

AP Stats  
Review HW #6

MULTIPLE CHOICE.

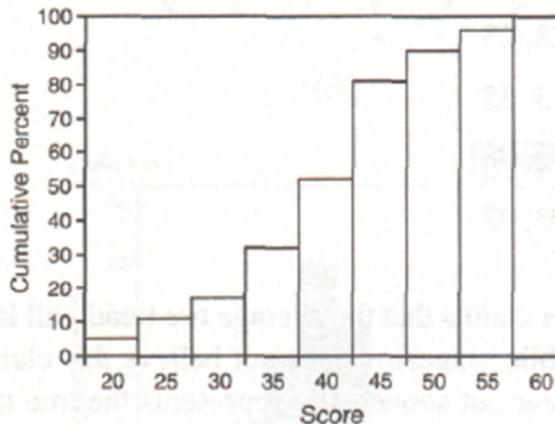
- A study was conducted to determine if the proportion of cars in a given area that do not meet exhaust emission standards has changed from 10 years ago when it was 8%. A test of  $H_0: p = 0.08$  against  $H_A: p \neq 0.08$  was performed with a significance level of  $\alpha = 0.05$ . Given that the data showed that there was a significant difference in the proportion of cars not meeting emission standards now versus 10 years ago, which of the following statements is true?
  - The researchers would have reached the same conclusion is  $\alpha = 0.01$  and  $\alpha = 0.10$ .
  - The researchers would have reached the same conclusion is  $\alpha = 0.01$ , but not at  $\alpha = 0.10$ .
  - A 95% confidence interval for the population proportion  $p$  would contain 0.08.
  - A 90% confidence interval for the population proportion  $p$  would contain 0.08.
  - The correct statement cannot be determined without knowing the P-value.

- An entomologist is studying fruit flies to determine if eye color is a sex-linked trait. They hypothesis is that a particular generation of flies will be evenly divided between males and females, with eye color - red or white - evenly divided within each gender. The actual results are shown below.

Male, red eyes	Male, white eyes	Female, red eyes	Female, white eyes
19	22	33	26

What is the value of the  $\chi^2$ -statistic for a goodness-of-fit test on these data?

- 0
  - 0.17
  - 4.28
  - 4.40
  - 27.5
- A pediatrician is looking over records of female patients, specifically girls aged 10 years. The tallest 10% of girls had heights of 146.0 cm or more, while the shortest 25% of girls had heights of 133.0 cm or less. If the heights of 10-year-old girls are approximately normally distributed, what are the mean and standard deviation of the heights?
    - Mean = 136.7 cm; standard deviation = 7.27 cm
    - Mean = 137.5 cm; standard deviation = 6.64 cm
    - Mean = 139.5 cm; standard deviation = 5.08 cm
    - Mean = 139.5 cm; standard deviation = 9.70 cm
    - Mean = 141.5 cm; standard deviation = 3.52 cm
  - The display below shows the cumulative relative frequency histogram of scores from the 20-question math placement examination taken by 40 freshmen upon entering a high school.



Which of the following is a correct statement based on the information in the display?

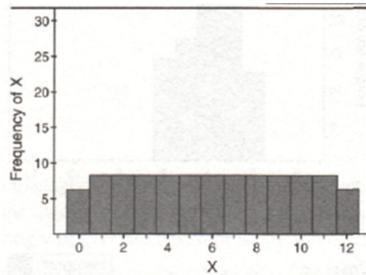
- The median score is 30.
- Most students scored above 50.
- No one scored 35 on this test.
- About four times as many students scored 30 than 20.
- There was about equal numbers of students with scores between 50 and 60.

5. What is the major difference between an experiment and an observational study?
- A treatment is imposed in an experiment.
  - An observational study can establish cause-effect relationships.
  - There are two control groups instead of one in an experiment.
  - Observational studies use only one population.
  - Experiments are blinded.
6. Five homes from a subdivision will be randomly selected to receive 1 month of free cable TV. There are 80 homes in the subdivision. The homes are assigned number 01-80 and the random number table below is used to select the five homes. No home may receive more than one free month of service. Which of the following is a correct selection of the five homes?

