For the problems 1-3, (a) describe the population and explain in words what the parameter p is; (b) give the numerical value of the statistics $\hat{p}$ that estimates p .

1.   Tonya wants to estimate what proportion of the students in her dormitory like dorm food. She interviews an SRS of 50 of the 175 students living in the dormitory. She finds that 14 think dorm food is good.

2.   Glenn wonders what proportion of the students at his school think that tuition is too high. He interviews an SRS of 50 of the 2400 students at his college. Thirty-eight of those interviewed think tuition is too high.

3.   A college president says, "99% of the alumni support my firing of Coach Taylor." You contact an SRS of 200 of the college's 14,000 living alumni and find that 76 of them support firing the coach.

4.   In which of the following situations can you safely use the methods of this section to get a confidence interval for the population proportion p ? Explain your answers.

A.   Gina wants to estimate what proportion of the students in her dormitory like the dorm food. She interviews an SRS of 50 of the 175 students living in the dormitory. She finds that 14 think the dorm food is good.

B.   Bob wonders what proportion of the students at his school think that tuition is too high. He interviews an SRS of 50 of the 2400 students at his college. Thirty-eight of those interviewed think tuition is too high.

C.   In the National AIDS Behavioral Surveys sample of 2,672 adult heterosexuals, 0.2% have both received a blood transfusion and had a sexual partner from a group at high risk of AIDS. We want to estimate the proportion p in the population who share these two risks factors.

5.   In which of the following situations can you safely use the methods of this section for a significance test? Explain your answers.

A.   You toss a coin 10 times in order to test the hypothesis $H_0 : p = .5$ that the coin is balanced.

B.   A college president says, "99% of the alumni support my firing of Coach Taylor." You contact an SRS of 200 of the college's 14,000 living alumni to test the hypothesis $H_0 : p = .99$.

C.   Do a majority of the 250 students in a statistics course agree that knowing statistics will help them in their future careers? You interview an SRS of 20 students to test $H_0 : p = .5$.

6.   As part of a quality improvement program, you mail-order company is studying the process of filling customer orders. Company standards say an order is shipped on time if it sends within 3 working

days after it is received. You audit an SRS of 100 of 5000 orders received in the past month. The audit reveals that 86 of these orders were shipped on time.

A.   Check that you can safely use methods in this section.

B.   Find a 95% confidence interval for the true proportion of the month's orders that were shipped on time.

7.   The 1995 Harvard School of Public Health College Alcohol Study examined use among college students, including the practice called "binge drinking". Binge drinking for men was defined as consuming 5 or more drinks on at least one occasion during the two weeks prior to the survey (four drinks for women). Binge drinkers experience a higher percentage of alcohol-related problems such as disciplinary problems, violence, irresponsible sexual activity, personal injury, and poor academic performance. In a representative sample of 140 colleges and 17,592 students, 7741 students identified themselves as binge drinkers. Considering this an SRS of 17,592 from the population of all college students, does this constitute strong evidence that more than 40% of all college students engage in binge drinking?

8.   In a recent year, 73% of first-year college students responding to a national survey identified "being very well-off financially" as an improvement personal goal. A state university finds that 132 of an SRS of 200 of its first-year students say that this goal is important.

A.   Give a 95% confidence interval for the proportion of all first-year students at the university who would identify being well-off as an important personal goal.

B.   Is there good evidence that the proportion of first-year students at this university who think being very well-off is important differs from the national value, 73%? (State the hypotheses, give the P-value, and state your conclusion.)

C.   Check that you could safely use the methods of this section in both (a) and (b).

9.   Around the year 1900, the English statistician Karl Pearson tossed a coin 24,000 times. He obtained heads 12,012 times.

A.   Test the null hypothesis that Pearson's coin had probability 0.5 of coming up heads versus the two-sided alternative. Give the P-value. Do you reject H_0 at the 1% significance level?

B.   Find a 99% confidence interval for the probability of heads for Pearson's coin. This is the range that cannot be rejected at the 1% significance level.

