Steps for a hypothesis test for a population mean.

1. Determine the null and alternative hypotheses. Your null hypothesis should be of the form "$H_0 : \mu = \mu_0$", where μ_0 is a number. The alternative hypothesis will take one of three forms: "$H_a : \mu \neq \mu_0$," "$H_a : \mu > \mu_0$," or "$H_a : \mu < \mu_0$." Normally, the null hypothesis will be the statement that you are trying to disprove and the alternative hypothesis will be the statement that you are trying to show is true.

2. Calculate the test statistic. If the population standard deviation σ is known, then the test statistic is $z = \frac{\bar{x} - \mu_0}{\sigma/\sqrt{n}}$. If σ is unknown, the test statistic is $t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$

3. Calculate the P-value for the test, which depends on the form that the alternative hypothesis takes. The probabilities for when σ is known can be found using Table A, and for when σ is

	σ known	σ unknown
$H_a : \mu \neq \mu_0$	$p = 2P(Z > |z|)$	$p = 2P(T > |t|)$
$H_a : \mu > \mu_0$	$p = P(Z > z)$	$p = P(T > t)$
$H_a : \mu < \mu_0$	$p = P(Z < z)$	$p = P(T < t)$

unknown can be found (or approximated) using Table C.

4. Determine if there is sufficient evidence against the null hypothesis in favor of the alternative hypothesis. If the P-value is smaller than the significance level, α, there is enough evidence against H_0 so we can reject it. Otherwise, the data do not provide enough evidence to reject H_0. If no significance level is given, you can use $\alpha = 0.05$.

Review Problems for Chapter 14 and Chapter 17

1. Julia enjoys jogging. She has been jogging over a period of several years, during which time her physical condition has remained constantly good. Usually, she jogs 2 miles per day. The standard deviation of her times is $\sigma = 1.80$ minutes. During the past year, Julia has recorded her times to run 2 miles. She has a random sample of 90 of these times. For these 90 times, the mean was $\bar{x} = 15.60$ minutes. Let μ be the mean jogging time for the entire distribution of Julia's 2-mile running times (taken over the past year).

   (a) What is the standard deviation of $\bar{x}$?
   (b) Find the margin of error for a 95% confidence interval for μ
   (c) Find a 95% confidence interval for μ

2. You want a sleeping bag that will keep you warm in temperatures from 20°F to 45°F. A random sample of prices of 20 such sleeping bags gives $\bar{x} = \$83.75$ and $s = \$28.97$.

   (a) What is the standard error of $\bar{x}$?

   (b) Find the margin of error for a 90% confidence interval for μ

   (c) Find a 90% confidence interval for μ

3. Pyramid Lake is on the Paiute Indian Reservation in Nevada and is famous for its cutthroat trout. Suppose a friend tells you that the average length of trout caught in Pyramid Lake is 19 inches. However, the Creel Survey, published by the Pyramid Lake Paiute Tribe Fisheries Association, reported that of a random sample of 51 fish caught, the mean length was 18.5 inches, with a standard deviation of 3.2 inches. Use the following steps to determine if the average length of a trout caught in Pyramid Lake is less than 19 inches.

   (a) What are the null and alternative hypotheses?

   (b) Find the test statistic.

   (c) What is the P-value?

   (d) Do the data indicate that the average length of trout is less than 19 inches? Use $\alpha = 0.01$

4. Sunspots have been observed for many centuries. Some archaeologists think sunspot activity may somehow be related to prolonged periods of drought in the southwestern United States. A random sample of 40 4-week periods from Spanish colonial times gave an average number of 47.0 sunspots. Previous studies of sunspot activity during this period indicate that $\sigma = 35$. Use the following steps to determine if the mean sunspot activity during the Spanish colonial period was higher than 41.

   (a) What are the null and alternative hypotheses?

   (b) Find the test statistic.

   (c) What is the P-value?

   (d) Do the data indicate that the mean sunspot activity during the Spanish colonial period was higher than 41? Use $\alpha = 0.10$

5. A table of random digits uses a sequence of digits where each digit is equally likely, so the mean of all random digits is 4.5. 101 digits chosen at random from a table have mean 3.9 and standard deviation 2.9. Use the following steps to determine if there is enough evidence to determine that this table is using a different method to produce random digits.

   (a) What are the null and alternative hypotheses?

   (b) Find the test statistic.

   (c) What is the P-value?

   (d) Do the data indicate that there is a problem with the table of random digits? Use $\alpha = 0.05$