3.2-3.4 Probability Topics

Section 3.2-3.4 Probability Topics

Learning Objective:

In this section, you will:

- Calculate probabilities of events, including conditional and compound events (and's, or's).
- Read and construct contingency tables to calculate probabilities.

If A and B are defined on a sample space, then: $P(A \text{ OR } B) = P(A) + P(B) - P(A \text{ AND } B)$. If A and B are **mutually exclusive**, then $P(A \text{ OR } B) = P(A) + P(B)$.

Example 1: A box contains 5 white marbles, 2 green, 8 blue, and 4 red marbles. **1 marbles** is selected.

P(green or blue) =

Example 2:

	Male	Female	Total
Scored a C or higher on the exam	28	41	
Scored a D or F on the exam	5	4	
Total			

Let A = Scored a C or higher on the exam

Let B = Scored a D or F on the exam

Let M = Male

Let F = Female

1. P(A) =
2. P(M) =
3. P(A OR M) =
4. P(A AND M) =
5. P (A|M) =

Independent Events: Two events A and B are independent if the knowledge that one occurred does not affect the chance the other occurs. For example, the outcomes of two roles of a fair die are independent events. The outcome of the first roll does not change the probability for the outcome of the second roll.

Sampling with replacement: If each member of a population is replaced after it is picked, then that member has the possibility of being chosen more than once. When sampling is done with replacement, then events are considered to be **independent**, meaning the result of the first pick will not change the probabilities for the second pick.

Sampling without replacement: When sampling is done without replacement, each member of a population may be chosen only once. In this case, the probabilities for the second pick are affected by the result of the first pick. The events are considered to be **dependent** or not independent.

If it is not known whether A and B are independent or dependent, **assume they are dependent until you can show otherwise**.

If A and B are **independent**, then $P(A \text{ AND } B) = P(A)P(B)$

If A and B are **dependent**, then $P(A \text{ AND } B) = P(A)P(B|A) = P(B)P(A|B)$

Example 3: A box contains 5 white marbles, 2 green, 8 blue, and 4 red marbles. **3 marbles** are selected.

1. Find P(All three are red) With replacement:

Without replacement:

2. Find P(The first is green, and the second two are blue) With replacement:

Without replacement:

3. Find P(all three are green) With replacement:

Without replacement:

2

Example 4: Reported use of vaping is 27.8% of 12th graders in the United States. If 4 randomly selected 12th graders are selected, find the probability that they all vape.

Example 5:

	High school	Community College	University
Male	7	13	10
Female	12	8	11

1. P(selecting a student that is in community college)
2. P(selecting a student is male AND in high school)
3. P(selecting a student is male OR in high school)
4. P(selecting male, GIVEN that it is a high school student)
5. P(selecting a high school student, GIVEN that is a male)
6. If four students are selected, find:
7. P(All are university students)

2. P(none are university students)

For more information and examples see online textbook OpenStax Introductory Statistics pages 181-198.