MATH 450
Fall 2017
Review problems
11/30/17
Time Limit: 90 Minutes

Name (Print): ______________________________

This exam contains 6 pages (including this cover page) and 5 problems. Check to see if any pages are missing. Enter all requested information on the top of this page, and put your initials on the top of every page, in case the pages become separated.

You may *not* use your books/notes on this exam. You may use calculator.

You are required to show your work on each problem on this exam. The following rules apply:

- **Organize your work**, in a reasonably neat and coherent way, in the space provided. Work scattered all over the page without a clear ordering will receive very little credit.
- **Mysterious or unsupported answers will not receive full credit**. A correct answer, unsupported by calculations, explanation, or algebraic work will receive no credit; an incorrect answer supported by substantially correct calculations and explanations might still receive partial credit.

Do not write in the table to the right.

Problem	Points	Score
1	20	
2	20	
3	20	
4	25	
5	15	
Total:	100	

1. (20 points) A gas station sells three grades of gasoline: regular unleaded, extra unleaded, and super unleaded. These are priced at 2.20, 2.35, and 2.50 per gallon, respectively. Let X_1, X_2, and X_3 denote the amounts of these grades purchased (gallons) on a particular day. Suppose the X_i's are independent with $\mu_1 = 1000$, $\mu_2 = 500$, $\mu_3 = 300$, $\sigma_1 = 100$, $\sigma_2 = 80$, $\sigma_3 = 50$. Compute the expected value and the standard deviation of the revenue from sales

$$Y = 2.2X_1 + 2.35X_2 + 2.5X_3.$$

2. (20 points) Fat content (in percentage) of $n = 10$ randomly selected hot dogs are

$$25.2 \quad 21.3 \quad 22.8 \quad 17.0 \quad 29.8 \quad 21.0 \quad 25.5 \quad 16.0 \quad 20.9 \quad 19.5$$

Assuming that these were selected from a normal population distribution,

- Construct the 95% confidence interval of the population mean fat content
- Another hot dog of this type is selected, construct the 95% prediction interval for its fat content.

3. (20 points) In an experiment designed to measure the time necessary for an inspectors eyes to become used to the reduced amount of light necessary for penetrant inspection, the sample average time for $n = 9$ inspectors was 6.32s and the sample standard deviation was 1.65s.

   It has previously been assumed that the average adaptation time was 7s. Assuming adaptation time to be normally distributed, does the data contradict prior belief? Use the t test with $\alpha = 0.1$.

4. (25 points) The following data summarizes the proportional stress limits for specimens constructed using two different types of wood:

Type of wood	Sample size	Sample mean	SD
Red oak	14	8.48	0.79
Douglas fir	10	6.65	1.28

Assuming that both samples were selected from normal distributions, carry out a test of hypotheses with significance level $\alpha = 0.05$ to decide whether the true average proportional stress limit for red oak joints exceeds that for Douglas fir joints by more than 1 MPa. Provide the P-value of the test.

5. (15 points) A data set $x_1, x_2, \ldots, x_{10}$ is sampled from a *log-normal distribution* with parameter μ and σ and satisfies

$$\sum x_i = 3860 \quad \text{and} \quad \sum x_i^2 = 4,574,802.$$

Given that for a lognormal distribution with parameter μ and σ, we have

$$E(X) = \exp\left(\mu + \frac{\sigma^2}{2}\right) \quad \text{and} \quad E(X^2) = \exp\left(2\mu + 2\sigma^2\right),$$

estimate μ and σ using the method of moments.