IEOR 151 – Homework 1
Due Friday, September 26, 2013 in class

1. For each the following scenarios, would you (i) accept the null hypothesis, (ii) reject the null hypothesis, or (iii) gather additional data and information before making a decision? Explain your reasoning. Note: The numbers in the scenarios below are fictional.

   (a) The null hypothesis is that hospitals using paper records have equal costs compared to hospitals using electronic records, the difference in average costs per patient is \$213 more for hospitals using paper records, and $p = 0.051$. (2 points)

   (b) The null hypothesis is that diners sitting at black tables spend as much as diners sitting at dark brown tables, the difference between the average spend amount is 10 cents, and $p = 0.049$. (2 points)

   (c) The null hypothesis is that there is no botulism bacteria in honey, 10% of store bought honey is found to contain botulism bacteria, and $p = 0.023$. (2 points)

   (d) The null hypothesis is that the speed of light in a vacuum on earth is the same as the speed of light in a vacuum in space, the measured difference is $20,000$ meters per second, and $p = 0.009$. (2 points)

2. Suppose 5 different hypothesis tests have been conducted, with p-values of: Test 1 ($p = 0.07$), Test 2 ($p = 0.002$), Test 3 ($p = 0.011$), Test 4 ($p = 0.003$), Test 5 ($p = 0.04$).

   (a) Using the Bonferroni correction, which tests should be accepted or rejected when the family-wise error rate is $\alpha = 0.05$. (2 points)

   (b) Using the Holm-Bonferroni method, which tests should be accepted or rejected when the family-wise error rate is $\alpha = 0.05$. (3 points)

3. Suppose $X_i \sim \mathcal{N}(\mu, \sigma^2)$ (for $n = 10$ data points) is iid data drawn from a normal distribution with mean μ and variance $\sigma^2 = 20$. Here, the mean is unknown, and we would like to determine if the mean is $\mu_0 = 0$ (decision d_0) or $\mu_1 = 5$ (decision d_1). Lastly, suppose our loss function is

   - $L(\mu_0, d_0) = 0$ and $L(\mu_0, d_1) = 2$;
   - $L(\mu_1, d_0) = 4$ and $L(\mu_1, d_1) = 0$.

   (a) Suppose γ^* is the threshold for the minimax hypothesis test. Without doing any calculations, what region must γ^* lie in? Explain your reasoning. Hint: There are three possibilities: $\gamma^* \in (0, 5)$, $\gamma^* \in (0, 2.5)$, or $\gamma^* \in (2.5, 5)$. (2 points)

(b) Using a binary search and a z-table, compute γ^* to within an accuracy of ± 0.1. (4 points)

4. Suppose we would like to select the optimal level of inventory of raspberries using a newsvendor model with production costs. Here, demand $X \sim \mathcal{N}(5200, 1000)$ is in units of boxes of raspberries, fixed costs are 1325 dollars, variable costs are 0.27 dollars per box of raspberries, holding costs are 1.50 dollars per box of raspberries, and the sale price is 2.99 dollars per box of raspberries. What is the optimal inventory level? (3 points)

5. Suppose we would like to select the optimal level of inventory of newspapers using a newsvendor model without production costs. Here, demand $X \sim \mathcal{U}(100, 200)$ is in units of newspapers, holding costs are 2.00 dollars per newspaper, and the sale price is 1.50 dollars per newspaper. What is the optimal inventory level? (4 points)