Name:

Group _____

1. For all groups. It is important that you understand the difference between independence and disjoint events. For each of the following situations, provide and example that is not in the book or on this worksheet to exemplify the situation.

a) Give an example of two events that are neither disjoint nor independent.

b) Give an example of two events that are disjoint, but not independent.

c) Give an example of two events that are independent, but not disjoint.

d) Give an example of two events that are both independent and disjoint.

2. Theoretical differences between disjoint and independent probabilities.

a) If two events are disjoint, determine their joint probability.

b) If two events with positive probability are independent, explain why their joint probability is not0. The conclusion is that these two events can't be disjoint. Please use a mathematical proof and explain in words.

3. Is the following statement true or false? If true, provide the proof, if false, provide a counter example If events A and B are independent and events B and C are independent, then events A and C are independent."

4. Roll a red 4-sided die and a white 4-sided die.

A: The red die is 1 B: The white die is 1 C: The sum of the two dice is 4 Which of the following are independent? Explain each answer by each of the following ways: a) $P(A \cap B) = P(A) P(B) b) P(A|B) = P(A), c)$ in words.

a) A and B

b) A and C

5. If the probability that a fuse is good in a particular batch of fuses is 0.8 and each fuse is independent of the other fuses, what is the probability that 2 fuses are bad?

6. The game of craps is played by rolling two balanced 6-sided dice. A first roll of a sum of 7 or 11 wins; a first roll of a 2, 3, or 12 loses. To win with any other first sum, the sum must be repeated before a sum of 7 is thrown. Suppose that a player rolls a sum of 4 on the first roll. Determine the probability that the player wins."

- 7. Pairwise Independence. Roll a red 4-sided die and a white 4-sided die.
- A: the red die is even B: the white die is even C: the sum of the two dice is even
- a) Show that A, B, and C are pairwise independent.

b) Show that $A \cap B$ and C are NOT independent.

8. Roll a red 6-sided die and a white 6-sided die. D: red die is 1 or 2 or 3 E: white die is 4 or 5 or 6 F: the sum of the two dice is 5 Show that $P(D \cap E \cap F) = P(D)P(E)P(F)$ but D, E and F are NOT independent. 9. Roll a die (6-sided). Let A be the event that the outcome on the die is an even number. Let B be the event that the outcome on the die is 4 or smaller. Let C be the event that the outcome on the die is 3 or larger. Please explain your answer.

a) Are A and B independent?

b) Are B and C independent?

10. From Problem 7 on Worksheet W3M concerning the deck of cards, please answer the following. Please explain your answer using conditional probabilities and in words.

a) Is drawing a 7 independent from drawing a spade?

b) Is drawing a black card independent from drawing a spade?

11. On Monday you wake up for class 45 minutes before class and the probability, that you arrive on time is 0.98. On Wednesday, you wake up for class 32 minutes before class, and the probability that you arrive on time is 0.71. On Friday, you wake up very, very late, and your probability of being on time is only 0.16. I guess you decided at the last minute that you wanted to attend the PSO ©

a) What is the probability that you were never on time?

b) What is the probability that you were on time at least 1 day? (Hint: this is related to part a)

12. While taking a probability exam, you come to three questions that you have no clue how to answer. Each question on the exam is multiple choice with the correct answer being either a, b, c, d, or e. (Your guesses are independent .)

What is the probability that:

a) you randomly guess the right answer to all three questions?

b) you randomly guess the right answer to none of the three questions?

c) you randomly guess the right answer to exactly one of the three questions?

d) you randomly guess the right answer to exactly two of the three questions?

e) Do the probabilities in parts a – d sum to 1? Why?

f) What is the probability that you pass the exam? (Passing here means you get at least 2 of the answers correct.)

13. In a very large collection of sandwiches, 40% are cheese, 45% have steak, and 15% have tofu. A person is a vegetarian and therefore samples the sandwiches randomly until finding a cheese or tofu sandwich. What is the probability that they will find a cheese sandwich before finding a tofu sandwich?