I pledge my honor that I have abided by the Honor System. ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯

Show your work for full credit.

1. A battery retailer has received a large shipment of automobile batteries from a supplier. The supplier claims that the batteries have a mean life of 36 months. Ten batteries, randomly sampled from the shipment, yielded the following lifetimes, in months.

   ```
   27.6    28.7    34.7    29.0    22.9
   29.6    29.4    30.2    36.5    34.7
   ```

   (a) (5 pts) Compute the sample average lifetime, $\bar{x}$, of the batteries.

   (b) (5 pts) Construct a stem-and-leaf plot for the the lifetimes, making sure to label the plot appropriately.

   (c) (5 pts) Give the appropriate null (H_0) and alternative (H_a) hypotheses for testing whether the mean life of the supplier's batteries is less than the claimed 36 months?

   (d) (5 pts) Compute the p-value obtained when testing the hypotheses of part (c), assuming the lifetimes are normally distributed. Note that the sample standard deviation in lifetimes for the sample data is $s = 4.01$.

   (e) (5 pts) Do the results of your test indicate that the null hypothesis should be rejected at the 1% significance level? Justify your answer.

2. (10 pts) A taxi company is trying to decide whether to purchase tires of brand A or brand B for its fleet of taxis, both costing approximately the same. To estimate the difference in lifetime for the two brands, an experiment is conducted using 32 tires of brand A and 36 of brand B. The tires are run until they wear out. The results are:

Brand A	$n_1 = 32$	$\bar{x}_1 = 36,300$ km	$s_1 = 5000$ km
Brand B	$n_1 = 36$	$\bar{x}_1 = 38,100$ km	$s_1 = 6100$ km

Compute a 95% confidence interval for $\mu_1 - \mu_2$.

3. (10 pts) The probability that a doctor correctly diagnoses a particular illness is 0.7. Given that the doctor makes an incorrect diagnosis, the probability that the patient files a lawsuit is 0.9. What is the probability that the doctor makes an incorrect diagnosis AND the patient sues?

4. (10 pts) Professor Coke is a peanut freak. At home, he eats peanuts one after the other without stopping. It takes him an average of 5 seconds to eat a peanut, with standard deviation 1 second. His peanut eating times are independent of each other, but we don't know their distribution. What is the probability it takes him more than 8 minutes to eat a bag containing 100 peanuts?

5. (10 pts) A manufacturer of college textbooks is interested in estimating the strength of the bindings produced by a particular binding machine. Strength can be measured by recording the force required to pull the pages from the binding. If this force is measured in pounds, how many books should be tested in order to estimate the average force required to break the binding to within 0.05 lb with 98% confidence? Assume that the standard deviation in required force is $\sigma = 1.2$.

6. A dealer's profit on a new automobile, in units of $1000, can be looked upon as a random variable, X, having density function

$$f(x) = \begin{cases} 2(x - 1), & 0 < x < 1 \\ 0, & \text{otherwise} \end{cases}$$

(a) (5 pts) Find the cumulative distribution function, $F(x) = P(X < x)$, describing the dealer's profit per automobile and use it find the dealer's median profit per automobile, *i.e.* x such that $F(x) = 0.5$.

(b) (5 pts) Compute the variance in dealer profit per automobile, $Var(X)$.

7. (10 pts) A government agency is evaluating the effectiveness of electronic mail to replace interoffice memos. Although rapid and increased communication is a major benefit of the new technology, significant operating-cost reductions are needed to substantiate procurement of the new hardware. A three month test was performed using e-mail in a sample of 12 district offices. Each office in this district was matched with a counterpart where all interoffice memos were generated on hard copy. The average difference in costs for the offices using e-mail relative to the offices using hard copies was $\bar{d} = 104.25$, with $s_d = 203.50$. Is it cost effective for the agency to switch to e-mail? Test at the 5% significance level.

8. The controls in a brewery need adjustment whenever the proportion p of underfilled cans is 0.05 or greater.

   (a) (5 pts) Assume the true proportion of underfilled cans is 0.10. What is the probability that in a sample of 10 cans, more than one is found to be underfilled?

   (b) (5 pts) Suppose we do not know the true proportion of underfilled cans. Periodically, a sample of 100 cans is selected and the contents are measured. In one such sample, 12 underfilled cans were found. Compute a 96% confidence interval for the true proportion of underfilled cans.

   (c) (5 pts) Based on your answer to part (b), do you believe the brewery controls need adjustment? Justify your answer.