Class #8 - Monday February 29
Probability: Basic Concepts & Properties

Homework #3 – due Wednesday, March 9:

- **Ross, Sec 3.7 (pp128-129)**: Exercises #3, #4
- **Ross, Sec 12.2 (pp542-543)**: Exercises #1, #3 (for both of these exercises, in addition to the questions in the textbook, also calculate the slope and y-intercept of the linear regression line, and add the linear regression line to the scatterplot)
- **Ross, Sec 4.2 (pp150-151)**: Exercises #1, #2, #4, #7, #9, #10
- **Ross, Sec 4.3 (pp155-157)**: Exercises #1(a)-(d), #9, #10

Exam #1 – Wednesday, March 9:

- The exam will cover the material from Homeworks #1-3

Basic Concepts/Definitions:

- **probability experiment**: any process where the outcome is uncertain
- **sample space** (of an experiment): the set of all possible outcomes S of an experiment
- an **event**: any particular set of outcomes, i.e., a subset of the sample space $A \subseteq S$
- basic set theory: complement of A, union $A \cup B$, intersection $A \cap B$, disjoint sets

Example 1: Many probability examples involves rolling dice or tossing coins.

(i) Suppose an experiment of rolling a 6-sided die. What is the sample space, i.e., the set of possible outcomes? What are some examples of events?

(ii) Next consider the experiment of flipping a coin. What is the sample space in this case?

Example 2: Now suppose a probability experiment consists of first flipping a coin and then rolling a 6-sided die.

(i) What is the sample space? How many outcomes are there in the sample space?

(ii) An example of an event A is $A =$ "Rolling a 4" $=$ { H4, T4 }. Another example of an event is $B =$ "Tossing heads and rolling an even number." List the outcomes that make up the latter event.

(iii) What is the complement of A, i.e., A^C? What is $A \cup B$? What is $A \cap B$? Are A and B disjoint?

Basic Properties of Probability: For an experiment with sample space S, we assume that for each event $A \subseteq S$ there is a number $P(A)$, called the probability of A, with the following properties:

- The probability of any event A is between 0 and 1: $0 \leq P(A) \leq 1$
- The probability of the entire sample space S is 1: $P(S) = 1$
- For any two disjoint events A and B: $P(A \cup B) = P(A) + P(B)$

What about two events that are not disjoint, i.e., that do have outcomes in common?

Addition Rule: For any events A and B,

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

Examples...