# Mathematics 210, Summer 1999 (Wilson)

## Exam 1    July 1, 1999

Your Name: _____

1. There are six problems. Write your answers to them in the spaces provided. If you must continue an answer somewhere other than immediately after the problem statement, be sure (a) to tell where to look for the answer, and (b) to label the answer wherever it winds up. In any case, be sure to circle your final answer to each problem.

2. There is scratch paper on the back of this page.

3. You have 75 minutes to work on this exam.

4. You may refer to notes you have brought in on one sheet of paper, as announced in class.

BE SURE TO SHOW YOUR WORK: YOU MAY RECEIVE REDUCED OR ZERO CREDIT FOR UNSUBSTANTIATED ANSWERS.

| Problem | Points | Score |
|---------|--------|-------|
| 1 | 18 | |
| 2 | 18 | |
| 3 | 17 | |
| 4 | 15 | |
| 5 | 18 | |
| 6 | 14 | |
| TOTAL | 100 | |

# SCRATCH PAPER

Problem 1     (18 points)

Cards are dealt at random from a special deck constructed by taking out all the aces and face cards from a regular deck. Thus this deck has 36 cards in four suits, two red and two black, and each suit has 9 cards numbered from 2 through 10.

(a) If three cards are dealt, what is the probability that all three are the same color?

(b) If two cards are dealt and the first one is an eight, what is the probability that the second one is a nine?

(c) If two cards are dealt, what is the probability that the numbers on the cards add up to give 8? (E.g. one way to get 8 is to have one card with a 3 and the other with a 5.)

Problem 2     (18 points)

A box contains 3 blue balls, 2 green balls, and 1 red ball. One ball is taken from the box, and its color noted. Then another ball is taken from the box (the first one is not put back in the box) and its color is noted.

(a) Draw a tree diagram for this experiment. Label the outcomes with pairs of letters, e.g. "GR" for the outcome where a green ball is drawn first and a red ball second. Show the probability of each outcome.

(b) What is the probability that the second ball chosen is green, given that the first one is red?

(c) What is the probability that the first ball chosen is red, given that the second one is green?

Problem 3    (17 points)

A company has 4 assembly lines producing a product. Some of the machines are more reliable than others:

A: Assembly line A makes 40% of the units produced, and 5% of the units from this assembly line are defective.

B: Assembly line B makes 20% of the units produced, and 10% of the units from this assembly line are defective.

C: Assembly line C makes 30% of the units produced, and 15% of the units from this assembly line are defective.

D: Assembly line D makes 10% of the units produced, and 25% of the units from this assembly line are defective.

If a randomly selected unit is found to be defective, what is the probability that it was made on assembly line C?

Problem 4     (15 points)

In a lottery there is a machine which selects a number from 1 through 10. But this machine is not fair: The probability that it produces a 2 is 2 times the probability that it produces a 1, the probability that it produces a 3 is 3 times the probability that it produces a 1, and so on through the probability of producing a 10 which is 10 times the probability of producing a 1.

(a) What is the probability for each outcome? (You should have a list of 10 numbers for your answer.)

(b) What is the probability that the number produced is even?

Problem 5    (18 points)

A telemarketer makes telephone calls trying to sell a product. She makes calls until one (or more) of the following happens:

  (i) She has made two sales in a row.

 (ii) She has failed to make a sale on three calls in a row.

(iii) She has made a total of four calls.

(a) How many outcomes are there? (Order matters: E.g. a sale followed by three failures is not the same as a failure, a sale, and then two more failures.)

(b) How many outcomes have at least two sales?

(c) How many outcomes involve exactly three telephone calls?

Problem 6    (14 points)

Three events $A$, $B$, and $C$ have the following probabilities:

1. $\Pr[A] = .45$

2. $\Pr[B] = .50$

3. $\Pr[C] = .30$

4. $\Pr[A \cap B] = .15$

5. $\Pr[B \cap C] = .10$

6. $\Pr[A \cap B \cap C] = .05$

7. $\Pr[(A \cup B \cup C)'] = .10$

Are events $A$ and $C$ independent?