MATH 115
FALL 2016 NAME:
EXAM 5

1. $\boxed{\text{4 pts. each}}$ 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?

2. $\boxed{\text{4 pts. each}}$ A pet association claims that the mean annual costs of food for dogs and cats are as follows:

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?

3. $\boxed{\text{20 pts.}}$ 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?

4. $\boxed{\text{20 pts.}}$ Find the equation of the regression line for the data in Problem #3. Then construct a scatter plot of the data and draw the regression line.

5. $\boxed{\text{4 pts. each}}$ A researcher claims that the number of homicides in California by season is uniformly distributed. To test this claim, 1200 homicides from a recent year are randomly selected, and the season in which each happened is recorded. The results are as follows:

Season	**Frequency** f
Spring	309
Summer	312
Fall	290
Winter	289

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 researcher's claim be rejected?

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:

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