

# FREC 408 Assignment 4

**Issued:** October 7, 2003

**Due:** October 15, 2003

**Be sure to:**

- Put your name and the Assignment # on the front
- Answer as completely as you can. All I can go on is what you give me, so show your work.
- Be as neat as possible. You can write it out, but please be neat.
- Staple or place in a folder

**1. Discrete Random Variable Problem**

20 pts

A patient complaining of severe stomach aches checked into a local hospital. After a series of tests the doctors narrowed their diagnosis to four possible ailments. They believe that there is a 40% chance that the patient has hepatitis; a 10% chance that she has cirrhosis; a 45% chance of gallstones; and a 5% chance of cancer of the pancreas. The doctors are certain that the patient has only one of the diseases, but do not know which one until further tests are performed. The cost associated with treating each disease is given in the table below.

Disease	Hepatitis	Cirrhosis	Gallstones	Pancreatic Cancer
Cost	\$700	\$1,100	\$3,320	\$16,450
P(X)				

- a. Construct the probability distribution for the cost of treating the patient (use the table above to add the probabilities).
- b. Calculate the mean of the probability distribution. What does this number represent?
- c. Further testing revealed that the patient has either hepatitis or cirrhosis. Given this information construct the new probability distribution for the cost of treatment. Note: the costs don't change, but now there are only two relevant options. The new probabilities should sum to one, but make them proportional to each other in the same proportions as in part a.
- d. Calculate the mean of the new probability distribution from part c. What does this number represent?

**2. The following are some problems on the Binomial Distribution.**

20 pts

If  $x$  is a binomial random variable, compute  $p(x)$  for each of the following cases using the tables in the book or the formula. Also calculate the mean, variance, and standard deviation for each example.

- a.  $n = 5, \quad x = 1, \quad p = .2$
- b.  $n = 4, \quad x = 2, \quad q = .4$
- c.  $n = 3, \quad x = 0, \quad p = .7$
- d.  $n = 15, \quad x \leq 9, \quad p = .2$
- e.  $n = 5, \quad x \geq 1, \quad p = .1$
- f.  $n = 25, \quad x < 10, \quad p = .5$

3. Answer Problem 5.23 on page 256 in Chapter 5 (check-out scanner) 15 pts  
You must show your work to get credit.

4. The following are some problems on the Normal Distribution. 30 pts

Find the area under the standard normal probability distribution between the following z-scores

- a.  $z = 0$  and  $z = 2.00$
- b.  $z = 0$  and  $z = .58$
- c.  $z = -2.00$  and  $z = 0$
- d.  $z = -1.00$  and  $z = 1.50$

Find the following probabilities for the standard normal random variable  $z$

- e.  $P(-1 \leq z \leq 1)$
- f.  $P(z \geq -2.33)$
- g.  $P(z > 1.46)$
- h.  $P(z = 1)$

5. In studying the dynamics of fish populations, knowing the length of a species at different ages is critical. Fisheries Science (Feb., 1995) published a study of the length distributions of sardines inhabiting Japanese waters. At two years of age fish have a length distribution that is approximately normal with  $\mu = 20.20$  centimeters and  $\sigma = .65$  cm. 15 pts

- a. Find the probability that a two-year old sardine inhabiting Japanese waters is between 20 and 21 cm long.
- b. A sardine captured in Japanese waters has a length of 19.84 cm. Is this sardine likely to be two years old? Hint: find the probability that a sardine is less than 19.84.
- c. Repeat for part b for a sardine with a length of 22.01 cm