

**CHAPTER ONE: INTRODUCTION TO RESEARCH METHODS**

Due Friday, December 9

**1-A Populations and Samples**population • sample • sample size  $n$  • random selection • sampling bias • parameter • statistic • mean • proportion •  $\mu$  •  $\bar{x}$  •  $\sigma$  •  $s$  •  $p$  •  $\hat{p}$ **1 Identify samples and populations.**

- 1 Logan surveys 20 random SVHS juniors and 18 SVHS seniors to ask whether or not they like having a weekly tutorial period.

**2 Identify possible sources and consequences of sampling bias.**

- 2 To see how long teenagers can hold their breath, Vineha times 20 students at break.

**3 Label a mean, standard deviation, or proportion with the correct symbol.**

- 3 Out of 25 juniors, 21 say they would rather go a week without a phone than a car than a week without a smartphone.

**4 Distinguish between probability and statistics.**

- 4 In a UPI/Cvoter poll in August, 457 out of 981 likely voters selected Donald Trump over Hillary Clinton. What percentage of all likely voters would select Trump over Clinton?

**1-B Measuring Data**

operational definition • Likert scale • level of measurement • data • nominal • ordinal • interval • ratio

**1 Develop an operational definition for a variable.**

- 1 List some possible operational definitions for the variable "academic achievement" for seniors.

**2 Classify data by level of measurement.**

- 1 Describe how daily calorie consumption could be treated as different levels of measurement.

- 1 For each of the following variables, give a possible way it could be measured and what level of measurement applies.

a) color

b) temperature

c) distance

d) iPad capacity

**1-C Relationships Between Variables**

independent variable • level • experimental group • control group • placebo • dependent variable • experiment • random assignment • quasi-experiment • correlational • observational study • causal relationship • affect • effect

Use the following for **1** through **4** below.

Julissa predicts that starting each day with five minutes of yoga increases math grades and also causes students to be more interested in school, especially among girls.

- ❶ Identify an experiment or quasi-experiment's independent variables and their levels, and identify its dependent variables.
  
  
  
  
  
  
  
  
  
  
- ❷ Identify possible mediator variables to explain an independent variable's effects on a dependent variable.
  
  
  
  
  
  
  
  
  
  
- ❸ Use a moderator variable to test a mediator variable.
  
  
  
  
  
  
  
  
  
  
- ❹ Distinguish between experimental, quasi-experimental, and correlational research.
  
  
  
  
  
  
  
  
  
  
- ❺ Distinguish between affect and effect meaning influence.
  - ❶ Even though people may seem to be unaffected, the things we say can have big effects on others. Likewise, the way we say things can affect others, whether or not we realize the effect we are having.

### 1-D Extraneous and Confounding Variables

extraneous variable • confounding variable • random error • systematic error • socioeconomic status

- ❶ Interpret significant results with or without causation as appropriate.
  - ❶ Wang and Kenny (2013) found that the more teenagers were harshly verbally disciplined by their parents, the more depressed and aggressive they tended to be.

Use the following for ❷ through ❺ below.

Ben and Gavin are testing to see if people have better memory for words presented visually or auditorily. Ben reads a list of 30 words to his seventh period English class and then has them write down as many as they can remember. Gavin does the same with his fifth period Advanced Physics class, except he shows the words in a PowerPoint presentation instead of reading them.

- ❷ Identify possible confounding variables due to preexisting differences between participants in different conditions.

- ③ Identify possible confounding variables due to differences in the procedure between different conditions.
  
- ④ Identify possible confounding variables resulting from differences in time or other environmental factors between different conditions.
  
- ⑤ Identify possible extraneous variables that are not likely to be confounding.
  
- ⑥ Explain the possible effects of specific extraneous and confounding variables on a study.

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## CHAPTER TWO: GRAPHS

Due Monday, December 12

### 2-A Types of Graphs

time series plot • scatter plot • bar graph • pareto chart • circle graph

#### ① Choose an appropriate type of graph for two variables.

① Choose and justify an appropriate type of graph to display results for each of the following.

- a) What are kids' favorite seasons?
  
- b) How much do adults pay for food each month?
  
- c) How much rainfall has Scotts Valley had in each of the past 30 years?

#### ② Make a circle graph.

② Out of 70 kids, 31 preferred chocolate, 26 preferred strawberry, and 13 preferred vanilla.

3 Make a two-variable time series plot, scatter plot, or bar graph.

3 Make up realistic data and create each of the following:

a) a time series plot showing Cody's height through age 15

b) a scatter plot showing how long 25 kids of different ages could hold their breath

c) a bar chart comparing teenagers by gender on whether or not they regularly play video games

4 Make a time series plot, scatter plot, or bar graph with two independent variables.

4 Add a second independent variable to each of the graphs in 3.

## 2-B Histograms

distribution • class • frequency histogram • relative frequency histogram • uniform • bimodal • skewed

1 Make a frequency histogram.

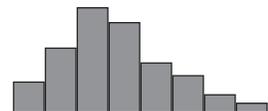
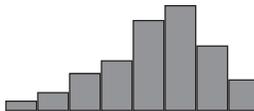
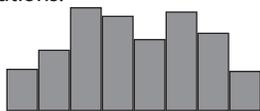
1 Make a frequency histogram for the following chapter three homework scores: 0, 11, 12, 16, 25, 25, 29, 30, 31, 34, 35, 35, 38, 38, 38, 39, 41, 41, 41, 41, 42, 42, 42, 43, 43, 43, 44, 45, 45, 45.

