Practice Exam 2 Math 10 Spring 2006
(I wrote this **fast**, hence there may be tpyso (typos), if you are confused contact me ASAP - Prof. Leibon)

1. (15 points) The Masterfoods company says that before the introduction of purple, yellow candies made up 20% of their plain M&M's, red another 20%, and orange, blue and green each made of 10%. The rest were brown.

   (a) If you pick three M&M's in a row what is the probability that the third on is the first one that is red?

   (b) If you draw three M&M's, are the events that "an orange is drawn on the first draw" and "the third one drawn is the first one that is red" independent or disjoint or neither. Explain.

2. (10 points) Pricilla is flying form Manchester NH to San Diego CA with a connection in Dallas. The probability that her first flight leaves on time is 0.20. If her flight is on time, the probability that her luggage will make the connecting flight in Dallas is 0.95, but if the first flight is delayed, the probability that the luggage will make it is only 0.60.

   (a) Are the flights leaving on time and the luggage making the connection independent events? Explain.

   (b) What is the probability that her luggage arrives in San Diego with her?

3. (10 points) Which statements are true about the creation of confidence intervals:

   (a) For a given sample size, lower confidence means a lager margin of error.

   (b) For a specified confidence level, larger samples provide smaller margins of error.

   (c) For a fixed margin of error, larger samples provide greater confidence.

   (d) For a given confidence level, halving the margin of error requires twice the sample size.

4. (15 points) A company with a fleet of 320 cars found that the emissions systems of 11 out of 30 they tested failed to meet pollution control guidelines.

   (a) Is this strong evidence that more than 25% of the fleet might be out of compliance?

   (b) Test an appropriate hypothesis and state your conclusion.

5. (10 points) It is widely believed that regular mammogram screening may detect breast cancer early, resulting in fewer deaths from that disease. One study that investigated this issue over a period of 18 years was published during the 1970s. Among 30,565 women who had never had mammograms, 196 died of breast cancer, while only 153 of 30,131 who had undergone screening died of breast cancer.

   (a) Do these results suggest that mammograms may be an effective screening tool to reduce breast cancer deaths?

   (b) If your conclusion is incorrect, then what type of error have you committed?

6. (10 points) Recall an American roulette wheel has 18/38 red slots, and imagine that a Tasmanian roulette wheel has 10/38 red slots. You wish to determine whether certain roulette data was produced by a Tasmanian or American Roulette wheel by examining whether the number of times that the wheel landed on a red slot.

   (a) Recall that assuming a symmetric risks forces

   $$p^* = p_0 0 + \frac{\sqrt{p_0 q_0}(p_1 - p_0)}{(\sqrt{p_0 q_0} + \sqrt{p_1 q_1})}$$

   (where p_0 is the smaller of the two successes rates). Suppose you wish to run an experiment with symmetric risks and that the maximal risk you are willing to take is a 5% chance of an error. What is the experiment's minimal cost? In other words, how large will your sample size need to be?

   (b) Imagine, that before seeing the data, you believe that the wheel is equally likely to be an American or a Tasmanian wheel. You are told that this roulette wheel came up red 12 times in 40 spins. After seeing this data, with what probability should you now believe that the wheel is Tasmanian?

7. (10 points) In an *efficient market* the fair price for a contract is the expected value and it lies between the price at which the contract can be bought and the price at which the contract can be sold. For a market to be efficient there can be no "free lunch", in other words, there can be no contracts available from which you could make money with no risk. Shares of the following contracts are offered in efficient market.

Contract: "The party holding this contract receives one dollar from the party who sold this contract if event E_i occurs." The E_i include

E_1 = {Hillary Clinton is the 2008 Democratic Presidential Nominee.}
E_2 = {Mark Warner is the 2008 Democratic Presidential Nominee}
E_3 = {John Edwards is the 2008 Democratic Presidential Nominee }
E_4 = {Al Gore is the 2008 Democratic Presidential Nominee }
E_5 = {US Attaks Iran}
E_6 = { US Attacks Iran and Hillary Clinton is the 2008 Democratic Presidential Nominee.}

(a) How are the following quoted prices at which you can buy or sell the below contract in our market related to the probability of the event that it is based upon? (Imagine that these prices include any transaction fees.)

Offering	Sell	Buy
E_1	0.45	0.48

(b) Is it possible that the market would offer the following opportunity for you to sell or buy the following contract? Why or why not?

Offering	Sell	Buy
E_1	0.45	0.42

(c) Is it possible that the market would offer the following opportunities for you to sell or buy the following contracts? Why or why not?

Offering	Sell	Buy
E_1	0.45	0.48
E_2	0.33	0.37
E_3	0.15	0.18
E_4	0.13	0.15

(d) Is it possible that the market would offer the following opportunities for you to sell or buy the following contracts? Why or why not?

Offering	Sell	Buy
E_1	0.45	0.48
E_5	0.33	0.36
E_6	0.10	0.13