**10.1 Introduction to Probability – Overview**

**Definitions / Key Ideas**

**Experiment (trial)** –The process by which a random observation / outcome is generated.

* Example: Flip a coin, roll a die, gender of a child

**Outcome** – Any possible individual observation of that experiment, like the smallest pieces.

* Example: Flip a coin once, Heads or Tails; Rolling a die, 1 2 3 … 6; Gender, Boy or Girl

**Sample Space, *S*** – The set of all possible outcomes of an experiment.

* Example: Flip a coin twice, S = {HH, HT, TH, TT}

**Tree diagram** – Uses branches to indicate all possible outcomes at each stage for an experiment.

* Each path of branches in a tree diagram indicates a single possible outcome for the experiment.

**Event, *E*** –Any collection of possible outcomes of an experiment. In other words, any subset of S.

* Example: Flip a coin twice: A = HH, A = HH or HT, A = {TT, HT, TH}, etc.

**Example**: Roll a pair of 4-sided die, we are interested in the sum of the two dice. Using the proper notation:

Write the sample space:

Write the event of a number less than 6:

Write the event of an even number:

**Two Ways to Calculate Probability** Probability = Likelihood of an event occurring 0 Probability 1

NEVER ALWAYS

occurs occurs

1) Classical Probability (Theoretical)

(if all outcomes are equally likely)

* Examples: Suppose we are randomly selecting a single card from a standard 52-card deck.

1. Find the probability of a red card.
2. Find the probability of a King.
3. Find the probability of a Heart or a 10.
4. Find the probability of a card that is not a Club.

2) Empirical Probability

(if all outcomes are based on an experiment)

* Examples: Suppose we collected data on majors of MATH 125 students and are randomly selecting a single student.

|  |  |
| --- | --- |
| **Major** | **Number of Students** |
| Math | 23 |
| Chemistry | 15 |
| Art | 18 |
| English | 20 |

1. Find the probability the student is a Math major.
2. Find the student is not a Math major.
3. Find the probability the student is an Art or Chemistry major.
4. Find the probability the student is a Math, Chemistry or English major.

**Example:** An experiment is performed where a fair 4-sided die is rolled and then a fair 3-color spinner is spun. The possible outcomes for each event are 1, 2, 3, and 4 for the 4-sided die and red (R), blue (B), and yellow (Y) for the 3-color spinner.

a) Identify the sample space for this experiment.

b) Find the probability of rolling a 3. c) Find the probability of an even number and R.

d) Is this a classical or empirical probability?