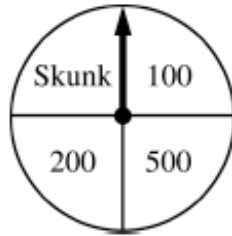




“FRAPPY” {Free Response AP Problem...Yay!}

The following problem is taken from an actual Advanced Placement Statistics Examination. Your task is to generate a complete, concise statistical response in 15 minutes. You will be graded based on the AP rubric and will earn a score of 0-4. After grading, keep this problem in your binder for your AP Exam preparation.



Contestants on a game show spin a wheel like the one shown in the figure above. Each of the four outcomes on this wheel is equally likely and outcomes are independent from one spin to the next.

- The contestant spins the wheel.
- If the result is a skunk, no money is won and the contestant's turn is finished.
- If the result is a number, the corresponding amount in dollars is won. The contestant can then stop with those winnings or can choose to spin again, and his or her turn continues.
- If the contestant spins again and the result is a skunk, all of the money earned on that turn is lost and the turn ends.
- The contestant may continue adding to his or her winnings until he or she chooses to stop or until a spin results in a skunk.

Scoring:

- (a) What is the probability that the result will be a number on all of the first three spins of the wheel?

1 1/2 0

(b) Suppose a contestant has earned \$800 on his or her first three spins and chooses to spin the wheel again. What is the expected value of his or her total winnings for the four spins?

1 1/2 0

(c) A contestant who lost at this game alleges that the wheel is not fair. In order to check on the fairness of the wheel, the data in the table below were collected for 100 spins of this wheel.

Result	Skunk	\$100	\$200	\$500
Frequency	33	21	20	26

Based on these data, can you conclude that the four outcomes on this wheel are not equally likely? Give appropriate statistical evidence to support your answer.

1/2 0

1/2 0

1/2 0

1/2 0

Total: __/4



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At an archaeological site that was an ancient swamp, the bones from 20 brontosaur skeletons have been unearthed. The bones do not show any sign of disease or malformation. It is thought that these animals wandered into a deep area of the swamp and became trapped in the swamp bottom. The 20 left femur bones (thigh bones) were located and 4 of these left femurs are to be randomly selected without replacement for DNA testing to determine gender.

Scoring:

(a) Let X be the number out of the 4 selected left femurs that are from males. Based on how these bones were sampled, explain why the probability distribution of X is not binomial.

E P I

(b) Suppose that the group of 20 brontosaurus who remains were found in the swamp had been made up of 10 males and 10 females. What is the probability that all 4 in the sample to be tested are male?

E P I

(c) The DNA testing revealed that all 4 femurs tested were from males. Based on this result and your answer from part (b), do you think that males and females were equally represented in the group of 20 brontosaurus stuck in the swamp? Explain.

E P I

(d) Is it reasonable to generalize your conclusion in part (c) pertaining to the group of 20 brontosaurus to the population of all brontosaurus? Explain why or why not.

E I

Total: __/4



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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.

Scoring:

(a) Propose a design for this study to compare these two treatments.

E P I

E I

(c) The null hypothesis for this study is that there is no difference in the mean reduction of diastolic blood pressure for the two treatments and the alternative hypothesis is that the mean reduction in diastolic blood pressure is greater for the music treatment. If the null hypothesis is rejected, the clinic will offer this music therapy as a free service to their patients with high blood pressure. Describe Type I and Type II errors and the consequences of each in the context of this study, and discuss which one you think is more serious.

E P I

E P I

Total: __/4



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Agricultural experts are trying to develop a bird deterrent to reduce costly damage to crops in the United States. An experiment is to be conducted using garlic oil to study its effectiveness as a nontoxic, environmentally safe bird repellent. The experiment will use European starlings, a bird species that causes considerable damage annually to the corn crop in the United States. Food granules made from corn are to be infused with garlic oil in each of five concentrations of garlic - 0 percent, 2 percent, 10 percent, 25 percent, and 50 percent. The researchers will determine the adverse reaction of the birds to the repellent by measuring the number of food granules consumed during a two-hour period following overnight food deprivation. There are forty birds available for the experiment, and the researchers will use eight birds for each concentration of garlic. Each bird will be kept in a separate cage and provided with the same number of food granules.

Scoring:

(a) For the experiment, identify

i. the treatments

ii. the experimental units

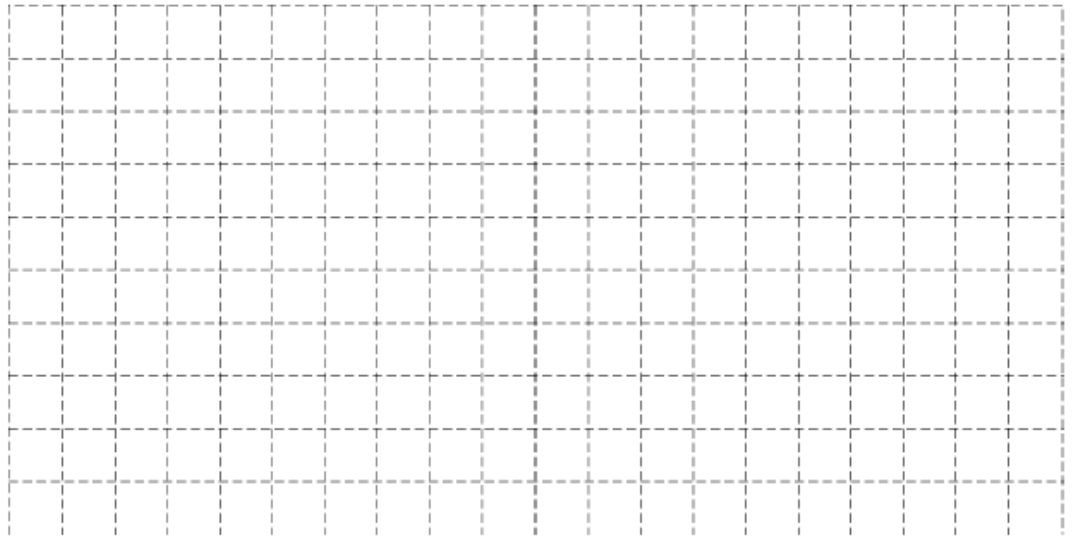
iii. the response that will be measured

(b) After performing the experiment, the researchers recorded the data shown in the table below.

Garlic oil concentration	0%	2%	10%	25%	50%
Mean number of food granules consumed	58	48	29	24	20
Number of birds	8	8	8	8	8

E P I

i. Construct a graph of the data that could be used to investigate the appropriateness of a linear regression model for analyzing the results of the experiment.



ii. Based on your graph, do you think a linear regression model is appropriate? Explain.

E P I

Total: __/4