Math 321
Lab #6

The directions for the t distribution chi-square distribution and F-distribution for MINITAB is the same as the directions for the standard normal. The only difference is that you have to also plug in degrees of freedom.

Note: If you want to calculate the mean and standard deviation of a data set,

1. input all the data into one column.
2. Click on the header Calc>Column Statistics.
3. Click on the statistic that you are interested in (mean, st.dev etc)
4. Type the column in which the data is in, in the input variable box (or click on the input variable box and then double click on the column where the data is located.
5. Hit enter or click on OK

You can also go into STAT>descriptive stats> input the column where the data is located and then press OK or hit enter.

Note: You should familiarize yourself with some of the other functions of MINITAB. Check them out. You may find some time saving techniques.

1. It takes on average 12.3 minutes to run a race with a standard deviation of 0.4 minutes. The times for a random sample of 6 of runners is considered. What is the probability that the average time for this sample is more than 12.75 minutes? [$P(z>2.76)=0.0029$]

2. In human engineering and product design, it is often important to consider the weights of people so that airplanes or elevators aren't overloaded, chairs don't break, and other such dangerous or embarrassing mishaps do not occur. Given that the population of players in offensive back positions (including quarterback) in the CFL have weights that are approximately normally distributed, with a mean of 197.5 lb and a standard deviation of 14.2 lb
   a. Find the probability if one player is randomly selected, his weight is greater than 200 lb. [P(z>,1761)=.4286]
   b. If 36 different players are randomly selected, find the probability that their mean weight is greater than 200 lb.? [$P(z>1.056)=0.1446$]

3. "Your Eyes", a daily eye ware retail store, serves an average of 14.3 customers per day. Assume that the distribution of the number of customer served per day has a standard deviation of 5.9. What is the probability that the average number of customers served per day will be:
   a. at least 15, based on a random sample of 50 days? [$P(z>.84)=.2005$]
   b. less than 14, based on a random sample of 50 days? [$P(z<-.36)=0.3594$]

4. Suppose that a machine dispenses sand into bags with a population mean of 100kg and a population standard deviation of 18kg.. A random sample of 101 bags is taken from a new machine and the standard deviation is 14kg with a mean of 100kg. Find the probability of getting a sample standard deviation of 14kg or lower. [$\chi^2 =60.4938$, $P(\chi^2<60.4938, df = 100)<.005$ (table) or =.000617 (computer)]

5. Last year, the mean number of books borrowed per cardholder at a major university was 18.2 books per semester with a standard deviation of 4.2. A random sample of 25 cardholders showed the following results for this semester: $s^2=6.17$. The library administration would like to know whether this semester's variance is smaller than last year's variance.

   a. Find the probability of having a sample variance of 6.17 or less if the true population variance is 17.64. What conclusions can be drawn. What assumptions were made? [$\chi^2=8.3946$, $P(\chi^2<8.3946, df = 24)= .0013$, since the probability of having a sample variance of 6.17 or less when the true population variance is 17.64 is very small, this indicates that the population variance for this semester is less than 17.64, normal population, random sample

b. Ninety-five percent of the time, if the true population variance is 17.64, the sample variance will fall between what two values. Does the sample variance of 6.17 fall in this range? [9.1148, 28.9326]

6. In developing patient appointment schedules, a medical center desires to estimate the mean time a staff member spends with each patient. How large a sample should be taken if the precision of the estimate is to be ± 2 minutes from the true population mean 95% of the time? How large a sample is needed for a 99% level of confidence? Use a planning value for the population standard deviation of 8 minutes. (62, 107)

7. An economist wants to estimate the mean income for the first year of work for a college graduate who has had the profound wisdom to take a statistics course. How many such incomes must be found if we want to be 95% confident that the sample mean is within $500 of the true population mean? Assume that a previous study has revealed that for such incomes, $\sigma = 6250$. (601)

8. Assume that human body temperatures are normally distributed with a mean of 36.4°C and a standard deviation of 0.62°C. Five percent of sample means from samples sizes of 30 are above a certain amount. What is this amount? [$\bar{y} = 36.59$ °C]

