Statistics Chapter 12: Review B – KEY

1. Give a definition and example in your own words for each of these concepts.

   a. Law of Large Numbers

   After repeated trials over a very, very long time, the probability of an event will tend to draw closer to the actual probability. For example, to observe that the true probability of getting heads with the flip of a coin, I would need to flip the coin for many, many times before it would become extremely close to 0.5.

   b. The non-existent law of averages

   In the short run, events will work together so that they even out. For example, if you're playing roulette, and say red 23 hasn't come up in a while, you should bet on red 23 because it's due to come up. If it hasn't appeared in a long time, it needs to occur sooner rather than later. This of course is not true.

   c. Fundamental Counting Principle (for and & or)

   If event A can occur in m ways and event B can occur in n ways, then A OR B can occur in $m + n$ ways. Also, A AND B can occur in mn ways. Let event A be draw a jack from a standard deck and event B be roll an even number on a six-sided die. A or B can occur in $4 + 3 = 7$ ways while A and B can occur in $4 \bullet 3 = 12$ ways.

   d. Permutation

   A permutation is when we group items in a particular way and care about the order. For example, the number of possible winners in a class election for president, vice president, secretary, and treasurer is a permutation.

   e. Combination

   A combination is when we group items in a particular way but don't care about the order. For example, how many ways to group toppings on a pizza.

2. A raffle has three prizes. Explain why the chance of winning a prize is not 1 out of 3.

   P(winning) = 3/# of tickets sold

   There are just three prizes. There are most likely many raffle tickets. As long as fewer than or more than three tickets were sold, the chance of winning is not 1 out of 3.

3. Including you, there are 11 boys and 18 girls in your chemistry class.

   a. How many ways can one boy and one girl be chosen to run an errand for the teacher?

   ${}_{11}C_1 \cdot {}_{18}C_1$

   $11 \bullet 18 = 198$ ways to choose one boy and one girl

   b. How many ways can one boy or one girl be chosen?

   11 29

   ~~12~~ + 18 = ~~30~~ ways to choose one boy or one girl

4. There are 12 suspects of a crime. How many ways can 5 of them be arranged in a lineup?

   ${}_{12}P_5 = ~~792~~$ ways that five of them can be arranged in a lineup.

   95,040

5. A committee of five members is to be randomly selected from a group of nine freshmen and seven sophomores.

   a. How many different committees of three freshmen and two sophomores can be chosen?

   $_9C_3 \bullet {}_7C_2 = 1764$ ways three freshmen and two sophomores can be chosen.

   b. What is the probability that Jake, a freshman, is on a randomly chosen committee?

$$P(\text{Jake is on a committee}) = \frac{\#\text{ of ways Jake can be chosen and 4 others}}{\#\text{ of possible committees with 3 freshmen and 2 sophomores}}$$
$$= \frac{{}_1C_1 \bullet {}_8C_2 \bullet {}_7C_2}{1764} = \frac{588}{1764} \approx 0.3333$$

6. Thinking about 5-card poker hands…

   a. How many hands are possible?

   $_{52}C_5 = 2{,}598{,}960$ possible 5-card hands.

   b. How many hands with exactly 2 aces are possible?

   $_4C_2 \bullet {}_{48}C_3 = 103{,}776$ hands with exactly 2 aces.

   c. How many hands are possible with exactly 2 or 3 Aces?

   $_4C_2 \bullet {}_{48}C_3 + {}_4C_3 \bullet {}_{48}C_2 = 108{,}288$ hands with 2 or 3 Aces.

7. Passwords for a cell phone use two letters followed by two digits followed by a special symbol (@, # , $, %, or &), as in AW52$.

   a. How many different passwords are possible?

   $26 \bullet 26 \bullet 10 \bullet 10 \bullet 5 = 338{,}000$ different passwords

   b. What's the probability that a password generated randomly will contain your first and last name initials, in order?

$$P(\text{Password will contain initials}) = \frac{\#\text{ of possible ways initials can be used in a combination}}{\#\text{ of possible passwords}}$$
$$= \frac{1 \bullet 1 \bullet 10 \bullet 10 \bullet 5}{338{,}000} = \frac{500}{338{,}000} \approx 0.0015$$

8. Seven African American, 5 Asian, 6 Hispanic, and 5 White students are finalists to participate in a summer enrichment camp. From these students, 6 winners will be selected randomly. What's the probability there will be no Hispanics among the winners? If this occurs, will you suspect foul play? Explain.

$$P(\text{no Hispanics}) = \frac{\#\text{ of possible combinations with no Hispanics}}{\#\text{ of possible combinations of winners}}$$
$$= \frac{{}_{17}C_6}{{}_{23}C_6} = \frac{12{,}376}{100{,}947} \approx 0.1226$$

No. While however unlikely, it may still occur due just to random chance.

Name: _____

Practice Multiple Choice Question Bank – Chapter 12

1. A fair coin has come up "heads" 10 times in a row. The probability that the coin will come up heads on the next flip is

   A) less than 50%, since "tails" is due to come up.
   B) 50%.
   C) greater than 50%, since it appears that we are in a streak of "heads."
   D) It cannot be determined.

2. Which two events are most likely to be independent?

   A) registering to vote; being left-handed
   B) having a car accident; having a junior license
   C) doing the Statistics homework; getting an A on the test
   D) having 3 inches of snow in the morning; being on time for school

3. Which two events are most likely to be independent?

   A) having a flat tire, and being late for school
   B) getting an A in math, and getting an A in Physics
   C) having a driver's license, and having blue eyes
   D) having a car accident, and having 3 inches of snow today

4. A serial number on an implanted medical device consists of 3 letters followed by 4 digits. The first number cannot be zero. How many serial numbers are possible?

   A) 117 B) 78,624,000 C) 158,184,000 D) 175,760,000

   $26 \cdot 26 \cdot 26 \cdot 9 \cdot 10 \cdot 10 \cdot 10$

5. A sandwich shop offers a lunchtime meal combo, consisting of a sandwich, a side dish, and a drink. You can choose from (turkey, ham, or veggie sandwiches) (potato chips or salad) as a side dish, and (coffee, soda, or iced tea) to drink. How many different lunch combos are possible?

   A) 3 B) 8 C) 18 D) 36

   3 insides x 2 sides x 3 drinks

6. Which of the following expressions are equal?

   I. ${}_{12}P_3$ II. ${}_{12}C_3$ III. ${}_{12}C_9$ IV. $\frac{{}_{12}P_3}{3!}$

   A) I and II only B) II and III only C) II and IV only D) I, III, and IV only

7. The Model United Nations club at your school consists of 4 juniors and 8 seniors. Four students will be chosen at random to represent the school at a state conference. What is the probability that the students chosen will consist of 1 junior and 3 seniors?

A) 0.11 B) 0.12 C) 0.33 D) 0.45

$\frac{{}_4C_1 \times {}_8C_3}{{}_{12}C_4} = \frac{224}{495} = .45$

8. Which of the following situations involves a permutation?

A) a game show host selects 4 people from the audience to play the game
B) students are assigned seats in study hall
C) 5 law interns are chosen to help a lawyer research a big case
D) a large group of friends at dinner will choose 3 desserts from dessert menu to share

9. Which of the following situations involves a combination?

A) a lottery player selects 6 numbers to play out of 48
B) a bank customer chooses a new ATM code
C) a survey asks respondents to rank political candidates in order of preference
D) every summer, the school custodian changes the locker combinations

Multiple Choice Question Bank – Chapter 12 – Key

1) B
2) A
3) C
4) C
5) C
6) D
7) D
8) B
9) A