

I. Descriptive Statistics

$$\bar{x} = \frac{1}{n} \sum x_i = \frac{\sum x_i}{n}$$

$$\hat{y} = a + bx$$

$$r = \frac{1}{n-1} \sum \left(\frac{x_i - \bar{x}}{s_x} \right) \left(\frac{y_i - \bar{y}}{s_y} \right)$$

$$s_x = \sqrt{\frac{1}{n-1} \sum (x_i - \bar{x})^2} = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}}$$

$$\bar{y} = a + b\bar{x}$$

$$b = r \frac{s_y}{s_x}$$

II. Probability and Distributions

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

Probability Distribution	Mean	Standard Deviation
Discrete random variable, X	$\mu_X = E(X) = \sum x_i P(x_i)$	$\sigma_X = \sqrt{\sum (x_i - \mu_X)^2 P(x_i)}$
If X has a binomial distribution with parameters n and p , then: $P(X = x) = \binom{n}{x} p^x (1 - p)^{n-x}$ where $x = 0, 1, 2, 3, \dots, n$	$\mu_X = np$	$\sigma_X = \sqrt{np(1 - p)}$
If X has a geometric distribution with parameter p , then: $P(X = x) = (1 - p)^{x-1} p$ where $x = 1, 2, 3, \dots$	$\mu_X = \frac{1}{p}$	$\sigma_X = \frac{\sqrt{1 - p}}{p}$

5. A research center conducted a national survey about teenage behavior. Teens were asked whether they had consumed a soft drink in the past week. The following table shows the counts for three independent random samples from major cities.

	Baltimore	Detroit	San Diego	Total
Yes	727	1,232	1,482	3,441
No	177	431	798	1,406
Total	904	1,663	2,280	4,847

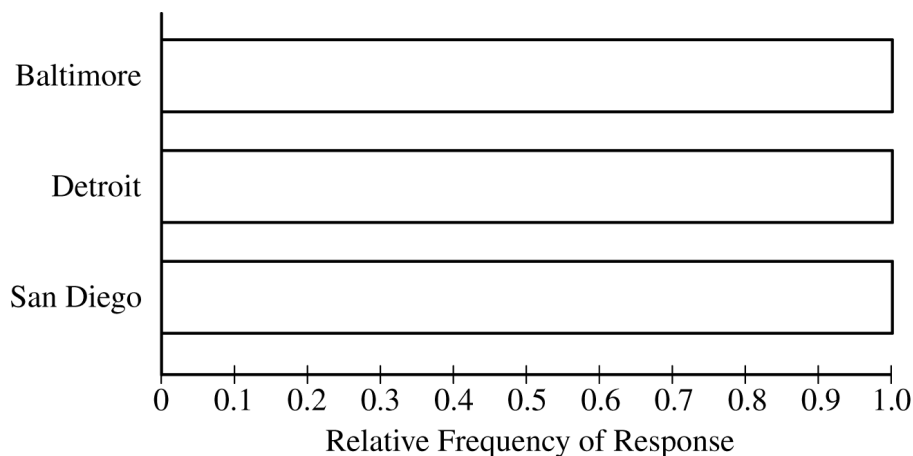
- (a) Suppose one teen is randomly selected from each city's sample. A researcher claims that the likelihood of selecting a teen from Baltimore who consumed a soft drink in the past week is less than the likelihood of selecting a teen from either one of the other cities who consumed a soft drink in the past week because Baltimore has the least number of teens who consumed a soft drink. Is the researcher's claim correct? Explain your answer.

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(b) Consider the values in the table.

(i) Construct a segmented bar chart of relative frequencies based on the information in the table.



(ii) Which city had the smallest proportion of teens who consumed a soft drink in the previous week?
Determine the value of the proportion.

(c) Consider the inference procedure that is appropriate for investigating whether there is a difference among the three cities in the proportion of all teens who consumed a soft drink in the past week.

(i) Identify the appropriate inference procedure.

(ii) Identify the hypotheses of the test.

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STATISTICS

SECTION II

Part A

Questions 1-5

Spend about 65 minutes on this part of the exam.

Percent of Section II score—75

Directions: Show all your work. Indicate clearly the methods you use, because you will be scored on the correctness of your methods as well as on the accuracy and completeness of your results and explanations.

1. An administrator at a large university is interested in determining whether the residential status of a student is associated with level of participation in extracurricular activities. Residential status is categorized as on campus for students living in university housing and off campus otherwise. A simple random sample of 100 students in the university was taken, and each student was asked the following two questions.

- Are you an on campus student or an off campus student?
- In how many extracurricular activities do you participate?

The responses of the 100 students are summarized in the frequency table shown.

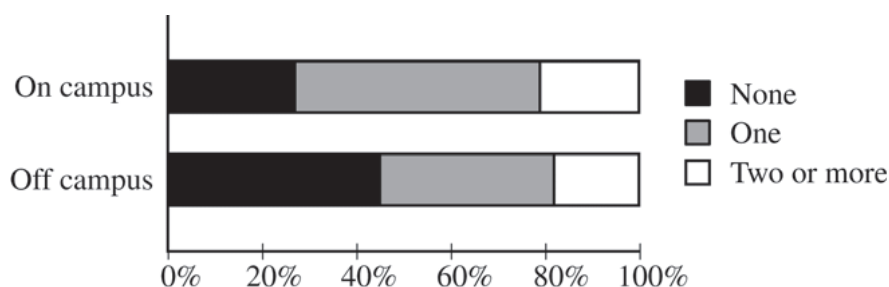
Level of Participation in Extracurricular Activities	Residential Status		Total
	On campus	Off campus	
No activities	9	30	39
One activity	17	25	42
Two or more activities	7	12	19
Total	33	67	100

- (a) Calculate the proportion of on campus students in the sample who participate in at least one extracurricular activity and the proportion of off campus students in the sample who participate in at least one extracurricular activity.

On campus proportion:

Off campus proportion:

The responses of the 100 students are summarized in the segmented bar graph shown.



- (b) Write a few sentences summarizing what the graph reveals about the association between residential status and level of participation in extracurricular activities among the 100 students in the sample.

- (c) After verifying that the conditions for inference were satisfied, the administrator performed a chi-square test of the following hypotheses.

H_0 : There is no association between residential status and level of participation in extracurricular activities among the students at the university.

H_a : There is an association between residential status and level of participation in extracurricular activities among the students at the university.

The test resulted in a p -value of 0.23. Based on the p -value, what conclusion should the administrator make?