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

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? (0.0039)

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. (.4286)
    b. If 36 different players are randomly selected, find the probability that their mean weight is greater than 200 lb.? (0.1469)

3. "Your Eyes", a daily eye ware retail store, serves an average of 14.3 customer 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? (.2008)
    b. less than 14, based on a random sample of 50 days? (0.3596)

4. 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? (.9641})
    b. What's the probability of having between 145 and 170 (inclusive) people having no problems? (.7302)
    c. What's the probability of having less than 160 having no problems? (.2611)

5. 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? (use approximation) (.0239)
    b. What's the probability of between 640 and 670 (exclusively) Canadians having at least 2 televisions? (.5361)
    c. What's the probability of greater than 670 Canadians having at least 2 televisions? (.3974)

6. Estimate the probability of getting at least 52 girls in 100 births. Assume that boys and girls are equally likely. (.3821)

7. Estimate the probability of passing a true/false test of 50 question if 60% (or 30 correct answers) is the minimum passing grade and all responses are random guesses. (.1020)

8. Do questions 7-7.43 and 7.44-7.61 in the text.

9. Let $Y_1, Y_2, ..., Y_n$ 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 $\hat{\theta}_1$ and unbiased estimator for θ? $E(\hat{\theta}_1) = \frac{\pi\theta}{4}$

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

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

10. Do questions 8.1-8.15

11. 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%]

12. Do questions 8.20, 8.22-8.23,

13. 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)

14. 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)

15. 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)

16. 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)

17. 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)

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

18. 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]

19. A hotel chain gives an aptitude test to job applicants and considers a multiple-choice test question to be easy if at least 80% of the responses are correct. A random sample of 6503 responses to one particular question includes 84% correct responses. Construct the 99% confidence interval for the true percentage of correct responses. Is it likely that the question is really easy? Why? [82.83%<p <85.17%, yes]

20. 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 at a 95% level of confidence? 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)

21. 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)

22. Suppose that a machine dispenses sand into bags. A random sample of 100 bags is taken from a new machine and the standard deviation is 14kg. The population standard deviation is known to be 18kg. Is 14 significantly lower that 18 kg?[$\chi^2 = 59.8889$, $P(\chi^2<59.8889, df = 99) = .0007$, yes]

23. Last year, the mean number of books borrowed per cardholder at a major university was 18.2 books per semester with a st.deviation of 4.2. A random sample of 25 cardholders showed the following results for this semester: $s^2=6.17$.
    a. The library administration would like to know whether this semester's variance is smaller than last year's variance. What assumptions were made? [$\chi^2=8.39$, $P(\chi^2<8.39, df = 24) = .0013$, yes]
    b. Construct a 95% confidence interval for σ^2. Comment on this. [3.7618,11.9409]
    c. Construct a 95% confidence interval for σ. Comment on this. [1.9395, 3.4556]

24. Business schools A and B reported the following summary of GMAT verbal scores:

	N	$\bar{x}$	s^2
A	11	34.75	48.59
B	13	33.74	44.68

    a. Is the population variance of school A greater than school B based on the sample data? [F = 1.0875, P(F>1.0875) = .4388, no]
    b. Construct a 95% confidence interval for the true population standard deviation ratio. Comment on this interval if school A is taken as the numerator.
    [0.5681, 1.9841]

25. 16 alkaline and 16 heavy-duty Radio shack batteries were placed individually in a circuit consisting of two flashlight bulbs wired in parallel, a switch, a battery holder, and a Hewlet Packard 427-Analog DC voltmeter. Each battery was drained to a reference failure voltage of 0.9 volts and the time to failure (min) was measured.:

Alkaline				Heavy-duty			
105	141	147	158	29	22	22	27
140	143	108	125	26	17	22	23
116	139	146	134	23	27	23	24
140	149	142	140	22	25	22	26

Assume the populations of times to failure is normally distributed.

(a) Is the population variance for Alkaline greater than that for heavy-duty? Fcalc=26.9141, P(F>26.9141) ~0, yes]

(b) Find the 95% confidence interval for the ratio of standard deviations. [3.0677, 8.7729] Comment on it.

26. Do questions 8.35 – 8.46, 8.49, 8.58-8.62