

**The University of Portland
Donald P. Shiley School of Engineering**

**EGR361
Analysis of Engineering Data**

HOMEWORK 3—Random Variables and Probability

Assigned: Tuesday, January 31, 2017
Due: Wednesday, February 8, 2017
Text: 3-1, 3-2, 3-3
Midterm Exam: Monday, February 20, 2017 (closed-book, 1 crib-sheet, calculator)

Problems:

- 1) Text, 3-11 (page 65)
- 2) Text, 3-13 (page 65)
- 3) Text, 3-14 (page 65)
- 4) Text, 3-17 (page 65)
- 5) A survey involving 100 random Starbucks customers indicates that 70 customers order vanilla flavored drinks, 45 order extra hot drinks, and one third of the customers ordering extra hot drinks also order vanilla flavored drinks. Let event A be a customer ordering vanilla flavored drink and event B be a customer ordering extra hot drink. Construct the Venn Diagram and calculate the following:
 - a) Find $P(A)$ and $P(B)$
 - b) Find $P(A^c)$ and $P(B^c)$
 - c) Find $P(A \cap B)$ and $P(A \cup B)$
 - d) Find $P(A|B)$ and $P(B|A)$
 - e) Are the events A and B mutually exclusive?
 - f) Are the events A and B independent?
- 6) Consider the toss of a fair die and let A be the event of rolling a prime number, B be the event of a Fibonacci number, and C be the event of a square number. Construct the Venn Diagram and calculate the following:
 - a) Find $P(A)$, $P(B)$, and $P(C)$
 - b) Find $P(A^c)$, $P(B^c)$, and $P(C^c)$
 - c) Find $P(A \cup B)$, $P(A \cup C)$, and $P(B \cup C)$
 - d) Find $P(A \cap B)$, $P(A \cap C)$, and $P(B \cap C)$
 - e) Find $P(A \cup B \cup C)$ and $P(A \cap B \cap C)$
 - f) Find $P(A|B)$, $P(B|A)$, and $P(C|B)$
 - g) Find $P(A|(B \cap C))$ and $P(A|(B \cup C))$
 - h) Are the events A, B and C mutually exclusive? If no, are any two of the three events mutually exclusive?
 - i) Are the events A, B and C independent? Are any two independent?
- 7) A bag contains 4 blue, 5 red, and 6 green identical balls. If one randomly takes out 3 balls from the bag at the same time, what is the probability that all three balls are of the same color?
- 8) A bag contains 10 identical balls numbered from 1 to 10.
 - a) If two balls are randomly drawn at the same time, what is the probability that their numbers add up to an even number?

- b) If the two balls are randomly drawn in succession, what is the probability that their numbers add up to an even number?
 - c) If the two balls are randomly drawn in succession, what is the probability that their numbers add up to a square number?
- 9) What is the probability that a baby shares the same birthday with mom and dad? (Assume all three births to be independent events and neglect leap years.)
- 10) At a high school, 330 students like listening to rock music, 220 like listening to rap music, 110 like listening to both, and 85 don't like listening to either. Construct a Venn diagram and calculate the following: (a) The probability that a student who likes listening to rock music also likes listening to rap music. (b) The probability that a student likes listening to both rock and rap music.
- 11) A survey at 24-hour fitness shows that 70% of the members like watching basketball and 20% of the members like watching basketball and soccer. What percentage of those who like basketball also like soccer?
- 12) Consider an election where three candidates A, B and C are running for office. Candidate A has a 40% chance of winning, candidate B has a 35% chance and candidate C has a 25% chance. Suppose candidate C drops out of the election. What is the probability of A winning? B winning?
- 13) A survey conducted in a random population indicates that 90% expects to live to age 60 and 50% expects to live to age 80. Given a person is 60 what is the probability that they will live to age 80?

Resources for further reading:

<https://www.mathsisfun.com/data/random-variables.html>

<https://www.mathsisfun.com/data/probability-events-mutually-exclusive.html>