

Addition Rule of Probability

Lecture 10

Dated:

Rule 1: For Mutually Exclusive Events

When two events A and B are mutually exclusive, the probability of A or B will occur is

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

$$P(A \cup B) = P(A) + P(B)$$

Rule 2: For Overlapping Events

When two events A and B are overlapping, the probability of A or B will occur is

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

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

A city has 9 coffee shops: 3 Starbucks, 2 Caribou Coffees, and 4 Crazy Mocho Coffees. If a person selects one shop at random to buy a cup of coffee, find the probability that it is either a Starbucks or Crazy Mocho Coffees.

Solution:

$$P(\text{Starbucks or Crazy Mocho}) = P(\text{Starbucks}) + P(\text{Crazy Mocho})$$

$$P(A \cup B) = \frac{3}{9} + \frac{4}{9}$$

$$P(A \cup B) = 0.778$$

In a statistics class there are 18 juniors and 10 seniors; 6 of the seniors are females, and 12 of the juniors are males. If a student is selected at random, find the probability of selecting the following.

a. A junior or a female

b. A senior or a female

c. A junior or a senior

Solution: Organize Data in Table form

	Females	Males	Total
Seniors	6	4	10
Juniors	6	12	18
Total	12	16	28

a. A junior or a female

$$P(\text{Junior or Female}) = P(\text{Junior}) + P(\text{Female}) - (\text{Junior and Female})$$

$$P(J \cup F) = P(J) + P(F) - P(J \cap F)$$

$$P(J \cup F) = \frac{18}{28} + \frac{12}{28} - \frac{6}{28} = \frac{24}{28} = \frac{6}{7}$$

b. A Senior or a female

$$P(\text{Senior or Female}) = P(\text{Senior}) + P(\text{Female}) - (\text{Senior and Female})$$

$$P(S \cup F) = P(S) + P(F) - P(S \cap F)$$

$$P(S \cup F) = \frac{10}{28} + \frac{12}{28} - \frac{6}{28} = \frac{16}{28} = \frac{4}{7}$$

c. A junior or a Senior

$$P(\text{Junior or Senior}) = P(\text{Junior}) + P(\text{Senior}) - P(\text{Junior and Senior})$$

$$P(J \cup S) = P(J) + P(S) - P(J \cap S)$$

$$P(J \cup S) = \frac{18}{28} + \frac{10}{28} - \frac{0}{28} = \frac{28}{28} = 1$$

Endangered Species The chart below shows the numbers of endangered and threatened species both here in the United States and abroad.

	Endangered		Threatened		Total
	USA	Foreign	USA	Foreign	
Mammals	68	251	10	20	349
Birds	77	175	13	6	271
Reptiles	14	64	22	16	116
Amphibian	11	8	10	1	30
	170	498	55	43	766

Choose one species at random. Find the probability that it is

- a. Threatened and in the United States b. An endangered foreign bird**
- c. A mammal or a threatened foreign species**

Rule: For Three Events

For three events A , B and C , the probability of A or B or C will occur is

$$P(A \text{ or } B \text{ or } C) = P(A) + P(B) + P(C) - P(A \cap B) - P(A \cap C) - P(B \cap C) + P(A \cap B \cap C)$$

$$P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(A \cap C) - P(B \cap C) + P(A \cap B \cap C)$$

Selecting a Card If one card is drawn from an ordinary deck of cards , find the probability of getting the following.

- a. A king or a queen or a jack**
- b. A club or a heart or a spade**
- c. A king or a queen or a diamond**

$$P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(A \cap C) - P(B \cap C) + P(A \cap B \cap C)$$

In a hospital unit there are 8 nurses and 5 physicians ; 7 nurses and 3 physicians are females. If a staff person is selected , find the probability that the subject is a nurse or a male.

	Females	Males	Total
Nurses	7	1	8
Physicians	3	2	5
Total	10	3	13

A single card is drawn at random from an ordinary deck of cards. Find the probability that it is either an ace or a black card.