

4.3 ADDITION RULE

Compound Event Union of 2 or more simple events

$P(A \text{ or } B) = P(A \text{ occurs or } B \text{ occurs or BOTH occur}) \dots$ inclusive or

Example 1 Consider a deck of cards - Find each or the following:

$P(\text{Heart or Spade})$ vs. $P(\text{Heart or Jack})$

Example 2 Crime Study

	Homicide	Robbery	Assault	Totals
Stranger	12	379	727	1118
Acquaintance or Relative	39	106	642	787
Unknown	18	20	57	95
Totals	69	505	1426	2000

a) Probability Assaulted or Robbed (Mutually Exclusive sets)

$$P(A \text{ or } R) = \frac{1426}{2000} + \frac{505}{2000} = \frac{1931}{2000} = .966$$

$$P(A \text{ or } R) = P(A) + P(R)$$

b) Probability Robbed or Victimized by a Stranger (NOT Mutually exclusive sets)

$$P(R \text{ or } S) = \frac{505}{2000} + \frac{1118}{2000} - \frac{379}{2000} = \frac{1244}{2000} = .622 \text{ or } \frac{379+106+20+12+727}{2000}$$

$$P(R \text{ or } S) = P(R) + P(S) - P(R \text{ and } S)$$

The Addition Rule

$$P(\mathbf{A \text{ or } B}) = P(\mathbf{A}) + P(\mathbf{B}) - P(\mathbf{A \text{ and } B})$$

IF A and B are **Disjoint**, then $P(\mathbf{A \text{ or } B}) = P(\mathbf{A}) + P(\mathbf{B})$
because $P(\mathbf{A \text{ and } B}) = 0$

Disjoint (Mutually Exclusive) Events cannot occur simultaneously.

VENN Diagrams can be used to depict mutually exclusive events and not mutually exclusive events. See figures 4-3 and 4-4 on page 155.

*****#6, pg. 156** Test for disjoint events.

*****#12, pg. 156**

Tables : Organizing information in a table can help with some problems.

*****#18, pg. 157**

*****#20, pg. 157**

*****Now try to set up a table for #'s 33 and 34, pg. 158**

Complementary Events

The complement of event A, denoted by \bar{A} , consists of all outcomes in which event A does not occur.

Since $P(A) + P(\bar{A}) = 1$ then $P(A) = 1 - P(\bar{A})$ and $P(\bar{A}) = 1 - P(A)$

Example: In a survey of families with 4 children, what is the probability of selecting a family that has at least 1 boy.

$$P(\text{At Least 1 boy}) = 1 - P(\text{No boys}) = 1 - \frac{1}{16} = \frac{15}{16}$$

***#14, pg. 157

More examples:

If $P(A) = \frac{1}{4}$ $P(B) = \frac{1}{3}$ and $P(A \text{ and } B) = \frac{1}{5}$, find:

a) $P(A \text{ or } B)$

b) $P(\bar{A})$

c) $P(\bar{B})$

d) $P(\overline{A \text{ or } B})$

Probability birthday in August or September

Probability birthday is 15th or in September

*****#22, pg. 158**

*****#26, pg. 158**

4.2 Summary — Probability (round to 3 significant digits)

- Experiment (any process to obtain observations)
- Sample Space (all possible outcomes of an experiment)
- Simple Event (single outcome of an experiment)
- Event (one or more outcomes of an experiment)
- Relative Frequency Approximation Method (experimental)

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

- Classical Approach for n-equally likely events (theoretical)

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

- Law of large numbers
- Tree diagrams
- Probability values : $0 \leq P(A) \leq 1$
- Impossible and Certain Events
(examples within the experiment of rolling a 1 — 6 die)

- Odds in favor: $O(A) = a : b$,

favor	against	total
a	b	n

- Odds against: $O(\bar{A}) = b : a$
- Given the odds, find the probability
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- For bets, the odds against an event = (net profit) : (amount bet) = payoff

4.3 Summary

- Compound Events (union of two or more simple events)
- Disjoint Events (cannot occur simultaneously)
- Venn Diagrams
- $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$
- For disjoint events: $P(A \text{ or } B) = P(A) + P(B)$
- Organizing information in a table
- Complementary events: $P(A) + P(\bar{A}) = 1$, $P(A) = 1 - P(\bar{A})$