1. Let $A$, $B$ and $C$ be events such that $P(A) = .2$ and $P(C) = .1$

   (a) If $P(B|A) = .4$ and $P(B|A^c) = .75$ find $P(A|B)$.

   (b) If $C \subset A$ and $B$ is independent of $C$ find $P(ABC)$. 
2. Let $A, B, C$ and $D$ be independent events on $\Omega$ with $P(A) = .75$, $P(B) = .2$, $P(C) = .4$, and $P(D) = .45$. Also let

$$Y = 5 \cdot 1_A + 12 \cdot 1_B X - 4 \cdot 1_C + 3 \cdot 1_D.$$ 

(a) Find $P(D \cup C)$

(b) Find $P(Y = 8)$

(c) Are $\{Y = 8\}$ and $A$ independent? Explain
3. Xavier flips 12 coins and Yannick rolls 2 dice. Let $X$ be the number of heads and let $Y$ be the sum of the two dice. Let $Z = \max(X, Y)$ All outcomes are equally likely. Find the following.

(a) $\text{Var}(X)$

(b) $P(X > Y)$

(c) $P(Z = 9)$
4. Let $X$ be a Poisson random variable with parameter 7.3. Let $Y$ be a binomial random variable with parameters $n = 18$ and $p = .2$.

(a) $P(X \geq 10)$

(b) $P(Y \geq 16)$

(c) If $P(X = 3 \text{ and } Y = 2) = .01$ then find $P(\{X = 3\} \cup \{Y = 2\})$
5. Customers at Whole Foods enter the checkout line independently of each other at a rate of 3 people every 2 minutes.

(a) What distribution best describes $X$ the number of people entering the checkout line between 12:00:00 and 12:02:00?

(b) What is the probability that 5 customers enter the checkout line during this period?

(c) During an interval of time there is a 75% chance of a customer entering the checkout line. How long is the length of the interval?
6. A roulette wheel has 38 slots labeled 0, 00 and all integers from 1 to 38. In a game show you spin a roulette wheel 11 times. On the first eight spins you win 7 dollars every time the ball lands on a red slot. On the last three you win 20 dollars every time the ball lands on 0, 00, 1, 2 or 3. Let $W_1$ be the amount of money you win on the first eight spins, $W_2$ be the amount of money you win on the next three spins and $W$ be the total amount you win.

(a) Find $E(W_1)$

(b) Find $\text{Var}(X_2)$

(c) $P(W \geq 40)$. 
7. Data indicate that the number of traffic accidents in Seattle on a rainy day is a Poisson random variable with mean 19, whereas on a dry day it is a Poisson random variable with mean 13. Let $X$ denote the number of traffic accidents tomorrow. If it will rain tomorrow with probability 0.6, find

(a) $E(X)$;

(b) $P(X \leq 1)$; and

(c) $P(\text{rain} \mid X = 15)$