9. A newspaper advertisement claims that 55% of the people who wear contact lenses experience no difficulty. In a random sample of 300 people who have purchased contact lens,
   a. What's the probability of at least 150 people having no problems? Find the estimated and the exact. [$\mu = 165$ $\sigma = 8.6168$, $P(z>-1.8)=.9641$, exact = .9637]
   b. What's the probability of having between 145 and 170 (inclusive) people having no problems? Find the estimated and the exact. [$P(-2.379<z<.6382)=.7302$, exact = .7291]
   c. What's the probability of having less than 160 having no problems? Find the estimated and the exact. [$P(z<-.64)=.2611$, exact = .2613]

10. According to one study, 2/3 of all Canadians have at least 2 televisions. In a random sample of 1000 Canadians,
    a. What's the probability of exactly 668 Canadians having at least 2 televisions? Find the estimated and the exact. [$\mu = 666.6667$ $\sigma = 14.9071$, $P(.06<z<.123)=.0239$, exact=.0267]
    b. What's the probability of between 640 and 670 (exclusively) Canadians having at least 2 televisions? Find the estimated and the exact [$P(-1.76<z<.19)=.5361$, exact = .5653]
    c. What's the probability of greater than 670 Canadians having at least 2 televisions? [$P(z>.26)=.3974$, exact = .3999]

11. Estimate the probability of getting at least 52 girls in 100 births. Assume that boys and girls are equally likely. [$P(z>.3)=.3821$]

12. Estimate the probability of passing a true/false test of 50 questions if 60% (or 30 correct answers) is the minimum passing grade and all responses are random guesses. [$P(z>1.27)=.1020$]

13. A hotel chain gives an aptitude test to job applicants and finds that normally, 80% of the applicants pass.

    a. Based on a random sample of 6503,

    (i) Within what range should we expect 95% of the sample percentages to fall within. [70.97%, 80.97%]
    (ii) Find the probability of getting a sample percentage of 81 or higher. [$P(z>2.02)=.0217$]

b. How big of a sample is required if we want the sample percentage to be within 2% of the true population percentage 9 times out of 10? [n=1083]

14. Do questions 7.1-7.79 omit 7.7, 7.8, 7.13, 7.16-7.21, 7.38, 7.39, 7.40, 7.41, 7.65, 7.66, 7.69, 7.77 in the text.

15. Let $Y_1, Y_2, \ldots, Y_n$ represent a random sample taken from a population having a variable that possesses the following probability density function:

$$f(y) = \left(\frac{1}{\theta}\right) e^{-(y/\theta)} \quad y > 0,\ \theta > 0 \qquad let\ \hat{\theta}_1 = \sqrt{Y_1 Y_2}$$

a. Is $\hat{\theta}_1$ an unbiased estimator for θ? $E(\hat{\theta}_1) = \dfrac{\pi\theta}{4}$

b. Find a function of $\hat{\theta}_1$ which is an unbiased estimator for θ. $\dfrac{4\hat{\theta}_1}{\pi}$

c. Find the MSE $\hat{\theta}_1$ $\quad MSE(\hat{\theta}_1) = 2\theta^2 - \dfrac{\pi^2\theta^2}{4} - .2146\theta$

16. Do questions 8.1-8.15

17. Wawanesa Mutual Insurance Company wants to estimate the percentage of drivers who change tapes or CDs while driving. A random sample of 850 drivers results in 544 who change tapes or CDs while driving.
   a. Find the point estimate of the percentage of all drivers who change tapes or CDs while driving. [64.0%]
   b. Find a 90% interval estimate of the percentage of all drivers who change tapes or CDs while driving. [61.29%<p<66.71%]

18. A simple random sample of five people provided the following data on ages: 21, 25, 20, 18, and 21. Develop a 95%confidence interval for the mean age of the population being sampled. State any assumptions you must make in you method. (17.8349, 24.1651, t-distribution)

19. The time (in minutes) taken by a biological cell to divide into two cells has a normal distribution. From past experience, the standard deviation can be assumed to be 3.5 minutes. When 16 cells were observed, the mean time taken by them to divide was 31.2 minutes. Estimate the true mean time for a cell division using a 98 percent confidence interval. (29.1645, 33.2355, z-dist)