10.   A national opinion poll found that 44% of all American adults agree that parents should be given vouchers good for education at any public or private school of their choice. The result was based on a small sample. How large of an SRS is required to obtain a margin of error of 0.03 (that is, $\pm 3\%$) in a 95% confidence interval?

A.   Answer this question using the previous poll's result as the guessed value p *.

B.   Do the problem again using the conservative guess p *= .5. By how much do the two samples differ.

11.   PTC is a substance that has a strong bitter taste for some people and is tasteless for others. The ability to taste PTC is inherited. About 75% of Italians can taste PTC, for example. You want to estimate the proportion of Americans with at least one Italian grandparent who can test PTC. Starting with the 75% estimate for Italians, how large a sample must you test in order to estimate the proportion of PTC tasters within ± 0.04 with 95% confidence?

12.   Gina, Sally, and Joe are investigating student attitudes toward college food for an assignment in their introductory to statistics class. Based on comments overheard from other students, they believed that fewer than 1 in 3 students liked college food. To test this hypothesis, each selected an SRS of students who regularly eat in the cafeteria, and asked them if they like college food. Fourteen in Gina's SRS of 50 replied, "Yes", while 98 in Sally's sample of 350, and 140 in Joe's sample of 500 said they like college food. Use your TI-83 to perform a test of significance on all three results and fill in a table like this:

X	n	$\hat{p}$	z	P-value
14	50			
98	350			
140	500			

Describe your finding in a short narrative.

13.   An experiment on the side effects of pain relievers assigned arthritis patients to one of several over-the-counter pain medications. Of the 440 patients who took one brand of pain reliever, 23 suffered some "adverse symptom." Does the experiment provide strong evidence that fewer than 10% of patients who take this medication have adverse symptoms?

14.   One-sample procedures for proportions, like those for means, are used to analyze data from matched pair designs. Here is an example.

        Each of 50 subjects tastes two unmarked cups of coffee and says which he or she prefers. One cup in each pair contains instant coffee; the other, fresh brewed coffee. Thirty-one of the subjects preferred fresh-brewed coffee. Take p to be the proportion of the population who would prefer fresh-brewed coffee in a blind tasting.

A.   Test the claim that a majority of people prefer the taste of fresh-brewed coffee. State hypotheses and report the z statistic and its P-Value. Is your conclusion significant at 5%? What is your practical conclusion?

B.   When you do an experiment like this, in what order should you present the two cups of coffee to the subjects?

15.   An automobile manufacturer would like to know what proportion of its customers are not satisfied with the service provided by their local dealer. The customer relations department will survey a random sample of customers and compute a 99% confidence interval for the proportion who are not satisfied.

A.   From past studies, they believe that this proportion will be about 0.2. Find the sample size needed if the margin of error of the confidence interval is to be about 0.015.

B.   When the sample is actually contacted, 10% of the sample said they were not satisfied. What is the margin of error of the 99% confidence interval?

16.   The 1958 Detroit Area Study was an important investigation of the influence of religion on everyday life. The sample "was basically a simple random sample of the population of the metropolitan area" of Detroit, Michigan. Of the 656 respondents, 267 were white Protestants and 230 were white Catholics.

        The study took place at the height of the cold war. One questions asked if the right of free speech included the right to make speeches in favor of communism. Of the 267 white Protestants, 104 said "Yes", while 75 of the 230 while Catholics said "Yes."

A.   Give a 95% confidence interval for the difference between the proportion of Protestants who agreed that communist speeches are protected and the proportion of Catholics who held this opinion.

B.   Check that is safe to use the z confidence interval.

17.   We want to know whether complainers of an HMO are more likely to leave than patients who do not file complaints. In the year of this study, 639 patients filed complaints, and 54 of these patients left the HMO voluntarily. For comparison, the HMO chose an SRS of 743 patients who had not filed complaints. Twenty-two of these patients left voluntarily.

