MATH 210 - Test #2 - 3/14/02

Points in [brackets] sum to 102. Show all work for full credit!

1. You wish to make a forecast regarding your business's profitability over the next five years. The following table provides estimated annual profits depending on the condition of the economy during a given year. (A "negative" profit corresponds to losing money.) An economist provides probabilities for the various economic conditions occurring in a given year.

Economy	Growth	Inflation	Stagnation	Recession
Probability (P)	.25	.15	.30	.30
Annual Profit (X)	$120,000	$80,000	$10,000	−$50,000

a. Explain why the probabilities in the table represent a valid *probability model*.

[5]

b. What is the probability that your company will make a profit every year, for *five years in a row*?

[6]

c. Calculate the *expected* (i.e., average) annual profit for your company and interpret its meaning.

[9]

d. Suppose you have $50,000 in cash reserves. Does your answer to (c) give you confidence about your business's future? **Explain.**

[5]

e. The answers to (b) and (c) make an assumption about the state of the economy in successive years. What is this assumption? Does it seem very realistic? **Explain.**

[5]

2. You are the quality control manager for ACME Manufacturing. Suppose your buyers are satisfied as long as no more than 2% of the product shipped to them is defective. Periodically you select a random sample of 20 items for inspection. Answer the following questions, assuming that 2% of the overall production is actually defective.

a. Show how this can be set up as a binomial experiment by defining the following components. Give specific values for n and p and a description for SUCCESS and X. **These must be defined *in the context of this problem*.**

[8]

n

SUCCESS

X

p

b. Compute the mean number of defectives in a sample of 20 items.

[3]

c. What is the probability that you will have *two or more* defective items in your sample?

[6]

d. Suppose you just choose one large random sample at the end of the day, say of 500 items. What is the probability that fewer than 5 of the items selected are defective? **Justify the validity of the method you use!**

[10]

3. The following two-way table gives a breakdown by sex and class for the 1055 full-time, undergraduate students enrolled at Manchester in Fall 2000. (p. 176, 2001-02 M.C. catalog)

[15]

	FY	SO	JR	SR	Total
MALE	185	111	97	92	
FEMALE	197	142	132	99	
Total					1055

You plan to choose a student "at random." (i.e., in a *fair* draw).

a. What is the probability the student chosen is a female?

b. What is the probability the student chosen is a junior (JR)?

c. Suppose you know the student drawn is a junior. What is the probability that the student is a female? That is, find P(female *given* the student is a junior).

d. **Explain** whether the events FEMALE and JR are *independent*. Answer based on your calculations from parts (a)–(c).

4. Miscellaneous

a. "The value of a sample statistic will approach the true population parameter as the sample size increases." This is known as the *Law of*: (circle *one*)

[3]

i. Supply and Demand
ii. Averages
iii. the Jungle
iv. Large Numbers

b. A continuous probability distribution where the chance of being in a certain range is proportional to the length of the range is called a _____ distribution.

[3]

c. Suppose 30% of all people in the United States have blue eyes. You conduct a random poll and observe 25% of those surveyed have blue eyes. Which of these two numbers is considered a *parameter*? **Explain.**

[4]

5. Consider the following randomized-comparative experiment designed to determine if taking a daily supplement of 1000 mg. of Vitamin C reduces colds for adults in the U.S.

- Using a newspaper ad placed in the Fort Wayne Journal-Gazette, 200 adult volunteers are solicited to participate in the experiment. The ad offers to pay each subject $500.
- The subjects are randomly divided into two groups — a treatment group (receiving a daily dose of 1000 mg. Vitamin C) and a control group (receiving a daily placebo).
- At the end of one year, the researchers ask each subject, "How many days did you have a cold during the past year?"
- The mean days with a cold is computed for each group and analysis is done to determine if there is a "significant" difference between the groups.

a. Explain the purpose of using "random assignments" in this kind of investigation.

[5]

b. What is the purpose of having a "control group?"

[5]

c. What is a "placebo" and why it is used?

[5]

d. Identify two possible weaknesses in the way this experiment was conducted. (i.e., reasons that the researchers' conclusions about the effectiveness of Vitamin C supplements may be questionable)

[5]