Math-42 Worksheet #24

Probability Theory

1. A standard die is arranged so that 1-6, 2-5, and 3-4 are on opposing faces. This forces all of the odd numbers to share a corner. A manufacturing defect on that corner makes each odd roll twice as likely as each even roll. If such a die is rolled, what is the probability of rolling:
   (a) A 1?
   (b) A 2?
   (c) An odd number?
   (d) An even number?
   (e) A 3 or a 4?

2. In a survery of electronic service companies, 75% of the companies offer email services, 50% of the companies offer web services, and 30% of the companies offer both email and web services. What percentage of the companies offer:
   (a) Email services only?
   (b) Web services only?
   (c) Neither email nor web services?

3. An urn is filled with 8 red balls and 15 white balls from which you randomly select balls without replacement. If two balls are selected, what is the probability that the first ball is white and the second ball is red?

4. A new test has been introduced to diagnose a disease that is estimated to infect 80% of the population. The test has a 1% false-negative rate and a 5% false positive rate. A total of 100 people are tested.
   (a) What is percentage of people that will test postive that actually have the disease?
   (b) What is percentage of people that will test negative that actually no not have the disease?
   (c) What is the expected number of people that will test negative?
   (d) What is the expected number of people that will test positive?

5. Consider rolling two distinct and fair die. Let D be the event of rolling doubles and S be the event of rolling a seven. Explain both intuitively and analytically why these are NOT independent events.

6. A certain production line has the characteristic that each unit coming off of the line has a 5% chance of failure. You, as the QA manager, select 10 units for testing. What is the probability that:

   (a) All units are working?

   (b) No units are working?

   (c) Only one unit does not work?

   (d) Five units do not work?