Math 210, Lec. 3, Fall 1999 **NAME:**

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EXAM 2, October 15, 1999 **SCORE:**

Some Formulas:

$$Pr[E|F] = Pr[E \cap F]/Pr[F],\ P(n,r) = n!/(n-r)!,\ C(n,r) = n!/r!(n-r)!$$

$$\mu = E[X] = x_1p_1 + \cdots + x_kp_k,\ Var[X] = (x_1-\mu)^2p_1 + \cdots + (x_k-\mu)^2p_k,\ \sigma = \sqrt{V(X)}$$

$$C(n,r)p^r(1-p)^{n-r},\ \mu = E[X] = np,\ Var[X] = np(1-p),\ \sigma[X] = \sqrt{np(1-p)}$$

NOTE: There are four major questions I, III, II, IV. Answers need not be computed unless needed to answer a subsequent question. Answers given as a number (e.g. 720) with no indication of the reasoning involved are not acceptable.

I. 25 points A test for a "Really Awful Disease" (abbreviated RAD) can sometimes give a *false-positive* result (this happens when a person does not have RAD but the test result is positive). The test can also give a negative result when a person does have RAD. Suppose that the probabilities for the results of this test on a random person are:

	positive	negative
person with RAD	.95	.05
person without RAD	.15	.85

Suppose 8% of the people in a community have RAD. If a person is selected at random and tests positive, what is the probability that she has RAD?

II. 25 points There are two containers, a **bag** and a **box**. The **bag** contains 5 Red and 3 Blue Balls and the **box** contains 2 Red and 5 Blue Balls. A stochastic process consists of (i) selecting at random one of the containers, (ii) picking a ball at random from the selected container, noting its color, and putting it in the other container, (iii) selecting a ball from the other container.

(a) Draw a tree diagram labeling the branches with the appropriate probabilities.

(b) Determine the probability of the event that the two balls selected have different colors.

III. 25 points Consider the game whereby a person chooses at random a pair of **distinct** numbers (two at the same time) from 1, 2, 3, 4, 5, 6, 7, 8, 9. If both numbers are odd, the player gets \$5; if both are even, she gets \$4; if one is even and one is odd, she loses \$4. Let X be the random variable which gives the player's payoff.

(a) Determine the expected value of X.

(b) Is it wise for the player to play this game? Why or why not?

IV. 25 points A bag contains 3 Red and 4 Blue balls. Six balls are drawn at random in succession and with replacement. Find:

(a) The probability that an odd number of Red balls are drawn:

(b) The probability that at least one ball of each color is drawn:

(c) The expected number of Red balls drawn when six balls are drawn as described above.

(d) The variance for this experiment.