

Math 247: Test 2

Name: _____

In-class test _____/80 points

Take home test _____/20 points

On all problems involving probability, express your answer as a fraction, decimal, and percent.

1. (2 pts) Which of the following numbers could NOT be probabilities? Circle your answer(s).
- a) 0.724 b) 1.043 c) 0.125 d) -0.432 e) 1
2. (a) What is the probability of getting heads, if you flip a fair coin once? Express your answer as a fraction, decimal, and percent.

(b) If you flipped a fair coin 1000 times, how many heads would you expect to get?

(c) Suppose you actually DID flip a coin 1000 times and got heads 512 times. What is the probability of getting heads based on this actual experiment?

(d) Explain why the answers in (a) and (c) aren't the same and include what you would have to do, in terms of coin flipping, to have the actual coin flip probability get closer to the answer in part (a).

(e) What is the name of the Law that relates the actual coin flip probabilities to the theoretical value?

3. (5 pts) Use your knowledge of the world to determine whether the following events are independent:

A = a person is tall B = a person plays basketball C = a person drives a white car

A and B are independent A and C are independent B and C are independent

4. (4 pts) Suppose Event A is that a person is sleeping. Give an example of another event, Event B, that is mutually exclusive to Event A.

Event B = _____

5. (a) If Event $A = \text{Rain today}$, what is the complement of A ? $A^C =$ _____
- (b) If $P(A) = .80$, what is $P(A^C)$? $P(A^C) =$ _____
6. Some dice are 8- sided. If you rolled an 8-sided die once and flipped a coin, what is the probability you would get a five on the die OR tails on the coin?
7. If you draw one card from a deck of playing cards (52 cards, 4 suits of hearts, spades, clubs, diamonds, 13 cards in each suit), what is the probability you'll draw either a queen or a heart?
8. (3 pts) The Humane Society of the United States reported that 25% of households own a dog and 42% own a cat. Would it be correct to say that 67% of households own a dog or a cat? YES, correct NO, not correct

Explain your answer. Include the "OR" formula as part of your answer.

9. (3 pts) Suppose a bag contains 5 red marbles and 15 yellow ones.
- (a) If you select one marble, what is the probability of getting a red one?
- (b) If you sample two marbles, with replacement, what is the probability of getting two red marbles?
- (c) If you sample two marbles, without replacement, what is the probability of getting two red marbles?

10. (15 pts) A survey of randomly selected adults found that 11% of the men said they thought adult children shouldn't live with their parents. Let N = no kids at home, and K = kids okay at home.
- If two men meet, list all of the possible outcomes of their opinions. Use N and K for this.
 - What is the probability that both of them will have the opinion that it's okay to have adult children live with their parents?
 - If two men meet, what is the probability they will disagree on this issue.
 - To find the values in parts (b) and (c), you have to assume the opinions of the two men are independent. If the men were allowed to discuss the issue first, THEN were asked whether or not adult children are okay at home, would their answers still be independent? Briefly explain.

11. (20 pts) The given table shows the data relating sex and handedness for 121 students. Use the table to answer the following questions:

	Handed	
	Left	Right
Female	7	46
Male	5	63

- What percentage of the students are left handed?
- What percentage of the female students are left handed?
- Based on just your answers to (a) and (b), is there an association in this group of students between being left-handed and being female? Explain your answer.(Note: Do NOT do a Chi-Square Test here. Just examine your answers from (a) and (b).)
- What percentage of students are either male or right-handed?

12. **Vitamin C** A study (double-blind) was done investigating the therapeutic value of vitamin C (ascorbic acid) for treating common colds. The study (done in 1971 by Linus Pauling) was conducted during a 2-week period on a sample of 279 school children in a skiing camp in the Swiss Alps. The participants were split into two groups, one taking 1 gram of vitamin C per day and the other taking a placebo. At the end of two weeks the researchers assessed who had gotten a cold and who hadn't.

These are the data for this study:

Work for Expected Counts:

	Cold	No Cold	
Placebo	31	109	
Vitamin C	17	122	

Using the data in the table, do a Chi-Square Hypothesis Test to see whether taking Vitamin C is associated with prevention of colds. Use $\alpha = .05$

- (a) Hypothesize: Write the Null and Alternative Hypotheses

- (b) Prepare: Level of significance = _____ Find and fill in the expected counts. Show work

What do you have to check regarding expected counts to make sure the Chi-Square Test is valid?

- (c) Find χ^2 and the degrees of freedom (DF) by hand. Show work!

$\chi^2 =$ _____ DF = _____

- (d) Interpret: The Minitab result from a Chi-Square Association Test is given to the right. Use this to write the conclusion to the hypothesis test.

	Chi-Square	DF	P-Value
Pearson	4.811	1	0.028

Conclusion:

- (e) Does this study show that watching taking vitamin C can cause a reduction in colds? Yes No

Math 247: Test 2 (Take Home)

Instructions: You and one other person in this class will team up for this assignment. **Fill in the name and the % of the assignment completed by each person. Ideally this will be 50/50; i.e., you will have both contributed equally to the work. If the work load wasn't balanced (i.e., a team member didn't pull his/her weight), then some of the points will be deducted from the person who didn't work as hard.**

Team Member 1: _____ % contribution: _____ Score: _____/30

Team Member 2: _____ % contribution: _____ Score: _____/30

- This exam is due at the beginning of class on Thursday, 3/15/2018
- Your work needs to be typed. You may write in any symbols or calculations that are performed by hand, but type as much as possible.
- Your work should incorporate all of the Minitab work mentioned below; i.e., copy and paste the Minitab results into your write-up.

Scoring will be based on organization of your work (10%), accuracy (60%), and thoughtful, well-written answers (30%).

Two problems:

1. (10 points) You'll need to purchase a bag of Skittles for this first problem. The proportions of colors for Skittles are supposed to be equal at the factory, but of course we don't expect individual bags to all be exactly, perfectly the same, right?

Perform and write up a Chi-Square Goodness of Fit Hypothesis Test to determine whether your bag of Skittles provides evidence that the colors are not distributed evenly at the Skittles factory. Model your write up after the M&M problem done in class (Section 10.2 notes). Be sure to include all four of the steps for the hypothesis test in your write-up!

2. (20 points) You are going to perform a Chi-Square Hypothesis Test for Association for two categorical variables of your choice.

Pick the two categorical variables that you will test for association. **Write a sentence or two explaining why you chose those variables to test for association; why are they interesting to you and do you have an idea about whether or not they're associated just by using your knowledge of the world?**

Examples: Gender vs. Happiness, Major vs. Stress Level, Ethnicity vs. Political Party, College Athletics Participation vs. Relocation for College (i.e., hometown is SLO or not SLO)

Decide on the categories within each variable and keep them to two or three at the most.

Example: Major vs. Stress Level. For "Major" you don't want to list a bazillion different majors (!), so break that down into broad categories. For instance, you could just have "Major" divided into your major and not your major (e.g., Nursing/Not Nursing),

For "Stress Level", the categories could be Not Stressed, Somewhat Stressed, Very Stressed. Don't break it down any further than that; i.e., don't make any more than 3 categories.

Set up a Two-Way Table and gather 100 observations. **Include a table like this in your write up.**

Example of Major vs. Stress Level Two-Way Table.

		Stress Level		
		Not Stressed	Somewhat Stressed	Very Stressed
Major	Nursing			
	Not Nursing			

Perform and **write-up a Chi Square Hypothesis Test (use Minitab for the calculations!)** to test whether your data provide evidence that there is an association between those two variables. Include all four steps of the hypothesis test.

Write a paragraph reflecting on and critiquing your study. What did you learn?