

**EECS 461 Short Quiz #1**  
**Probability and Statistics**  
**February 12, 2007**

Name: Key

**Closed Book and Closed Notes: Show all work. Provide numerical answers as four-place demimals.**

1. (30 %) You ask your neighbor to water a sickly plant while you are on vacation. Without water it will die with probability 0.8; with water it will die with probability 0.15. You are 90 percent certain that your neighbor will remember to water the plant.

a. What is the probability that the plant will be alive when you return?

Define the following events

$A_1$  = neighbor remembers to water

$A_2$  = neighbor forgets to water

$B$  = Plant is alive on my return

} These partition the sample space into ME events

Use Law of total probability

$$P(B) = \sum_{i=1}^2 P(B|A_i)P(A_i) = P(B|A_1)P(A_1) + P(B|A_2)P(A_2) = (1-0.15)0.9 + (1-0.8)0.1$$

$$= 0.7850$$

a. If it is dead, what is the probability your neighbor forgot to water it?

We are looking for  $P(A_2|\bar{B})$ , use Bayes' Rule

$$P(A_2|\bar{B}) = \frac{P(\bar{B}|A_2)P(A_2)}{P(\bar{B})}$$

$$= \frac{0.80 \cdot 0.1}{1 - 0.785} = 0.3721$$

2. (20 %) The industrial engineering department of the XYZ Company is performing a work sampling study on eight technicians. The engineer wishes to randomize the order in which he visits the technicians' work areas. In how many ways may he arrange these visits?

- ① Are the "objects" distinct? Yes, they are individual people.
- ② Does the order in which they are visited matter? Yes

Conclusion

This is a permutation problem

$$8! = 40320$$

3. (50%) A production lot of size 100 is known to be 5% defective. A random sample of 10 items is selected without replacement.

a. What is the probability that there will be no defectives in the sample?

The sample space in this experiment is  $\binom{100}{10}$

In this part, I must choose zero defectives and 10 not defectives.  
This number is  $\binom{5}{0}\binom{95}{10}$

$$P(\text{zero defectives}) = \frac{\binom{5}{0}\binom{95}{10}}{\binom{100}{10}} = \boxed{0.5838}$$

b. What is the probability that there will be exactly one defective in the sample?

There are  $\binom{5}{1}\binom{95}{9}$  ways of choosing 1 defective and 9 not defective

$$P(\text{one defective}) = \frac{\binom{5}{1}\binom{95}{9}}{\binom{100}{10}} = \boxed{0.3394}$$

c. What is the probability that there will be more than one defective in the sample?

The probability of 2, 3, 4, or 5 defectives is the same as

$$1 - [P(\text{zero defectives}) + P(\text{one defective})]$$

$$= \boxed{0.0769}$$

d. In parts a, b, and c, have we covered the entire sample space? (yes or no)

Yes, the sample space includes 0, 1, 2, 3, 4, and 5 defectives.