

Due by 4pm on Friday, September 6. Please leave your homework on the table before class begins on Friday or leave it in the dropbox outside my office. Do not forget to attach the honor code. Each problem is worth 20 points.

- (1) Suppose that three events -  $A, B$ , and  $C$  - are defined on a sample space  $S$ . Use the union, intersection, and complement operations to represent each of the following events:
- none of the three events occurs
  - all three of the events occur
  - only event  $A$  occurs
  - exactly one event occurs
  - exactly two events occur
- (2) Suppose two dice are tossed and the numbers on the upper faces are observed. Let  $S$  denote the set of all possible pairs that can be observed. (These pairs can be listed, for example, by letting  $(2, 3)$  denote that a 2 was observed on the first die and a 3 on the second.)
- Define the following subsets of  $S$ :
 

$A$ : The number on the second die is even.

$B$ : The sum of the two numbers is even.

$C$ : At least one number in the pair is odd.
  - List the points in  $A, \bar{C}, A \cap B, A \cap \bar{B}, \bar{A} \cup B$ , and  $\bar{A} \cap C$ .
- (3) A coin is tossed four times and the resulting sequence of heads and/or tails is recorded. Define the events  $A, B$ , and  $C$  as follows:
- $A$ : Exactly two heads appear
- $B$ : Heads and tails alternate
- $C$ : First two tosses are heads
- Which events, if any, are mutually exclusive?
  - Which events, if any, are subsets of other sets?
- (4) Let  $A$  be the set of five-card hands dealt from a 52-card poker deck, where the denominations of the five cards are all consecutive—for example, (7 of hearts, 8 of spades, 9 of spades, 10 of hearts, jack of diamonds). Let  $B$  be the set of five-card hands where the suits of the five cards are all the same. How many outcomes are in the event  $A \cap B$ ?
- (5) Let events  $A$  and  $B$  and sample space  $S$  be defined as the following intervals:

$$S = \{x : 0 \leq x \leq 10\}$$

$$A = \{x : 0 < x \leq 5\}$$

$$B = \{x : 3 \leq x \leq 7\}$$

Characterize the following events:

- $A^c$
- $A \cap B$
- $A \cup B$
- $A \cap B^c$
- $A^c \cup B$
- $A^c \cap B^c$