4.1 OVERVIEW Chapter Problem Page 137

- Probability - sometimes called the science of uncertainty (it is an attempt to measure uncertainties)

- If, under a given assumption, the probability of a particular event is extremely small, we colclude that the assumption is probably not correct.

4.2 FUNDAMENTALS OF PROBABILITY

Experiment: Any process that allows researchers to obtain observations

Sample Space: All possible outcomes of an experiment

Simple Event: Consists of a single outcome of an experiment

Event: Consists of one or more outcomes of an experiment

Probability of Event A is denoted P(A)

ROUND-OFF RULE FOR PROBABILITY: Use 3 significant digits as decimals (or use fraction form).

An event is considered unusual if its probability is less than or equal to .05.

THREE METHODS FOR FINDING PROBABILITY

1st Method: Relative Frequency Approximation

$$P(A) = \frac{\text{number of times A occurred}}{\text{number of times experiment was repeated}}$$

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2nd Method: Classical Approach- n simple EQUALLY LIKELY events

$$P(A) = \frac{\text{number of ways A can occur}}{\text{number of different simple events in the experiment}} = \frac{s}{n}$$

*****When rolling a die, what is the probability of getting a multiple of three?**

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Law of Large Numbers: As a procedure is repeated again and again, the relative frequency probability of an event tends to approach the actual probability.

3rd Method: Subjective Probabilities

The probability of a certain event is found by simply guessing or estimating its value based on knowledge of the relevant circumstances.

Example: What is the probability of rain within the next 30 minutes?

Probability Values

- Range from 0 to 1 $\quad 0 \leq P(A) \leq 1$
- Probability of **Impossible Event** is 0
- Probability of **Certain Event** is 1

Tree Diagrams: Multiple Births - GGG, GGB, etc. for a 3-child family.

Use a **tree diagram** to list the possible outcomes.

What is the probability of getting exactly one girl among three children?

Complementary Events

The complement of event A, denoted by $\overline{A}$, consists of all outcomes in the sample space in which event A does not occur. Together A and $\overline{A}$ make up the entire sample space.

$$\text{So: } P(A) + P(\overline{A}) = 1$$

$$\text{Therefore: } P(A) = 1 - P(\overline{A}) \quad \text{and} \quad P(\overline{A}) = 1 - P(A)$$

Example:

In a class of 20 students, 12 of them are girls. If we select one student at random, what is the probability that we do not select a girl?

Example:

In a family of 3 children, what is the probability of

a) at least one boy?

b) at least one of each gender?

Odds

Given: a is the number of ways that A occurs and b is the number of ways A does not occur
Then: $n = a + b$, and the

Odds in Favor of A = a : b ("a to b")
Odds Against A = b : a ("b to a")

Favor	Against	Total
a	**b**	**n**

Examples:

a) When rolling a die, what are the odds in favor or rolling a 1?

b) When rolling a die, what are the odds against rolling a number greater than or equal to 5?

c) If $P(A) = 3/8$, find the odds in favor of A.

d) If the odds in favor of A are 4:15, find P(A).

Payoff odds describe the relationship between the bet and the amount of the payoff.
They are not the same as the actual odds.
Payoff Odds Against A = (net profit) : (amount bet)

Examples:

Explain the meaning of the following payoff odds against A:
a) 5 : 1

b) 7 : 2

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