2 Make a relative frequency histogram.

2 Make a relative frequency histogram for the homework data in 1.

3 Describe the shape of a distribution graphed in a histogram.

3 Describe the following distributions.



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## CHAPTER THREE: CENTRAL TENDENCY AND VARIATION

Due Wednesday, December 14

### 3-A Central Tendency

sigma • mode • median • mean • trimmed mean

1 Calculate sums for data sets.

1 Calculate  $\sum(x - 10)^2$  for the data set { 15, 12, 3 }.

- ② Find the median of a data set.  
② Find the median of the data set { 40, 6, 6, 15, 24, 10 }.

- ③ Find the  $p\%$  trimmed mean of a data set.  
③ Find the 10% trimmed mean of the data set { 1, 3, 3, 5, 9, 10, 12, 12, 18, 21, 23, 30, 34, 40, 42, 50, 99 }.

### 3-B Variation

sum of squares • variance • standard deviation • coefficient of variation

- ① Calculate standard deviation, variance, and coefficient of variation.  
① Find  $\sigma^2$ ,  $s^2$ ,  $\sigma$ ,  $s$ , and the population and sample coefficient of variation for the data set { 11, 12, 14, 14, 19, 29, 34 }.

- ② Enter data into lists.  
③ Calculate mean, standard deviation, and other statistics.  
④ Distinguish between  $\sigma$  and  $s$ .  
④ Smith Safety Supplies manufactures supplies. Jackson times the burn duration of 5 emergency flares (in seconds): 812, 995, 909, 844, 960.

### 3-C Mean and Standard Deviation of Grouped Data

weighted average

- ① Calculate the mean and standard deviation of grouped data by hand.  
① In PreCalculus there were 4 D's, 9 C's, 7 B's, and 16 A's. Calculate an estimate of the class average and standard deviation, using 65 as the average D grade, 75 as the average C grade, etc.
- ② Calculate the mean and standard deviation of grouped data by using a calculator table.  
③ Calculate a weighted average.  
③ A calculus professor weights homework 10%, the midterm 40%, and the final 50%. Calculate Casey's grade if she scores 82 on the homework, 74 on the midterm, and 95 on the final.

### 3-D Percentiles and Quartiles

percentile • quartile • range • interquartile range • box-and-whisker plot • outlier • resistant measure

- ① Find the  $p^{\text{th}}$  percentile of a data set.  
① The scores on an Algebra II test were 30, 43, 50, 59, 60, 62, 62, 65, 70, 70, 72, 72, 74, 80, 81, 82, 86, 86, 86, 87, 90, 90, 91, 93, 94, 98, 101, 102, and 106. Find the 10<sup>th</sup> percentile.

② Find the quartiles and interquartile range of a data set.

② { 4, 6, 6, 8, 9, 9, 9, 9, 10, 12, 12, 19, 25 }

③ Make a box-and-whisker plot.

③ Make a box-and-whisker plot for the Algebra II test scores in ①.

④ Identify outliers in a data set.

④ Identify any outliers in the following Algebra II chapter one homework scores: 6, 11, 21, 25, 26, 27, 33, 34, 34, 35, 36, 37, 38, 43, 43, 47, 47, 48, 48, 49, 50, 51, 52, 52, 52, 53, 54, 54, 55.

⑤ Identify whether or not a measure is resistant.

⑤ Use the data set { 3, 5, 5, 9, 10, 11, 12, 12, 13, 80 } to explain why 10% trimmed mean is resistant but mean is not.

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## CHAPTER FOUR: PROBABILITY

Due Friday, December 16

### 4-A Counting Methods

multiplication principle • permutation • combination • choose • sample space

① Use a calculator to count combinations.

① State the number of combinations there are for each of the following, and list two possible combinations.

a) 3 out of 10 applicants are selected to win a scholarship.

b) 4 coins land on heads and 2 land on tails.

② Find the total number of possible outcomes in a series of events.

② State the number of possible outcomes of the following.

a) Choose 3 representatives out of 9 seniors and 2 representatives out of 8 juniors.

b) Identify the 1<sup>st</sup> place, 2<sup>nd</sup> place, 3<sup>rd</sup> place, and 4<sup>th</sup> place finisher out of 25 racers.

③ Find the size of a sample space by using permutations, if possible.

