Justify your answer.

$$P\text{-value} = P(\bar{x} > 567,000) = \frac{13}{1000} = .0013$$

This is surprising! Therefore, the mean home price in NY is probably higher than \$265,000