Section 7.1: Experiments, Sample Spaces and Events

Definitions: An experiment is an activity that has observable results. An outcome or sample point is a result of the experiment. The sample space, denoted $\mathcal{S}$, is the set of all possible outcomes of the experiment. Each repetition of an experiment is called a trial.

An event is a subset of a sample space. An elementary (simple) event is an event that has a single outcome. The empty set is called the impossible event. The sample space is called the certainty event. Mutually exclusive means the same as disjoint.

Example: A box has 3 red items, 4 green items, 2 purple items, and a black item. One item is drawn from the box and the color is noted. What is the sample space?

$$\mathcal{S} = \{ r, y, p, b \}$$

Example: Roll a 4 sided die and pick a ball from a box that contains 3 red and 2 green. The number rolled and the color of the ball are recorded. What is the sample space?

$$\mathcal{S} = \{(1,r), (2,r), (3,r), (4,r), 1g, 2g, 3g, 4g\}$$
Example: A box has 3 red items, 4 green items, and a black item. Two items are drawn in succession from the box without replacing the item drawn. The colors of the items are noted. What is the sample space?

\[ S = \{rr, rg, rb, gr, gb, br, bg\} \]

Example: A four sided die is rolled. If a four or a one is rolled the die is rolled a second time. The total sum of the numbers rolled is recorded.

A) What is the sample space.

\[ S = \{2, 3, 4, 5, 6, 7, 8\} \]

B) Give the event, E, that a odd sum was recorded.

\[ E = \{3, 5, 7\} \]

C) Give the event, F, that a sum greater than 5 was recorded.

\[ F = \{6, 7, 8\} \]

D) Determine if E and F are mutually exclusive.

\[ E \cap F = \emptyset \]

\[ \text{NO!} \]
Example: Two coins are drawn, without replacement, from a bag that contain 3 quarters, 4 dimes and 1 fifty-cent piece. The dollar amount is recorded. What is the sample space?

\[
\begin{array}{ccc}
\text{Q} & \text{D} & \text{F} \\
2 & 0 & 0 \\
0 & 2 & 0 \\
1 & 1 & 0 \\
1 & 0 & 1 \\
0 & 1 & 1 \\
\end{array}
\]

\[
\text{dollar amount}
\]

\[
\begin{array}{c}
.50 \\
.20 \\
.35 \\
.75 \\
.60 \\
\end{array}
\]

\[
S = \{.5, .2, .35, .75, .6\}
\]