1. An experiment is carried out on n = 15 rats where each rat is given a unit dose an experimental drug. Interest lies in measuring the response time to a neurological stimulus. The mean response time for rats not injected with the drug is 1.2 seconds. The experimenter wants to determine if the mean response time for rats injected with the drug differs from 1.2 seconds. Let μ denote the mean response time for rats injected with a unit dose of the experimental drug. Do the following parts:

   a) Set up an appropriate null and alternative hypothesis for this problem in terms of μ.

   b) In the context of this problem, what is a type I error?

   c) In the context of this problem, what is a type II error?

   d) Suppose the mean response time for the n = 15 rats was found to be $\bar{X}$ = 1.05 seconds with standard deviation s = 0.5 seconds. Perform t-test for this problem at alpha = 0.05.

2. Atrazine is a chemical used in herbicides. Over the last decade, the average atrazine concentration per liter of water in Lake Michigan was 10 ng/L. Efforts have been made to reduce the use of atrazine. A year after these efforts began, a study was conducted to determine if the average atrazine concentration had decreased in Lake Michigan. A random sample of n = 100 liters of Lake Michigan water were tested for atrazine a year after the efforts began. The sample mean was found to be $\bar{X}$ = 9.1 ng/L with standard deviation s = 2.3 ng/L. Do the following parts:

a) Let μ denote the average atrazine (ng/L) concentration in Lake Michigan a year after the effort to reduce the use of atrazine. Set up the appropriate null and alternative hypotheses *in terms of* μ.

b) In the context of this problem, what is a type I error?

c) In the context of this problem, what is a type II error?

d) Using a level of significance α = 0.05, test the hypothesis stated in part (a). Be sure to compute the test statistic and see if it falls in the critical region. Write a sentence discussing the result of your test.

e) Form a 95% confidence interval for μ.

3. A crossover study was conducted to investigate whether oat bran cereal helps to lower serum cholesterol levels in hypercholesterolemic males. Fourteen such individuals were randomly placed on a diet that included either oat bran or corn flakes; after two weeks, their low-density lipoprotein (LDL) cholesterol levels were recorded. Each man was then switched to the alternative diet. After a second two week period, the LDL cholesterol level of each individual was again recorded. The data from this study was shown below. (Anderson et al. Americal Journal of Clinical Nutrition, Vol 265, 1990, 495-499)

subject	LDL (mmol/l)	
	Corn Flakes	Oat Bran
1	4.61	3.84
2	6.42	5.57
3	5.40	5.85
4	4.54	4.80
5	3.98	3.68
6	3.82	2.96
7	5.01	4.41
8	4.34	3.72
9	3.80	3.49
10	4.56	3.84
11	5.35	5.26
12	3.89	3.73
13	2.25	1.84
14	4.24	4.14

a. Are the two samples of data paired or independent?

b. What are the appropriate null and alternative hypotheses for a two-sided test?

c. Conduct the test at 0.05 level of significance. What is p-value?

d. What do you conclude?

4. As part of the Women's Health Trial, one group of women were encouraged to adopt a low-fat diet while a second group received no dietary counseling. A year later, the women in the intervention group had successfully maintained their diets. At that time, a study was undertaken to determine whether their husbands also had a reduced level of fat intake. (Shattuck et al, American Journal of Public Health, Vol 82: 1244—1250, 1992)

In the intervention group, a sample of 156 husbands has mean daily fat intake 54.8 grams and standard deviation 28.1 grams. In the control group, a sample of 148 husbands has mean intake 69.5 grams and standard deviation 34.7 grams. Formally test the null hypothesis that the two groups of men have the same mean dietary fat intake using a two-sided test. What do you conclude?