Name: _____

Quiz 7.1: Sample spaces and events

1. Suppose your experiment is to flip a penny and a nickel to see which side lands face up.

(a) What is the sample space?

(b) What is the event "getting two tails"?

(c) What is the event "getting more heads than tails"?

(d) What is the event "getting both a head and a tail"?

2. Suppose the experiment is to flip a penny, a nickel, and a dime.

(a) What is the sample space?

(b) What is the event "getting two tails"?

(c) What is the event "getting more heads than tails"?

(d) What is the event "getting both a head and a tail"?

3. Suppose the experiment is flipping two indistinguishable pennies.

(a) What is the sample space?

(b) What is the event "getting two tails"?

(c) What is the event "getting more heads than tails"?

(d) What is the event "getting both a head and a tail"?

Examples 7.1: Sample spaces and events

An **experiment** is some repeatable activity with observable results. Each observable result is called a **sample point**. The **sample space** is the set of all possible **sample points**. An **event** is a subset of the sample space, that is, a set containing only sample points.

Since events are sets, we can form unions $E \cup F$, intersections $E \cap F$, differences $E - F$, and the **complements** E^c. The complement is the difference of the sample space and the event, or in plain English: the event E^c is just the event that E does not happen.

Two events are mutually exclusive if $E \cap F = \emptyset$.

Example: the experiment is to choose a card from a standard deck of cards. The sample point is just the (name of) the card chosen, like "eight of hearts". The sample space is the set of all 52 cards,

$$\{1\heartsuit, 2\heartsuit, 3\heartsuit, 4\heartsuit, 5\heartsuit, 6\heartsuit, 7\heartsuit, 8\heartsuit, 9\heartsuit, 10\heartsuit, J\heartsuit, Q\heartsuit, K\heartsuit,$$
$$1\diamondsuit, 2\diamondsuit, 3\diamondsuit, 4\diamondsuit, 5\diamondsuit, 6\diamondsuit, 7\diamondsuit, 8\diamondsuit, 9\diamondsuit, 10\diamondsuit, J\diamondsuit, Q\diamondsuit, K\diamondsuit,$$
$$1\clubsuit, 2\clubsuit, 3\clubsuit, 4\clubsuit, 5\clubsuit, 6\clubsuit, 7\clubsuit, 8\clubsuit, 9\clubsuit, 10\clubsuit, J\clubsuit, Q\clubsuit, K\clubsuit,$$
$$1\spadesuit, 2\spadesuit, 3\spadesuit, 4\spadesuit, 5\spadesuit, 6\spadesuit, 7\spadesuit, 8\spadesuit, 9\spadesuit, 10\spadesuit, J\spadesuit, Q\spadesuit, K\spadesuit\}$$

The event "got a club" is $\{1\clubsuit, 2\clubsuit, 3\clubsuit, 4\clubsuit, 5\clubsuit, 6\clubsuit, 7\clubsuit, 8\clubsuit, 9\clubsuit, 10\clubsuit, J\clubsuit, Q\clubsuit, K\clubsuit\}$

The event "got a five" is $\{5\heartsuit, 5\diamondsuit, 5\clubsuit, 5\spadesuit\}$.

The event "got a red face card" is $\{J\heartsuit, Q\heartsuit, K\heartsuit, J\diamondsuit, Q\diamondsuit, K\diamondsuit\}$

The last two events are mutually exclusive, the first two are not.

The union of the first two events is "got a club or a five". The intersection of the first two events is "got the five of clubs". The complement of the first event is "did not get a club". The difference of the first and second events is "got a club other than the five of clubs".

See the book for examples in a business context. I will focus on "gambling" problems where the wording is clearer. Standard business applications include surveys, customer reactions, and equipment failure. Stocks and other investments with risks are covered in most (junior level) corporate finance classes, and use the techniques of probability as a starting point.