STAT 515 hw 1
Basics of sets, basic probability

1. Consider rolling two dice and let

   $A =$ both rolls are at least 3
   $B =$ both rolls are 3 or less
   $C =$ the sum of the rolls is 10 or more
   $D =$ the absolute value of the difference between the rolls is at most 1.

   Give the following probabilities:
   (a) $P(A)$
   (b) $P(B)$
   (c) $P(C)$
   (d) $P(D)$
   (e) $P(A \cup B)$
   (f) $P(A \cap B)$
   (g) $P(A \cap B^c)$
   (h) $P((A \cap B)^c)$
   (i) $P(A^c \cup B^c)$
   (j) $P((A \cup B)^c)$
   (k) $P(A^c \cap B^c)$
   (l) $P(C \cap D)$
   (m) $P(C \cup D^c)$

   Hint: Begin by listing all possible outcomes of rolling two dice, i.e. the sample space.

2. Consider a bag of marbles, 19 of which are green, 25 of which are blue, and 6 of which are red. Moreover, suppose 9 of the green marbles are opaque, 5 of the blue marbles are opaque, and 3 of the red marbles are opaque, and the rest of the marbles are transparent.

   (a) Suppose you draw one marble from the bag. Give the probability that you draw
       i. a red marble.
       ii. a transparent green marble.
       iii. an opaque marble.
       iv. a marble that is either blue or opaque or both.

   (b) Suppose you remove all the opaque marbles from the bag and then draw one marble. Give the probability that you draw
       i. a green marble.
       ii. a red or a blue marble.

3. Suppose you draw 1 athlete at random from a group of 100 athletes such that: 30 swim; 44 run; 9 swim and run; 5 swim, bike, and run; 11 swim and bike; 10 bike and run but do not swim; and 35 only bike. Let S, B, and R denote the events that the athlete you draw swims, bikes, and runs, respectively. Give the following probabilities:

(a) $P(S \cup R)$

$$P(S \cup R) = \frac{65}{100} = 0.65$$

(b) $P(S \cap R^c)$

$$P(S \cap R^c) = \frac{21}{100} = 0.21$$

(c) $P(B)$

$$P(B) = \frac{56}{100} = 0.56$$

(d) $P(S \cup B)$

$$P(S \cup B) = \frac{75}{100} = 0.75$$

(e) $P((S \cap R) \cap B^c)$

$$P((S \cap R) \cap B^c) = \frac{4}{100} = 0.04$$

(f) $P(S^c \cup R^c)$

$$P(S^c \cup R^c) = \frac{91}{100} = 0.91$$

(g) $P((R \cap B) \cup (R \cap B^c))$

$$P((R \cap B) \cup (R \cap B^c)) = \frac{44}{100} = 0.44$$