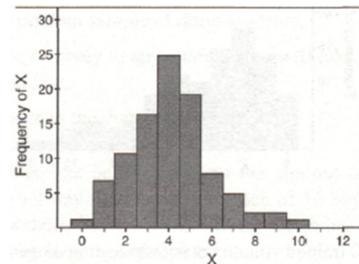
99 154 70 392 23 889 92 335  
 92 210 70 439 08 629 73 299

- 9, 1, 5, 4, 7
  - 15, 47, 03, 23, 35
  - 99, 15, 47, 03, 92
  - 15, 47, 03, 23, 23
  - 99, 70, 23, 92, 08
7. A tire manufacturer claims that the average tire tread will last about 50,000 miles. An automobile magazine does not believe this claim; they believe the tire tread to wear out sooner. If  $\mu$  represents the true number of miles the tread will last, which of the following pairs of hypotheses is correct to test the claim?
- $H_0: \mu = 50,000$   
 $H_A: \mu > 50,000$
  - $H_0: \mu < 50,000$   
 $H_A: \mu \geq 50,000$
  - $H_0: \mu = 50,000$   
 $H_A: \mu < 50,000$
  - $H_0: \mu > 50,000$   
 $H_A: \mu \leq 50,000$
  - $H_0: \mu = 50,000$   
 $H_A: \mu \neq 50,000$
8. A fair six-sided die has four faces painted green and two faces painted red. The die is rolled 12 times; let  $X$  be the number of times a red face shows. This procedure of 12 rolls is repeated 100 times. Which of the following plots is most likely to display the distribution of  $X$  from these 100 trials?

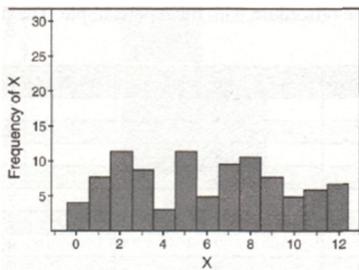
A.



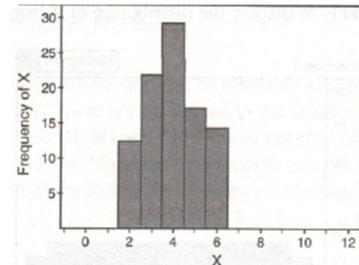
B.



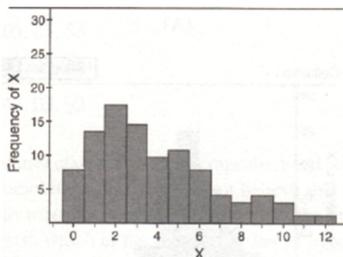
C.



D.



E.



9. A group of 10 trained volunteers is taste-testing a new cola for a soft drink manufacturer. There are two formulas under consideration. One of the characteristics the tasters will rate is "spice." Each volunteer is randomly assigned to taste a sample of one formula, rate it on a scale of 1 to 10, and then repeated the procedure with the other sample. The data are given in the table below.

Tester	Spice for Formula A	Spice for Formula B
1	9	6
2	7	5
3	8	8
4	6	6
5	9	7
6	7	7
7	7	8
8	9	7
9	4	5
10	7	6

What is the number of degrees of freedom associated with the appropriate t-confidence interval to see which formula has a higher "spice" rating?

- A. 9                      B. 10                      C. 16                      D. 18                      E. 20
10. The cafeteria manager at a university wants to conduct a survey of 100 students about the quality of food for students that live in the dorms. Which of the following will give the best representation of all dorm students?
- A. Survey every eighth student that arrives in the cafeteria.  
 B. Survey the first 100 students that arrive at the cafeteria at dinner time.  
 C. Select a random sample of dorm students.  
 D. Hand out a survey to any student who will take the time to answer the questions.  
 E. Put surveys in the dormitory mailboxes.

#### AP Questions

11. A manufacturer of toxic pesticide granules plan to use a dye to color the pesticide so that birds will avoid eating it. A series of experiments will be designed to find colors or patterns that three bird species (blackbirds, starlings, and geese) will avoid eating. Representative samples of birds will be captured to use in the experiments, and the response variable will be the amount of time a hungry bird will avoid eating food of a particular color or pattern.
- (a) Previous research has shown that male birds do not avoid solid colors. However, it is possible that males might avoid colors displayed in a pattern, such as stripes. In an effort to prevent males from eating the pesticides, the following two treatments are applied to the pesticide granules.
- Treatment 1: A red background with narrow blue stripes  
 Treatment 2: A blue background with narrow red stripes
- To increase the power of detecting a difference in the two treatments in the analysis of the experiment, the researcher decided to block on the three species of birds (blackbirds, starlings, and geese). Assuming there are 100 birds of each of the three species, explain how you would assign birds to treatments in such a block design.
- (b) Other than blocking, what could the researcher do to increase the power of detecting a difference in the two treatments in the analysis of the experiment? Explain how your approach would increase the power?

12. Scientists interested in preserving natural habitats and minimizing the possible extinction of certain bird species conducted a study to determine if it is better for conservation groups to purchase a few large nature preserves or many small preserves in order to meet these goals.

