Statistics 20: Summer Session 2007
Quiz n. 3 *Monday July 30, 2007*

Full Name (Please print): _____ ID:_____ Lab:____

YOU MUST SHOW WORK TO RECEIVE ANY CREDIT

1. The nicotine content in cigarettes of a certain brand is normally distributed with standard deviation $\sigma = 0.1$ milligrams. The brand advertises that the mean nicotine content of their cigarettes is $\mu = 1.5$. The FDA believes that the actual nicotine content is higher than what is advertised by the brand, and they plan to investigate the advertised claim by measuring the nicotine content of 15 randomly selected cigarettes of this brand.

   (a) [2 point] Give the appropriate null hypothesis H_0 and alternative hypothesis H_a for the test that the FDA plans to conduct.

   (b) [3 points] Let $\bar{x}$ denote the average nicotine content for the 15 cigarettes that were randomly sampled. If $\bar{x} = 1.55$, what is the value of the test statistic for testing your hypotheses in (a)? (show all work)

(c) [3 points] What is the $P-$value for your test statistic? Can you reject the null hypothesis at the 5% significance level? (show all work)

(d) [3 points] What is the smallest value of $\bar{x}$ for which you will reject H_0 at the 5% significance level?

2. Suppose that the readings of a laboratory scale are normally distributed with unknown mean μ and standard deviation $\sigma = 0.01$ grams. To assess the accuracy of the laboratory scale, a standard weight that is known to weigh exactly 1 gram is repeatedly weighed a total of $n = 50$ times. Let $\bar{x} = 0.998$ be the average of the 50 readings.

   You can use the following formulas regarding confidence intervals to answer the questions below:

   For a random sample of size n drawn from a population of unknown mean μ and known SD σ, the $(1-\alpha)$ CI for μ is $\left(\bar{x} - z^* \frac{\sigma}{\sqrt{n}}, \bar{x} + z^* \frac{\sigma}{\sqrt{n}}\right)$, where z^* is the ***critical value****, selected so that a standard Normal density has area $(1-\alpha)$ between $-z^*$ and z^*.*

   (a) [3 points] What is a 95% confidence interval for μ? (show all work)

   (b) [3 points] What is a 99% confidence interval for μ? (show all work)

   (c) [3 points] How large of a sample is needed so that the margin of error for a 95% confidence interval for μ is no larger than 0.0001. (show all work)