3.8: Chapter Review

3.1 Introduction

Key Terms:

experiment: an activity or process that has a set of well-defined results and can be repeated indefinitely

outcomes: the results of an experiment

sample space: the collection of all possible outcomes of the experiment

event: a set of certain outcomes of an experiment that you want to have happen

tree diagram: a graphical way of representing a random experiment with multiple steps using branches for outcomes

3.2 Three Types of Probability

Key Terms:

probability: the likelihood of an event happening

theoretical probability (classical approach): the probability calculated from the number of favorable outcomes divided by the total number of outcomes when each outcome has an equal probability

empirical (experimental) probability: the probability calculated by finding the relative frequency of an event from performing an experiment many times

Law of Large Numbers: as *n* increases, the relative frequency tends toward the theoretical probability

subjective probability: the probability of an event is estimated using previous knowledge and is someone's opinion

Formulas:

Theoretical Probability: $P(A) = \frac{\text{Number of ways A can occur}}{\text{Number of different outcomes in S}}$

Empirical Probability: $P(A) = \frac{\text{Number of times A occurred}}{\text{Number of times the experiment was repeated}}$

3.3 Complement Rule

Key Terms:

complementary events: events that have no outcomes in common and together make up the entire sample space

Venn diagram: a visual way to represent sets and probability using a rectangle to represent the sample space and circles to represent events

Formulas:

Complement Rule: P(*A*) + P(*A*') = 1 or P(*A*) = 1 – P(*A*') or P(*A*') = 1 – P(*A*)

3.4 Union and Intersection

Key Terms:

mutually exclusive (disjoint) events: events that cannot occur at the same time

intersection: where two events overlap and happen at the same time

union: the junction of two events including their intersection

Formulas:

Mutually Exclusive Events: $P(A \cap B) = 0$

Addition Rule for Not Mutually Exclusive Events: $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

Addition Rule for Mutually Exclusive Events: $P(A \cup B) = P(A) + P(B)$

3.5 Independent Events

Key Terms:

independent events: two events that are not related and the outcome of one event does not affect the probability of the other event

dependent events: two events that are related and the outcome of one event does affect the probability of the other event

Formulas:

Multiplication Rule for Independent Events: $P(A \cap B) = P(A) \cdot P(B)$

Probability of "at least one": P(at least one) = 1 – P(none)

3.6 Conditional Probability

Key Terms:

conditional probability: the probability of an event happening, given that another event already happened

Formulas:

General Multiplication Rule: $P(A \cap B) = P(A) \cdot P(B|A)$

Conditional Probability Rule: $P(A|B) = \dfrac{P(A \cap B)}{P(B)}$ or $P(B|A) = \dfrac{P(A \cap B)}{P(A)}$

3.7 Counting Rules

Key Terms:

Fundamental Counting Rule: the number of ways to do event 1, 2, … *n* together would be to multiply the number of ways each event can be done, $m_1 \cdot m_2 \cdot \ldots \cdot m_n$

factorial: the mathematical way to multiply a list of decreasing numbers

permutation: an arrangement of items with a specific order

combination: an arrangement of items when order is not important

Formulas:

Factorial Rule: $n! = n(n-1)(n-2)\ldots \cdot 3 \cdot 2 \cdot 1$

Permutation Rule: ${}_nP_r = P(n,r) = \dfrac{n!}{(n-r)!}$

Combination Rule: ${}_nC_r = C(n,r) = \dfrac{n!}{r!(n-r)!}$
