MONT 103N – Analyzing Environmental Data
Problem Set 5
Due: in class, Friday, April 20

1. Cadmium, a heavy metal, is toxic to animals. Mushrooms are able to absorb and accumulate cadmium at high concentrations from the soil they grow in. The Czech and Slovak authorities set a safety limit of 0.5 ppm cadmium in mushrooms. M. Melgar, et. al. measured the cadmium levels in a random sample of $n = 12$ examples of the edible mushroom *Boletus pinicola* and published the results in the *Journal of Environmental Science and Health*, vol. B33(4), p. 439-455. Their data was as follows (all cadmium levels in ppm)

$$0.24, 0.59, 0.62, 0.16, 0.77, 1.33, 0.92, 0.19, 0.33, 0.25, 0.59, 0.32$$

A) What are the average cadmium level and the SD of the cadium level in this mushroom sample?
B) Describe an appropriate test to decide whether the cadmium level in these mushrooms exceeds the government safety limit. Give the null and alternative hypotheses, describe how the test statistic would be computed, and state the rejection region for a test with $\alpha = .05$.
C) Carry out your test and explain the results.

2. Doctors have determined that about 2.29% of all human pregnancies result in children who have major birth defects. A study of the effect of folic acid (reported in the *New England Journal of Medicine*) found that out of a random sample of $n = 2701$ women given folic acid as a dietary supplement during pregnancy (assume no twins or higher multiples), 35 of the children had major birth defects.

A) Identify an appropriate test to decide whether taking folic acid reduces the incidence of major birth defects. Give the null and alternative hypotheses, describe how the test statistic would be computed, and state the rejection region for a test with $\alpha = .01$.
B) Now carry out your test. Is there sufficient evidence to conclude that women who take folic acid have a reduced risk of having children with major birth defects? Explain.

Comment: This is a simplified version of the actual study. That involved randomly assigning women to a treatment group (getting folic acid) and a control group (getting only a placebo) and comparing the rates of birth defects.

3. The seagrass *Thalassia testudinum* is an integral part of the Texas coastal ecosystem. Essential to the growth of this plant is ammonium in the sediment on the sea floor where the plants are rooted. In a study reported in the *Marine Ecology Progress Series*, vol 196, p. 39-48, the following data on sediment ammonium concentrations was collected at two locations: Corpus Christi Bay (CCB) and Lower Laguna Madre (LLM). The y_i are the average ammonium concentrations (in micromoles) , the SD_i are the sample SD's, and the

n_i are the number of measurements made at each site:

CCB	LLM
$\overline{y_1} = 115.1$	$\overline{y_2} = 24.3$
$SD_1 = 79.4$	$SD_2 = 10.5$
$n_1 = 51$	$n_2 = 19$

A) At the $\alpha = .05$ level, is there sufficient evidence to say that the ammonium level is different at CCB and LLM? (Note: Since the total number of samples is large, you can use the large-sample formulas even though the $n_2 = 19$ would not "qualify" by itself. Also, the way the question is phrased indicates you want to carry out a 2-tail test!)

B) Estimate the p-value of your test in part A.

C) Based on your answer to part A and the information given above, would you expect the seagrass beds to be taller and thicker at CCB or LLM?