Section 1.3: Sample Spaces and Events

Definitions: An experiment is an activity that has observable results. An outcome is the result of the experiment.
The sample space, denoted S, of an experiment 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.

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.

A) What is the sample space?

\[ S = \{ r, g, p, b \} \]

B) Give two events for the sample space that are mutually exclusive.

\[ E = \{ r, g \} \]
\[ F = \{ p \} \]
Example: A eight sided die is rolled and the result is recorded. What is the sample space?

\[ S = \{1, 2, 3, 4, 5, 6, 7, 8\} \]

Example: A eight sided die is rolled. The remainder when the result is divided by 5 is recorded. What is the sample space?

\[ S = \{0, 1, 2, 3, 4\} \]
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?

$$\mathcal{S} = \{ (1, r), (1, g), (2, r), (2, g), 3r, 3g, 4r, 4g \}$$
Example: A four sided die is rolled. If a four or a one is rolled the 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. \textit{No}.
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?

\[ S = \{ rr, rg, rb, gr, gg, gb, br, bg \} \]
Example: Two coins are drawn, without replacement, from a bag that contain 3 quarters, 4 dimes and 1 fiftycent piece. The dollar amount is recorded. What is the sample space?

\[
\begin{array}{ccc}
Q & D & F \\
2 & - & - & \text{total} \Rightarrow 0.5 \\
- & 2 & - & 0.2 \\
1 & 1 & - & 0.35 \\
1 & - & 1 & 0.75 \\
- & 1 & 1 & 0.6 \\
\end{array}
\]

\[S = \{0.2, 0.35, 0.5, 0.6, 0.75\}\]