**Classical Probability**

Instructions: Refer to the accompanying handout for a summary of all the topics covered in this worksheet. Take out several sheets of paper. Put your name at the top of each page. Complete the following problems on these sheets. Show all of your work. Turn in everything at the front desk when you are finished.

1. **First Law of Probability.** Esmeralda Villalobos, Vivienne Saint Clair and Bartholomew Von Neumann are running for class president. Out of 36 students, Esmeralda gets 22 votes, Bartholomew gets 10 and poor Vivienne only gets 4 votes.

You randomly select a student from the class who voted.

a. What is the probability this student voted for Esmeralda, P( **E** ) ?

b. What is the probability this student voted for Vivienne, P ( **V** ) ?

c. What is the probability this student voted for Bartholomew, P( **B** )?

d. What is the probability this student voted for both Esmeralda and Bartholomew?

*Hint*: This is a trick question.

e. What is P( **E** ) + P ( **V** ) + P( **B** ) ? Explain in English the meaning of this result.

2. **Classical Probability.** Chewbacca's bandolier carries 12 cartridges for his bowcaster. During a firefight with the Black Sun crime syndicate, Chewbacca used 3 of his cartridges. If he randomly selects a cartridge from the remaining ones on his bandolier, what is the probability he will select an unused cartridge?

3. **More Classical Probability.** You are reading a 100 page romance novella set in a zombie apocalypse.

a. What is the probability of randomly flipping to a page and landing on a page number that ends in 9?

b. What is the probability of randomly flipping to a page and landing on a page number that ends in 5 or 0?

4. **Law of Complements.** Out of 18 people in MAT 120, 7 of them have seen a rhinoceros in person.

a. What is the probability a randomly selected MAT 120 student will have seen a rhinoceros?

b. What is the probability a randomly selected MAT 120 student will not have seen a rhinoceros?

5. **More Complements**. You flip a coin three times. What is the probability of getting at least one tail?

*Hint:* First find how many outcomes there are in this experiment. Try constructing a tree diagram where each branch of the diagram represents another flip of the coin. After you figure out the number of outcomes, find the probability of *no* *tails*. Then use the law of complements to find the probability of at least one tail.

6. **Even More Complements.** A bag of M and M's contains 30 M and M's. There are 15 green M and M's, 7 red M and M's, 7 brown M and M's and 1 orange M and M.

a. If you select an M and M at random from the bag, what is the probability of selecting a red M and M?

b. If you select an M and M at random from the bag, what is the probability of selecting an M and M that is not red?

7. **Simple Events and Compound Events.** Napoleon, Caesar and Alexander are trying to decide which general was the greatest general in history. They decide to leave it to chance. They write each of their names onto a separate sheet of paper and stick the sheets into Napoleon's famous hat. Napoleon, always a believer that fate favors the well-prepared, slips his name in three times without anyone noticing. In other words, the list of names in the hat is given by,

*{Napoleon, Napoleon, Napoleon, Caesar, Alexander}*

A. **Simple Events.** Consider the case where they select one name at random from the hat.

a. What is the probability of Napoleon being selected?

b. What is the probability of Napoleon not being selected?

B. **Compound Events.** Consider the case where they select two names from the hat with replacement, i.e. they replace the name back into the hat each time one is drawn.

a. What is the probability of selecting Napoleon in either draw?

b. What is the probability of selecting Caesar in either draw?

c. What is the probability of *only* Napoleon being selected?

d. What is the probability of Napoleon and *then* Caesar being selected?

e. What is the probability of Caesar and *then* Napoleon getting selected?

f. What is the probability of selecting *both* Caesar and Napoleon?

Hint: Consider the *part b* and *c*!

g. What is the probability of selecting either Caesar or Napoleon?

h. What is the probability of selecting neither Caesar nor Napoleon?

8. **Independence.** An exam in MAT 120 has 10 multiple choice questions. Each question has 5 possible answers. Suppose after a long night of partying, you show up to class unprepared and randomly guess on his each question.

a. What is the probability of getting a 100% on the exam?

b. What is the probability of getting a 0% on the exam?

c. What is the probability of getting at least one question right?

*Hint:* What is this event the complement of?

d. What is the probability of getting a 90% on the exam?

*Hint*: In order to get a 90%, you have to get 9 questions right. How many different ways can you get 9 questions right? What is the probability of each sequence?

9. **Law of Unions.** You take a survey of students on campus at FRCC Westminister about their preferences concerning coffee and donuts. The results are tabulated in the table below,

|  |  |  |
| --- | --- | --- |
|  | Likes Donuts | Doesn't Like Donuts |
| Likes Coffee | 30 | 50 |
| Doesn't Like Coffee | 80 | 12 |

a. What is the probability of selecting a student who likes coffee?

b. What is the probability of selecting a student who likes donuts?

c. What is the probability of selecting a student who likes doesn't like donuts?

d. What is the probability of selecting a student who likes coffee and doesn't like donuts?

e. What is the probability of selecting a student who likes coffee or doesn't like donuts?

f. Given that a student likes coffee, what is the probability of a student liking donuts?

g. Is the event of liking coffee independent of the event of liking donuts?