ISTA 116: Lab Assignment #5 (50 pts)

Due Monday, October 31 by 11:59 P.M.

Problem 1:

(18 pts)

For each of the following random experiments, identify the sample space of all distinct outcomes, along with how many elements (individual outcomes) it contains (3 pts each).

a. Rolling two six-sided dice.

b. Picking a three-digit lottery number by drawing once from each of three buckets of ten ping-pong balls numbered 0 through 9.

c. Spinning a roulette wheel with one pocket each for the numbers 1 through 36, as well as a pocket for 0 and a pocket for 00.

d. Randomly selecting a letter from A to Z and then randomly selecting whether it is uppercase or lowercase.

e. Flipping a quarter, a nickel and a penny.

f. Choosing two pizza toppings from a list of four (pepperoni, mushrooms, peppers and black olives). Assume that order doesn't matter: for example, mushrooms and peppers is the same outcome as peppers and mushrooms.

Problem 2:

(15 pts)

Consider rolling two balanced six-sided dice, where each individual pair of numbers [$(1,1)$, $(1,2)$, $\ldots$, $(2,1)$,$(2,2)$,$\ldots$,$(6,5)$, $(6,6)$] occurs with equal probability.

Compute the probability of each of the following events (3 pts each)

a. Rolling double ones (aka "snake eyes").

b. Rolling a total of three.

c. Rolling a total of seven.

d. Rolling doubles of any kind.

e. Rolling a total of four or less.

Problem 3:

(17 pts)

Consider a standard deck of 52 playing cards (see Figure 1 below)

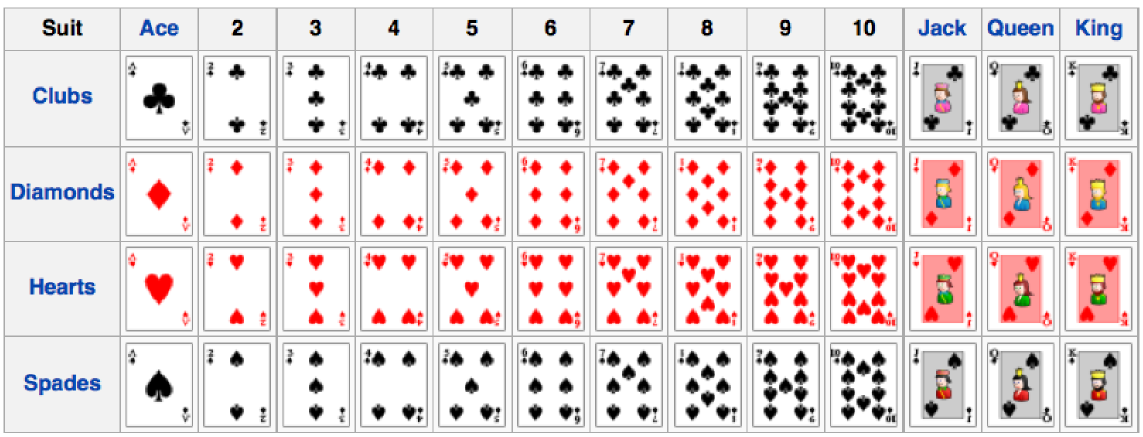

Figure 1: A standard deck of 52 playing cards (Source: Wikipedia)

Let Ace, Two, $Three$, $\dots$, $Queen$, $King$ represent the events corresponding to drawing an Ace, Two, etc. Similarly let $Club$, $Diamond$, $Heart$ and $Spade$ represent the events corresponding to drawing a club, diamond, etc.

For each of the following events, represent it using unions, intersections and complements of the basic events above. For example, if $E =$ "Drawing a black Queen", then

$$E = Queen \cap (Spade \cup Club)$$

or

$$E = (Queen \cap Spade) \cup (Queen \cap Club)$$

Then, use the probability axioms and corollaries to write its probability in terms of probabilities of basic events and their intersections.

For the example above:

$$P(E) = P(Queen \cap Spade) + P(Queen \cap Club)$$

where we used the disjoint additivity rule (Axiom 2).

Check your equations by computing the probabilities of each term directly by counting, assuming each card has an equal probability of being selected.

Example:

$$\begin{aligned} P(E) = P(\text{“Black Queen”}) &= {}^{2}\!/_{52} \\ P(Queen \cap Spade) &= {}^{1}\!/_{52} \\ P(Queen \cap Club) &= {}^{1}\!/_{52} \\ P(Queen \cap Spade) + P(Queen \cap Club) &= {}^{1}\!/_{52} + {}^{1}\!/_{52} = {}^{2}\!/_{52} = P(\text{“Black Queen”}) \end{aligned}$$

a. (4 pts) $E =$ Drawing a face card (Jack, Queen or King)

b. (6 pts) $E =$ Drawing a spade or an Ace.

c. (7 pts) $E =$ Drawing a card that is neither red nor a Jack