Student: ____________ **Date:** ____________	**Instructor:** Andreas Lazari **Course:** Math2620 F - Fall 2018	**Assignment:** Chapter 5.3-Homework

1. Fill in the blank.

   Two events E and F are ________ if the occurrence of event E in a probability experiment does not affect the probability of event F.

   Two events E and F are (1) Independent if the occurrence of event E in a probability experiment does not affect the probability of event F.

   (1)
   - ○ unusual
   - ○ disjoint
   - ● independent
   - ○ dependent

2. Fill in the blank.

   The word *and* in probability implies that we use the ________ rule.

   The word *and* in probability implies that we use the (1) multiplication rule.

   (1)
   - ● multiplication
   - ○ subtraction
   - ○ division
   - ○ addition

3. The word *or* in probability implies that we use the (1) Addition Rule.

   (1)
   - ● Addition
   - ○ Combination
   - ○ Empirical
   - ○ Multiplication
   - ○ Large Numbers

4. Determine if the following statement is true or false.

   When two events are disjoint, they are also independent.

   Choose the correct answer below.

   - ○ True
   - ● False

5. Determine whether the events E and F are independent or dependent. Justify your answer.

(a) E: A person attaining a position as a professor.
F: The same person attaining a PhD.

- ○ **A.** E and F are independent because attaining a PhD has no effect on the probability of a person attaining a position as a professor.
- ● **B.** E and F are dependent because attaining a PhD can affect the probability of a person attaining a position as a professor.
- ○ **C.** E and F are dependent because attaining a position as a professor has no effect on the probability of a person attaining a PhD.
- ○ **D.** E and F are independent because attaining a position as a professor has no effect on the probability of a person attaining a PhD.

(b) E: A randomly selected person finding cheese revolting.
F: A different randomly selected person finding cheese delicious.

- ○ **A.** E can affect the probability of F because the people were randomly selected, so the events are dependent.
- ● **B.** E cannot affect F and vice versa because the people were randomly selected, so the events are independent.
- ○ **C.** E cannot affect F because "person 1 finding cheese revolting" could never occur, so the events are neither dependent nor independent.
- ○ **D.** E can affect the probability of F, even if the two people are randomly selected, so the events are dependent.

(c) E: The rapid spread of a cocoa plant disease.
F: The price of chocolate.

- ● **A.** The rapid spread of a cocoa plant disease could affect the price of chocolate, so E and F are dependent.
- ○ **B.** The price of chocolate could affect the rapid spread of a cocoa plant disease, so E and F are dependent.
- ○ **C.** The rapid spread of a cocoa plant disease could not affect the price of chocolate, so E and F are independent.

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6. What is the probability of obtaining six heads in a row when flipping a coin? Interpret this probability.

The probability of obtaining six heads in a row when flipping a coin is 0.01563.
(Round to five decimal places as needed.)

$P(HHHHHH) = (\frac{1}{2})^6 = 0.015625$

Interpret this probability.

Consider the event of a coin being flipped six times. If that event is repeated ten thousand different times, it is expected that the event would result in six heads about 156 time(s).
(Round to the nearest whole number as needed.)

$10000 \times 0.01563 = 156.3 \approx 156$

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7. About 16% of the population of a large country is hopelessly romantic. If two people are randomly selected, what is the probability both are hopelessly romantic? What is the probability at least one is hopelessly romantic?

(a) The probability that both will be hopelessly romantic is 0.0256.
(Round to four decimal places as needed.)

$P(A_1 \cap A_2) = P(A_1) \cdot P(A_2) = (.16)(.16) = 0.0256$

(b) The probability that at least one person is hopelessly romantic is 0.2944.
(Round to four decimal places as needed.)

$P(A_1 \cup A_2) = P(A_1) + P(A_2) - P(A_1 \cap A_2) = .16 + .16 - 0.0256 = 0.2944$

8. Suppose Emerson wins 37% of all chess games.
(a) What is the probability that Emerson wins two chess games in a row?
(b) What is the probability that Emerson wins six chess games in a row?
(c) When events are independent, their complements are independent as well. Use this result to determine the probability that Emerson wins six chess games in a row, but does not win seven in a row.

$P(A_1 \cap A_2) = P(A_1) \cdot P(A_2) = (.37)(.37) = .136$

(a) The probability that Emerson wins two chess games in a row is 0.1369 .
(Round to four decimal places as needed.)

(b) The probability that Emerson wins six chess games in a row is 0.0026 . $P(6 \text{ games}) = (.37)^6 = .0025657 \approx .002$
(Round to four decimal places as needed.)

(c) The probability that Emerson wins six chess games in a row, but does not win seven in a row is 0.0016 .
(Round to four decimal places as needed.) $(.37)^6(1-.37) = .0016164 \approx 0.0016$

9. Among 20- to 25-year-olds, 37% say they have used a computer while under the influence of alcohol. Suppose five 20- to 25-year-olds are selected at random. Complete parts (a) through (d) below.

(a) What is the probability that all five have used a computer while under the influence of alcohol?

$(.37)^5 = .006934 \approx 0.0069$

0.0069
(Round to four decimal places as needed.)

(b) What is the probability that at least one has not used a computer while under the influence of alcohol?

0.9931 $P(\text{At least one has Not used}) = 1 - P(\text{None has not used}) = 1 - (.37)^5 = 0.993065 \approx 0.9931$
(Round to four decimal places as needed.)

(c) What is the probability that none of the five have used a computer while under the influence of alcohol?

0.0992 $P(\text{None of the five}) = (.63)^5 = 0.099243 \approx 0.0992$
(Round to four decimal places as needed.)

(d) What is the probability that at least one has used a computer while under the influence of alcohol?

0.9008 $P(\text{At least one has used}) = 1 - P(\text{None has used}) = 1 - (.63)^5 = 0.900756 \approx 0.9008$
(Round to four decimal places as needed.)

10. For the fiscal year 2007, a tax authority audited 1.53% of individual tax returns with income of \$100,000 or more. Suppose this percentage stays the same for the current tax year. What is the probability that two randomly selected returns with income of \$100,000 or more will be audited?

The probability is 0.000234 . $P(A_1 \cap A_2) = P(A_1) \cdot P(A_2) = (.0153)(.0153) = 0.00023409 \approx 0.000234$
(Round to six decimal places as needed.)

1. (1) independent

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2. (1) multiplication

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3. (1) Addition

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4. False

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5. B.

E and F are dependent because attaining a PhD can affect the probability of a person attaining a position as a professor.

B. E cannot affect F and vice versa because the people were randomly selected, so the events are independent.

A. The rapid spread of a cocoa plant disease could affect the price of chocolate, so E and F are dependent.

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6. 0.01563

156

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7. 0.0256

0.2944

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8. 0.1369

0.0026

0.0016

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9. 0.0069

0.9931

0.0992

0.9008

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10. 0.000234
