Math 244 Exam I, Fall

Name:_____

September 28, 2010 **Student #:** _____

Instructor: Dhar

Must show all work for full credit!!!

I pledge that I have not violated the NJIT code of honor_____

1. About 2.8% of all births are twin. Twins may be either identical or fraternal. The probability of a birth being that of identical twins has remained fairly constant at 0.39%. What proportion of twin births is identical?

(12 pts) (Please see problem page 67, #3.14)

T: twins I: identical

$P(T) = .028$

$P(I) = .0039$

$P(I/T) = \frac{P(TI)}{P(T)}$

$= \frac{.0039}{.028} = 0.1392857$

2. Children and adults with sore throats are often tested for strep throat. If untreated strep throat can lead to rheumatic fever. The traditional method for assessing whether or not someone has strep throat is a culture. Because the results of the culture take a day to obtain, more rapid test are often used. A study which looked at a specific rapid test labeled (Strep A OIA) among 900 patients who potentially had strep throat reports results in the following table.

Number of Results				
Test	True Positive	False Positive	True Negative	False Negative
Strep A OIA	250	46	551	53

a. What is the specificity of the Strep A OIA test? (8 points)

b. What is the predictive value of the Strep A OIA test? (8 points)

(Please see problem pages 67 - 68, # 3.15 -16)

$\# TP \cap D = 250$

$\# TP \cap \bar{D} = 46$

$\# TN \cap \bar{D} = 551$

$\# TN \cap D = 53$

(a) $P(TN/\bar{D}) = \frac{551}{46+551} = \frac{551}{597} = 92\%$

(b) $P(D/TP) = \frac{250}{250+46} = \frac{250}{296} = 85\%$

3. Suppose that 16 employees are to be divided among 5 job assignments 3 going to job I (J1), 4 going to job II (J2), 2 going to job III (J3), 3 going to job IV (J4), and 4 going to job V (J5).
   a. What is the probability the 16 employees are assigned to the jobs in the following manner J1, J2, J2, J3, J4, J4, J1, J2, J3, J5, J5, J4, J1, J2, J5, J5 respectively? (10 points)

$$1 \Big/ \left(\frac{16!}{3!\,4!\,2!\,3!\,4!}\right) = \frac{1}{504{,}504{,}000}$$

   b. Suppose that job V (J5) is the least favorite among all employees and that four employees of a certain ethnic group are all get assigned to job V. Assuming that they are the only employees among the 16 under consideration who belong to this ethnic group, what is the probability of this happening under random assignment of employees to jobs? (10 pts) (Please see problem #2.53, page 46)

$$\frac{\binom{4}{4}\dfrac{12!}{3!\,4!\,2!\,3!}}{504{,}504{,}000} = \frac{277200}{504{,}504{,}000}$$

$$= .000549451$$

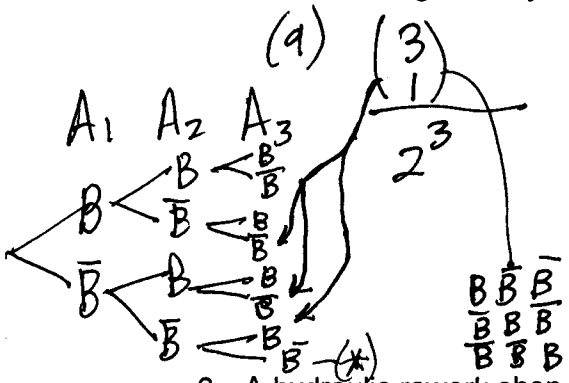
Very rare less than .05% chance.

4. Seven applicants (Jim, Don, Mary, Sue, Tom, Jane, and Nancy) are available for:
(a) Three identical jobs. How many ways can a supervisor select three applicants to fill these jobs? (7 points) $\binom{7}{3} = (7)(6)(5)/3! = 35$
(b) Three distinct jobs (say director, sub-director, and assistant director). How many ways can a supervisor select three applicants to fill these jobs? ? (7 points) (problem 2.10, page 20)

$(7)(6)(5) = 210$

5. A small company has three automobiles in its car pool. Each automobile may break down or not break down on any given day. An experiment consists of counting the number of automobile breakdowns to occur on a randomly selected day. Suppose that each automobile is equally likely do breakdown or not breakdown. (a) What is the probability that exactly one out of the three automobiles will break down on the given day. (b) What is the probability at least one will break down on the given day? (wording page 16 example 2.1) (15 points)

B: break down



(a) $\dfrac{\binom{3}{1}}{2^3} = \dfrac{3}{8} = .375$

(b) $1 - P(\text{no one breakdown}) = 1 - \dfrac{1}{8} = \dfrac{7}{8} = .875$

represents (*)

6. A hydraulic rework shop in a factory turned out ten rebuilt pumps today. Suppose that four pumps are still defective. Three of the ten are selected for thorough testing and then classified as defective or not defective. Find the probability that the selection includes exactly two defectives? (Please problem 2.76, page 54) (12 pts)

10

4D 6G

$$\frac{\binom{4}{2}\binom{6}{1}}{\binom{10}{3}} = \frac{(6)(6)}{\frac{(10)(9)(8)}{3!}} = \frac{\cancel{6}^{\,1}}{(10)\cancel{(9)}\cancel{(4)}(2)} = \frac{3}{10} = .3$$

7. A quality improvement plan calls for daily inspection of 12 items from a production process with the items periodically sampled throughout the day. To see whether a 'clumping" of the defects seems to be occurring; inspectors count the number of runs of defectives and non defectives. Would you suspect a nonrandom arrangement if among ~~four defectives and~~ 3 defective and nine non defectives, one observes 2 runs? (10 points)

$$P(2\text{ runs}) = \frac{2\binom{3-1}{1-1}\binom{9-1}{1-1}}{\binom{12}{3}}$$

$$= \frac{2}{\left(\frac{12!}{3!\,9!}\right)} = \frac{(2)(6)}{12(11)(10)}$$

$$= \frac{1}{110} = .0\overline{09}.$$

Yes, because clumping is going on the probality is 0.9%

END