The scientists studied 13 randomly selected islands of different sizes to determine the risk of extinction for bird species. Islands are thought to be a good imitation of what would happen in a nature preserve because of their isolation. If a species lived on only one island, it was considered to be at risk. Scientists have determined that whether or not one species becomes extinct is independent of whether or not another species becomes extinct.

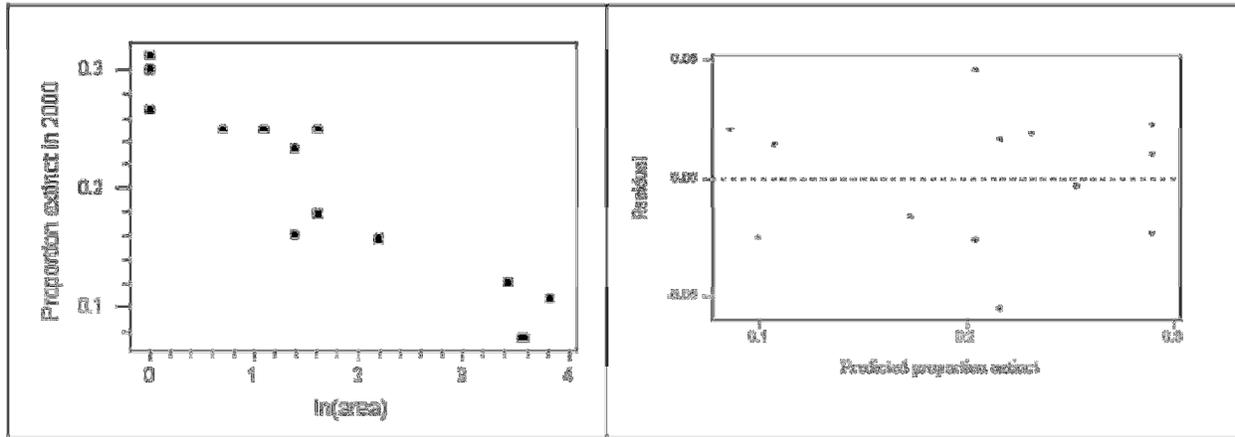
In 1990 scientists counted the number of at-risk species on each of the selected islands. They returned to each of these islands in the year 2000 to see whether the species will exist on the islands. Species that were present in 1990 but absent in 2000 were considered extinct. Data collected by the scientists are given in the table below.

Island	Area (in sq km)	Species at Risk in 1990	Species Extinct by 2000	Proportion Extinct
1	46	75	8	0.11
2	36	67	3	0.04
3	31	66	8	0.12
4	9	51	8	0.16
5	5	28	5	0.18
6	5	20	6	0.30
7	4	43	10	0.23
8	4	31	5	0.16
9	3	28	7	0.25
10	2	32	8	0.25
11	1	30	8	0.27
12	1	20	4	0.20
13	1	16	5	0.31

- (a) One scientist involved in the study believes that large islands (those with areas greater than 25 square kilometers) are more effective than small islands (those with areas of no more than 25 square kilometers) for protecting at-risk species. The scientist noted that for this study, a total of 19 of the 208 species on the large island became extinct, whereas a total of 66 of the 299 species on the small island became extinct. Assume that the probability of extinction is the same for all at-risk species on large islands and the same for all at-risk species on small islands. Do these data support the scientist's belief? Give appropriate statistical justification for your answer.
- (b) Another scientist who worked on this study thinks that the proportion of species that become extinct is more directly related to the size of the islands than simply to whether the islands are grouped as large or small. This scientist investigated the relationship between the proportion of extinct birds and the area, in square kilometers, of islands. A least squares analysis was conducted on the proportion of extinct and  $\ln(\text{area})$ . This regression analysis output, the scatterplot, and the residual plot are shown below.

Predictor	Coef	StDev	T	P
Constant	0.28996	0.01269	22.85	0.000
ln(area)	-0.05323	0.00618	-8.61	0.000

S = 0.02863    R-Sq = 87.1%



Estimate the slope of the least squares regression line using a 95 percent confidence interval. Interpret your answer in the context of this situation.

- (c) In part (a), the scientist assumed that the probability of a species becoming extinct is the same for each of the large islands. Similarly, the scientist assumed that the probability is the same for each of the small islands. Based on your answer in part (b), do you think this is a reasonable assumption? Explain.
- (d) A conservation group with a long-term goal of preserving species believes that all at-risk species will disappear whenever land inhabited by those species is developed. It has an opportunity to purchase land in an area about to be developed. The group has a choice of creating one large nature preserve with an area of 45 square kilometers and containing 70 at-risk species, or 5 small nature preserves, each with an area of 3 square kilometers and each containing 16 at-risk species unique to that preserve. Which choice would you recommend and why?