③ Use combinations to express the size of the sample space for each of the following. Then rewrite the solution using permutations if possible, or explain why not.

a) Emma chooses her 3 favorite months.

b) Emma chooses her favorite, second favorite, and third favorite month.

c) Use a 6-sided die to choose a color for each of three teams.

d) Put 6 colors in a hat and draw three of them to choose a different color for each of three teams.

## 4-B Probability of a Single Event

set • element • cardinality • intersection • union • complement • universal set • empty set • mutually exclusive • given • conditional probability

### 1 Read set notation.

1 State the following in words, given  $A$  is the set of aces and  $B$  is the set of black cards.

a)  $A$

b)  $U$

c)  $\emptyset$

d)  $|A|$

e)  $|U|$

f)  $A \cup B$

g)  $A \cap B$

h)  $|A \cap B|$

i)  $A'$

j)  $(A \cap B)'$

k)  $(A \cup B)'$

### 2 Use the size of a sample space to find the probability of an event.

2 Ryan draws two cards. Find the probability that...

a) the first card is a ace

b) both cards are aces

### 3 Find the probability of either of two events.

3 Find the probability of a card being as stated.

a) red or an ace

b) a 9 or an ace

### 4 Find probabilities based on given information.

4 Find the following probabilities for Ryan's two cards.

a) The second card is an ace.

b) The second card is an ace, given the first card is an ace.

### 5 Make a table to calculate conditional probabilities for two events.

5 10% percent of the population has a certain disease. A test for this disease gives a positive result for 70% of people who have the disease and for 20% of people who do not. Show this information in a table, and use it to calculate the probabilities below.

a) a person tests positive

b) a person has the disease and tests positive

c) a person has the disease, given he or she tests positive

## 4-C Probability of Multiple Events

dependent events • independent events

### 1 Identify whether events are dependent or independent.

1 Savannah rolls three dice, checking for a 6 each time, and she draws two cards, checking for an ace each time.

② Calculate the probability of multiple events.

- ② Cody draws five cards. Calculate the probability that the first two cards are aces and the fourth card is not an ace.

③ Calculate the probability of an event that can occur in different ways.

- ③ Sarah grabs 3 random pens from a drawer with 6 black pens, 4 red pens, and 1 purple pen. What is the probability that they are all the same color?

④ Calculate the probability of an event that can occur in different orders.

- ④ What is the probability that Sarah's 3 pens, above, are all different colors?

⑤ Calculate the probability of at least or at most  $x$  out of  $n$  occurrences of an event.

- ⑤ Find the probability that out of five 6-sided dice, at least two will roll a 6.

#### 4-D Expected Value

expected value

① Calculate the expected value of a casino event.

- ① Neil pays \$5 to draw a card. He wins \$10 if it is a king, and he wins \$100 if it is a black ace.

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## CHAPTER FIVE: DISCRETE PROBABILITY DISTRIBUTIONS

Due Monday, December 19

### 5-A Introduction to Probability Distributions

discrete variable • continuous variable • probability distribution

① Classify a variable as discrete or continuous.

- ① a) shoe size                      b) foot length

② Determine whether or not a discrete variable will be treated as continuous.

- ② a) number of people in a car    b) number of people in a school

③ Give the probability distribution of an event.

- ③ Show the probability distribution for a coin flip.

④ Calculate the mean and standard deviation of a discrete probability distribution.

- ④ A spinner has 50 spaces. The gold one is worth 50 points, the 3 red ones are each worth 20 points, and the 9 brown ones are each worth 10 points.

## 5-B Geometric and Binomial Probabilities

geometric probability distribution • binomial probability distribution • binomial experiment

- ① Calculate the probability that the first success will be on the  $n^{\text{th}}$  trial.
  - ① Natalie is predicting rolls on 8-sided dice. Find the probability that her first successful prediction will be after her fourth roll.
  
- ② Calculate the probability that the first success will be after the  $n^{\text{th}}$  trial.
  - ② Natalie is predicting rolls on 8-sided dice. Find the probability that her first successful prediction will be on her fourth roll.
  
- ③ Calculate the probability of getting exactly  $r$  successes in a binomial experiment.
  - ③ Out of five 6-sided dice, exactly three roll a 6.
  
- ④ Explain the components of a binomial experiment calculation.
  - ④ Out of five 6-sided dice, exactly three roll a 6.
  
  
  
  
  
  
  
  
  
  
- ⑤ Calculate the probability of getting at most or at least  $r$  successes in a binomial experiment.
  - ⑤ Out of seven 4-sided dice, at least three roll a 4.
  
  
  
  
  
  
  
  
  
  
- ⑥ Calculate binomial probabilities with the calculator.
  - ⑥ Out of five 6-sided dice, more than two roll a 6.

## 5-C Binomial Distributions

- ① Make a histogram for a binomial probability distribution.
  - ① Give the probability distribution for predicting 4 rolls on a 4-sided die.
  
  
  
  
  
  
  
  
  
  
- ② Calculate the mean and standard deviation for number of successes in a binomial distribution.
  - ② Find the mean and standard deviation for number of correct predictions out of 4 rolls on a 4-sided die.