MATH 3307
Lesson 8

Basic Probability Models

- The **probability** of any outcome of a random phenomenon is the proportion of times the outcome would occur in a very long series of repetitions.

- The **sample space** of a random phenomenon is the set of all possible outcomes.

- An **event** is an outcome or a set of outcomes of a random phenomenon. It is a subset of the sample space. A **simple event** is an event consisting of exactly one outcome.

Computing Probability

- To compute the probability of some event *E* occurring, divide the number of ways that *E* can occur by the number of possible outcomes the sample space, *S*, can occur:

$$P(E) = \frac{n(E)}{n(S)}$$

Basic Rules of Probability

1. All events have a probability between zero and one. $0 \leq P(E) \leq 1$

2. All possible outcomes together must have a probability of one. $P(S) = 1$

3. Complement Rule: For any event E, $P(E^c) = 1 - P(E)$

4. Addition Rule: If A and B are disjoint events, then $P(E \cup F) = P(E) + P(F)$

5. If E and F are **any** events of an experiment, then $P(E \cup F) = P(E) + P(F) - P(E \cap F)$

You are selecting one card from a standard deck of 52 cards:

(What Rule is being applied here?)

What is the probability that the card is red or a club?

What is the probability that the card is a queen or a black card?

What is the probability that the card is an emperor?

What is the probability that the card is not a spade?

What is the probability that the card is a diamond, heart, spade or club?

Examples:

If 5 marbles are drawn at random all at once from a bag containing 8 white and 6 black marbles, what is the probability that 2 will be white and 3 will be black?

Examples:

The qualified applicant pool for six management trainee positions consists of seven women and five men.

a. What is the probability that a randomly selected trainee class will consist entirely of women?

b. What is the probability that a randomly selected trainee class will consist of an equal number of men and women?

Examples:

A sports survey taken at UH shows that 48% of the respondents liked soccer, 66% liked basketball and 38% liked hockey. Also, 30% liked soccer and basketball, 22% liked basketball and hockey, and 28% liked soccer and hockey. Finally, 12% liked all three sports.

a. What is the probability that a randomly selected student likes basketball or hockey? Solve this by also using an appropriate formula.

Examples:

A sports survey taken at UH shows that 48% of the respondents liked soccer, 66% liked basketball and 38% liked hockey. Also, 30% liked soccer and basketball, 22% liked basketball and hockey, and 28% liked soccer and hockey. Finally, 12% liked all three sports.

b. What is the probability that a randomly selected student does not like any of these sports?