Exercise 6

1. Consider the following null and alternative hypotheses:

$$H_0: \mu = 120 \text{ vs } H_1: \mu < 120$$

A random sample of 81 observations taken from this population produced a sample mean of 116.5. The population standard deviation is known to be 15.

   a. If this test is made at a 10% significance level, would you reject the null hypothesis? Use the critical-value approach.
   b. What is the probability of making a Type I error in part a?
   c. Calculate the *p*-value for the test. Based on this *p*-value, would you reject the null hypothesis if $\alpha = 0.01$? What if $\alpha = 0.05$?

2. Customers often complain about long waiting times at restaurants before the food is served. A restaurant claims that it serves food to its customers, on average, within 15 minutes after the order is placed. A local newspaper journalist wanted to check if the restaurant's claim is true. A sample of 36 customers showed that the mean time taken to serve food to them was 15.75 minutes with a standard deviation of 2.4 minutes. Using the sample mean, the journalist says that the restaurant's claim is false.

   a. Do you think the journalist's conclusion is fair to the restaurant? State the null and alternative hypotheses and use a 1% significance level to answer this question. You are free to use the *p*-value or critical value approaches.
   b. What are the Type I and Type II errors in part a?

3. A consulting agency was asked by a large insurance company to investigate if business majors were better salespersons than those with other majors. A sample of 20 salespersons with a business degree showed that they sold an average of 11 insurance policies per week. Another sample of 25 salespersons with a degree other than business showed that they sold an average of 9 insurance policies per week. Assume that the two populations are approximately normally distributed with population standard deviations of 1.80 and 1.35 policies per week, respectively. Using a 1% significance level, can you conclude that people with a business degree are better salespersons than those who have a degree in another area? Use the critical value approach.

4. A study of pet owners showed the following information concerning the ownership of dogs and cats.

	Number of people in family		
Pet type	**1**	**2**	**3 or more**
Dog	7	31	27
Cat	13	19	23

   a. You are interested in identifying the relationship between the number of people in a family and dog or cat ownership. Write down the appropriate null and alternative hypotheses.
   b. Calculate the test statistic and write down the distribution of this test statistic.
   c. It is given that the critical value for $\alpha = 0.10$ is 6.251. Given this information, how do you conclude the hypothesis test?

5. A clothing store chain is having a sale based on the use of a coupon. The company is interested in knowing whether the wording of the coupon affects the number of units of the product purchased by customers. The company created four coupons for the same product, each with different wording. Four groups of 50 customers each were selected at random. Group 1 received the first version of the coupon; Group 2 received the second version; and so on. The units of the product purchased by each customer were recorded.
   a. What would be the suitable null and alternative hypotheses that can be used to test whether the wording of the coupon affects the number of units of the product purchased by customers? What procedure is used to test the two hypotheses?
   b. Suppose that the *p*-value is found to be 0.532. What conclusion can we draw from the test?
   c. Suppose that the *p*-value is found to be 0.00023. What conclusion can we draw from the test?