20. In 10 half-hour programs on a TV channel, Mary found that the number of minutes devoted to commercials were 6, 5, 5, 7, 5, 4, 6, 7, 5, and 5. Set a 95% confidence interval for the true mean time devoted to commercials during a half-hour program. Assume that the amount of time devoted to commercials is normally distributed. (4.8049, 6.1951, t-dist)

21. A random sample of 16 servings of canned pineapple has a mean carbohydrate content of 49 grams. If it can be assumed that population is normally distributed with a variance of 4 grams, find a 98 percent confidence interval for the true mean carbohydrate content of a serving. (47.835, 50.165)

22. It is suspected that a substance called actin is linked to various movement phenomena of non-muscle cells. In a laboratory experiment when eight fertilized eggs were incubated for 14 days the following amounts (mg) of total brain actin were obtained: 1.2, 1.4, 1.5, 1.2, 1.4, 1.7, 1.5, 1.7. Assuming that brain-actin amount after 14 days of incubation is normally distributed,
   a. Find a 95 percent confidence interval for the true mean brain-actin amount. (1.2890, 1.6111,t-dist)

b. How can we decrease/increase the error? Assume that the variability does not change from the data given above.

23. The mean number of books borrowed per cardholder at a major university was 18.2 books per cardholder with a certain variance. A random sample of 25 cardholders showed the following results : s^2=6.17 and the sample mean =18.3.
    a. Construct a 95% confidence interval for σ^2. Comment on this. [3.7618,11.9409]
    b. Construct a 95% confidence interval for σ. Comment on this. [1.9395, 3.4556]
    c. Based on these confidence intervals, could the population variance be 13 or 10? Explain.

24. In a study of store checkout scanners, 1234 items were checked and 20 of them were found to be overcharges.
    (a) Using the sample data, a confidence interval for the proportion of all such scanned items that are overcharges was found to be from 0.00915 to 0.02325. What was the level of confidence that was used? [~95% level of confidence]
    (b) Find the sample size necessary to estimate the proportion of scanned items that are overcharges. Assume that you want 99% confidence that the estimate is in error by no more than 0.005.
        (i) Use the sample data as a pilot study [4228]
        (ii) Assume, instead, that we do not have prior information on which to estimate the value of $\hat{p}$. [66307]

25. In a survey, 1039 adults were asked " How much respect and confidence do you have in the public school system?" The results, reported in the Toronto Star (Sept. 26, 1988), are shown below:

Responses	A great deal	Quite a lot	Some	Very little	No opinion
Percentages	12%	30%	35%	13%	10%

    Estimate with a 90% confidence the proportion of all adults who had " a great deal" or quite a lot" of respect for the public school system. Interpret this interval. [.3948, .4452]

26. Of the 200 individuals interviewed, 80 said they were concerned about fluorocarbon emissions in the atmosphere. Obtain a 99% confidence interval estimate for the true proportion of individuals who are concerned. [.3108, .4892] Interpret this interval.

27. As part of a study of post-secondary education, a random sample of the graduating classes of colleges and universities is to be selected to estimate their expected success in finding employment. It is desired to estimate the success rate to within ±0.01, with a confidence of 95%. No reliable planning value for the success rate is available.
    (a) What is a conservatively large sample size to meet the precision requirements? [9604]
    (b) It was finally decided to select 2500 graduating students for the sample. Of these, 1141 were successful in finding immediate employment. Estimate the true success rate of this graduating class in a 99% confidence interval. Interpret the meaning of the interval. [.4307, .4821]

28. A marketing research organization wishes to estimate the proportion of television viewers who watch a particular prime-time situation comedy on December 14. The proportion is expected to be approximately 0.30. At a minimum, how many viewers should be randomly selected to ensure that a 95% confidence interval for the true proportion of viewers will have a **width of at most 0.01**? [32270]

29. Do questions 8.20-8.116, omit 8.21,8.24, 8.25, 8.26, 8.31, 8.41, 8.47, 8.48, 8.50, 8.51, 8.52, 8.53, 8.54, 8.55 (b,c), 8.56, 8.57, 8.63, 8.64, 8.65,8.66,8.67, 8.71,8.73, 8.75-8.80, ,8.90,,8.91, 8.96,,8.97, 8.103-8.105, 8.109 and 8.110