MAT 300 Week 2 Probability

This assignment has an automatic extension through middle of Week 3.

Assignment:

1. Roughly speaking, what is an experiment? An event? Give an example of each.
2. The probability of an event is always between ____ and ____, inclusive. Fill in the blanks.
3. The probability of an impossible event is equal to ____.
4. Coin tossing: A balanced dime is tossed three times. The possible outcomes are as follows: (For example, HHT means that the first two tosses come up heads and the third tails.)

   HHH, HTH, THH, TTH

   HHT, HTT, THT, TTT

   Find the probability that:

   a. exactly two of the three tosses come up heads.

   b. the last two tosses come up tails.

   c. all three tosses come up the same.

5. **Addition Rules**: The following is a relative-frequency distribution for the religious preference of

of Americans for the year 2000 (R. Doyle, Religion in America, 2003):

Preference	Relative Frequency
Protestant	.560
Catholic	.250
Jewish	.025
Other	.015
None	.150

Find the probability that the religious preference of a randomly selected American is:

a. Catholic or Protestant

b. Not Jewish

c. Not Catholic, Protestant, or Jewish

6. **Multiplication Rule:** ESP Experiment. A person has agreed to participate in an ESP experiment. He is asked to randomly pick two numbers between 1 and 6. The second number must be different from the first. Let

   H = event the first number picked is a 3, and

   K = event the second number picked exceeds 4

   Determine,

   a. P(H)

   b. $P(K \mid H)$

   c. P(H & K)

   Extra credit: Find the probability that both numbers picked are:

   d. less than 3
   e. greater than 3

7. **Multiplication Rule**: US Governors. Political-party distribution of U.S. governors, as of 2003 is as follows:

Party / Frequency	
Democratic	**24**
Republican	**26**

   Two U.S. governors are selected at random without replacement.

   a. Find the probability that the first is a Republican and the second a Democrat.

   b. Find the probability that both are Republicans.

8. **Permutations:** Determine the value of each quantity.

$${}_nP_r = \frac{n!}{(n-r)!}$$

a. n = 20 r = 15

b. n = 10 r = 6

9. **Combinations:**

$${}_nC_r = \frac{n!}{(n-r)!\,r!}$$

a. n = 20 r = 10

b. n = 10 r = 5

10. **Bayes Rule**: Smoking and Lung Cancer. According to the Arizona Chapter of the American Lung Association: 7% of the population has lung cancer, of those with lung cancer 90% are smokers. Of those not having lung disease, and 25.3 % are smokers. What is the probability that a randomly selected smoker has lung disease? (I will assist in setting this problem up for you.)

Let S = event the person selected is a smoker. And:

L1 = event the person selected has no lung disease, and

L2 = event the person selected has lung disease.

Note: L1 and L2 are complimentary (mutually exclusive and exhaustive).

P(L1) = .930

P(L2) = .070

P(S | L1) = .253

P(S | L2) = .900

The problem is to determine the probability that a randomly selected smoker has lung disease, that is, P(L2 | S).

Please set this problem up using Bayes Rule without doing the calculations. (For your information, the result of the calculations is .211. That is, 21.1% of smokers have lung disease.

Again, all I want you to do is to set up the problem using Bayes formula:

P(L2 | S) = P(L2) * P (etc.....)