A.   How much higher is the proportion of complainers who leave? Give a 90% confidence interval.

B.   The HMO has more than 400,000 members. Check that you can safely use the methods of this section.

18.   The 1958 Detroit Area Study was an important investigation of the influence of religion on everyday life. The sample "was basically a simple random sample of the population of the metropolitan area" of Detroit, Michigan. Of the 656 respondents, 267 were white Protestants and 230 were white Catholics.

        One question asked whether the government was doing enough in areas as housing, unemployment, and education; 161 of the Protestant and 136 of the Catholics said "No." is there evidence that white Protestants and white Catholics differ on this issue?

A.   State the hypotheses and check that can safely use the *z* test.

B.   Carry out the test, find the P-value, and give your conclusion.

19.   A study of "adverse symptoms" in users of over-the-counter pain relief medications assigned subjects at random to one of two common pain relievers: acetaminophen and ibuprofen. (Both of these pain relievers are sold under various names, sometimes combines with other ingredients.) In all, 650 subjects who took acetaminophen, 44 had an adverse symptom. Of the 347 subjects who took ibuprofen, 49 had an adverse symptom. How strong is the evidence that the two pain relievers differ in proportion of people who experience an adverse symptom?

A.   State hypothesis and check that you can use the *z* test.

B.   Find the P-value of the test and give your conclusion.

20.   The drug AZT was the first drug that seemed effective in delaying the onset of AIDS. Evidence of AZT's effectiveness came from a large randomized comparative experiment. The subjects were 1300 volunteers who were infected with HIV, the virus that causes AIDS, but did not yet have AIDS. The study assigned 435 of the subjects at random to take 500 milligrams of AZT each day, and another 435 to take the placebo. The others were assigned to a third treatment, higher dose of AZT. We will compare only two groups. At the end of the study, 38 of the placebo subjects and 17 of the AZT subjects had developed AIDS. We want to test the claim that AZT lowers the proportion of infected people who will develop AIDS in a given time period.

A.   State hypotheses, and check that you can safely use the *z* procedure.

B.   How significant is the evidence that AZT is effective?

C.   The experiment is double-blind. Explain what this means?

21.   A study of small-business failure looked at 148 food-and-drink businesses in central Indiana. Of these, 106 were headed by men and 42 were headed by women. During a three-year period, 15 of the men's businesses and 7 of the women's businesses failed. Is there significant difference between the rate at which businesses headed by men and women failed?

22.   The Physician's Health Study examined the effects of taking aspirin every other day. Earlier studies suggested that aspirin might reduce the risk of heart attacks. The subjects were 22,071 healthy male physicians at least 40 years old. The study assigned 11,037 of the subjects at random to take aspirin. The others took a placebo pill. The study was double-blind. Here are the counts for some of the outcomes of interest to the researcher:

	Aspirin Group	Placebo Group
Fatal Heart Attacks	10	26
Nonfatal Heart Attacks	129	213
Strokes	119	98

For which outcomes in the difference between the aspirin and placebo groups significant? Use a 2-sided alternative. Write a brief summary of you conclusion.

23.   Never forget that even small effects can be statistically significant if the samples are large. To illustrate the fact, return to the study of 148 small businesses in problem 21.

A.   Find the proportion of failures for businesses headed by women and businesses headed by men. These sample proportions are quite close to each other. Give the P-value for the z test of the hypothesis that the same proportion of women's and men's business fail. Use the two-sided alternative. The test is far from being significant.

B.   Now suppose that the same sample proportions came from a sample of 30 or larger. This is, 210 out of1260 businesses headed by women failed and 450 out of 3180 businesses headed by men. Verify that the proportions of failures are exactly the same in (A). Repeat the z test for the new data and show that it is now significant at the $\alpha = .05$ level.

C.   It is wise to use a confidence interval to estimate the size of an effect, rather than just giving a P-value. Give a 99% confidence intervals for the difference between the proportions of women's and men's businesses that failed for the setting of both (A) and (B). What is the effect of larger samples on the confidence interval?