AMS 102.7 Homework #1

Due: 02/09/2012

1) Consider the following random process, you flip a fair coin and then roll a fair die.

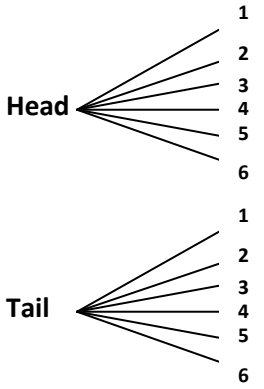
   a) Create a tree diagram mapping out this random process.

   b) Identify all the possible outcomes in your sample space.

   c) Define Event A to be any outcome where you rolled a number greater than 2. List the outcomes in A^c.

   d) Define Event B to be any outcome where your coin flip resulted in a head. List the outcomes in $A \cap B$.

a)



b) S = {(H,1), (H,2), (H,3), (H,4), (H,5), (H,6), (T,1), (T,2), (T,3), (T,4), (T,5), (T,6)}

c) A^c = {(H,1), (H,2), (T,1), (T,2)}

d) $A \cap B$ = {(H,3), (H,4),(H,5),(H,6)}

2) Consider the operation of opening a new business. Assume that some possible outcomes of your business are considered as events.

Event A: Your company makes a profit within the first 5 years

Event B: Your company goes out of business within the first 5 years

Event C: Your company is purchased by a competitor within the first 5 years

And the probabilities associated with these events are as follows.

$$\boldsymbol{P(A) = 0.45} \qquad \boldsymbol{P(B) = 0.65} \qquad \boldsymbol{P(C) = 0.20}$$

a) Based on the probabilities above, is it possible that events *A* and *B* are Mutually Exclusive? Why or why not?

b) You are provided additional information that $\boldsymbol{P(A \mid C) = 0.85}$. What is the probability that your company makes a profit <u>*AND*</u> is purchased by a competitor within the first 5 years?

c) Are the events *A* and *C* Independent? Why or why not?

a) No, if *A* and *B* are Mutually Exclusive then by the addition rule

$$\boldsymbol{P(A \cup B) = P(A) + P(B) = 0.45 + 0.65 = 1.10 > 1}$$

Since all probabilities must be between 0 and 1, this is impossible, therefore A and B cannot be mutually exclusive.

b) We are asked to find $\boldsymbol{P(A \cap C) = P(A \mid C)P(C) = 0.85 * 0.20 = 0.17}$ by the multiplication rule.

c) No, since $\boldsymbol{P(A \mid C) = 0.85 \neq P(A) = 0.45}$, which is required if *A* and *C* were independent. Therefore they are not independent events.