MATH 115
SPRING 2017 NAME:
EXAM 5

1. $\boxed{\text{4 pts. each}}$ The axial load of a random sample of 20 aluminum cans with thickness 0.277 mm is found to have a standard deviation of 85.6 N. It is claimed that cans with thickness 0.277 mm have axial loads with the same standard deviation as that of cans with thickness 0.282 mm. The thicker cans are known to have axial loads with a standard deviation of 118.4 N. Assume the population is normally distributed. Let $\alpha = 0.01$.

   (a) State H_0 and H_a, identifying the claim.
   (b) Find the critical value(s).
   (c) Identify the rejection region.
   (d) Find the standardized test statistic.
   (e) Is the claim supported?

2. $\boxed{\text{4 pts. each}}$ An energy company wants to choose between two regions in a state to install wind turbines. A researcher claims that the wind speed in Region A is less than in Region B. To test the regions, the mean wind speed is recorded for 60 days in each region. The mean wind speed in Region A is 21.0 km/h (assume the population standard deviation is 3.4 km/h). The mean wind speed in Region B is 22.7 km/h (assume the population standard deviation is 4.9 km/h). Assume the samples are random and independent, and the populations are normally distributed. Let $\alpha = 0.05$.

   (a) State H_0 and H_a, identifying the claim.
   (b) Find the critical value(s).
   (c) Identify the rejection region.
   (d) Find the standardized test statistic.
   (e) Can the company support the researcher's claim?

3. $\boxed{\text{4 pts. each}}$ A pet association claims that the mean annual cost of food for a dog is greater than that for a cat. Data is collected and the following is found:

Dogs	**Cats**
$\overline{x}_1 = \$239$	$\overline{x}_2 = \$203$
$s_1 = \$32$	$s_2 = \$21$
$n_1 = 16$	$n_2 = 18$

   Let $\alpha = 0.10$, assume the samples are random and independent, and assume the population variances are not equal.

   (a) State H_0 and H_a, identifying the claim.
   (b) Find the critical value(s).
   (c) Identify the rejection region.
   (d) Find the standardized test statistic.
   (e) Can the pet association's claim be rejected?

4. $\boxed{\text{20 pts.}}$ The weights (in pounds) of eight vehicles are the variabilities of their braking distances (in feet) when stopping on a wet pavement are as follows:

Weight x	5890	5340	6500	4800	5940	5600	5100	5850
Variability y	3.16	2.40	4.09	1.72	3.78	2.53	2.32	2.78

At $\alpha = 0.05$ is there enough evidence to conclude that there is a significant linear correlation between vehicle weight and braking distance variability on a wet pavement?

5. $\boxed{\text{20 pts.}}$ Find the equation of the regression line for the data in Problem #4. Then construct a scatter plot of the data and draw the regression line.

Some Formulas

Two-Sample z-test for the difference between means (independent samples):

$$z = \frac{(\overline{x}_1 - \overline{x}_2) - (\mu_1 - \mu_2)}{\sigma_{\overline{x}_1 - \overline{x}_2}}, \qquad \sigma_{\overline{x}_1 - \overline{x}_2} = \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}.$$

Two-Sample t-test for the difference between means (independent samples), variances not equal:

$$t = \frac{(\overline{x}_1 - \overline{x}_2) - (\mu_1 - \mu_2)}{s_{\overline{x}_1 - \overline{x}_2}}, \qquad s_{\overline{x}_1 - \overline{x}_2} = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}},$$

d.f. is the smaller of $n_1 - 1$ and $n_2 - 1$.

Correlation coefficient:

$$r = \frac{n\sum xy - (\sum x)(\sum y)}{\sqrt{n\sum x^2 - (\sum x)^2} \cdot \sqrt{n\sum y^2 - (\sum y)^2}}$$

Regression line ingredients:

$$m = \frac{n\sum xy - (\sum x)(\sum y)}{n\sum x^2 - (\sum x)^2}, \qquad b = \overline{y} - m\overline{x}.$$