Hypothesis Tests About the Mean and Proportion

Chapter 9

Test for a Mean where the Population Standard Deviation is Known

Enter the following data points into a Minitab spreadsheet. Assume $\sigma = 3$.

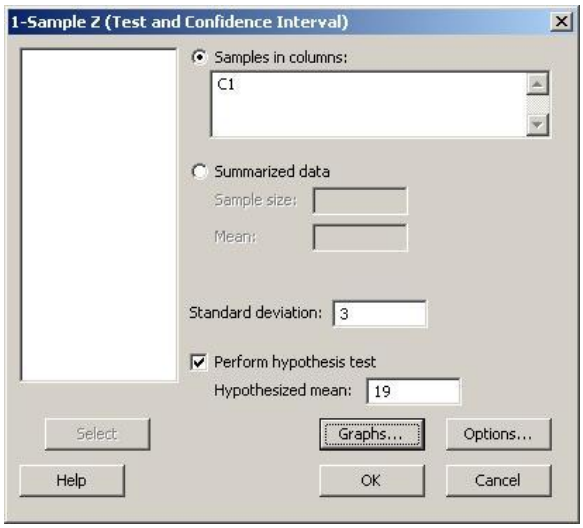
21.7	19.7	20.5	19	18.1	22
21.8	25.4	18.5	22.6	23.9	20.4
20.6	23.7	20.6	19.7	14.7	24.2
22.3	22.4	25.1	24.9	23.7	19.3
19.6	20.5	22	19.1	20.7	22.8

To test the hypothesis

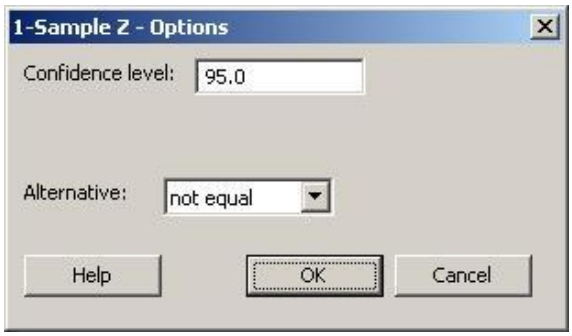
$$H_O : \mu = 19$$

$$H_1 : \mu \neq 19$$

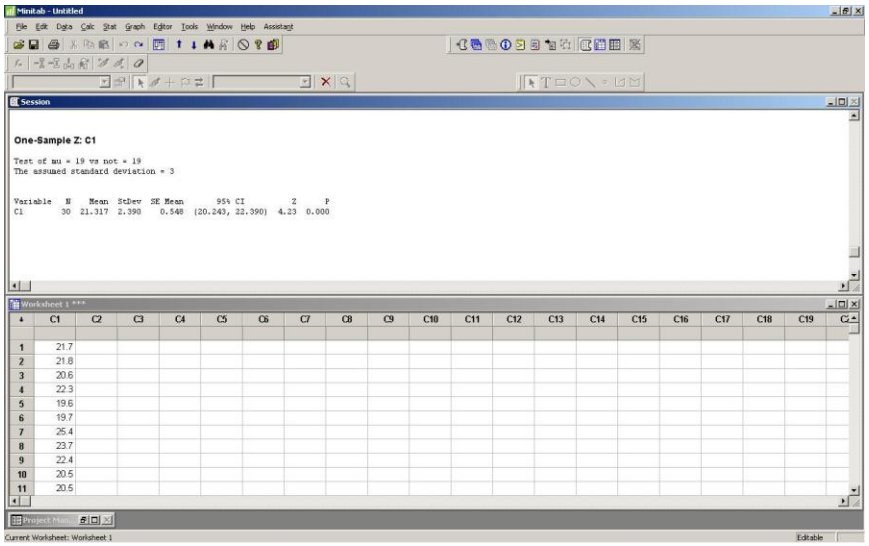
click on **Stat → Basic Statistics → 1-Sample Z.** Select the circle next to **Samples in columns** and select the data in column C1. For **Standard deviation,** enter the assumed value of 3. Select the checkbox next to **Perform Hypothesis Test**, and enter a **Hypothesized mean** of 19. Select the **Options** button.



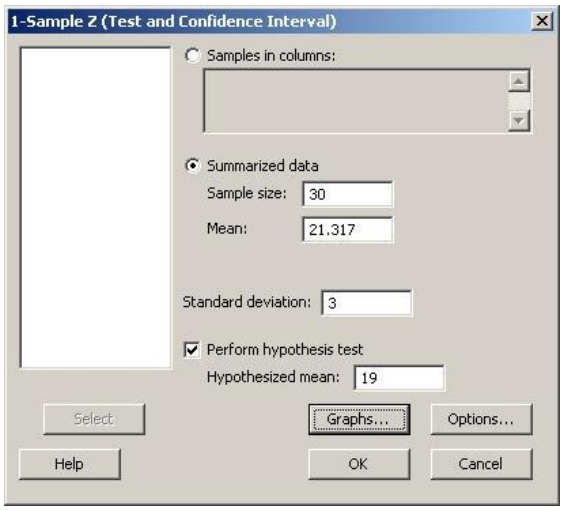
The Confidence Level field will be defaulted to 95.0, for a 95% confidence interval. This will not need to be edited this unless you would also like to perform a different confidence interval at this time. This will not influence the results of the hypothesis test. Since the alternative hypothesis is "not equal to" for this example, make sure the **Alternative** field has the **not equal** option selected. Click **OK**. Click **OK** on the **1-Sample Z (Test and Confidence Interval)** window.



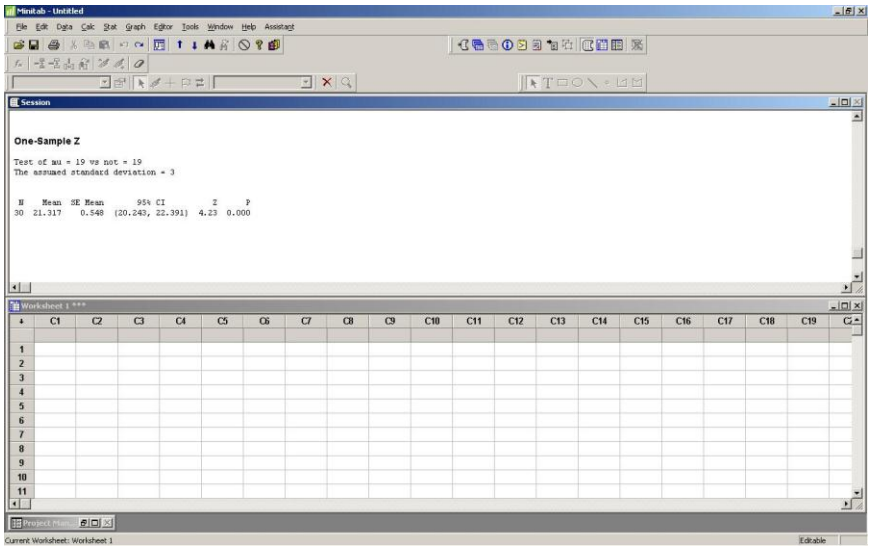
The results will be displayed in the Session window. In the test of "mu = 19 vs not = 19", *Z* is 4.23, and the *p*-value is 0.000. Therefore, for any level of $\alpha > 0$, the correct decision would be to reject the null hypothesis.



In the above example, the data was entered in raw format. If instead you have the summary data, click on **Stat → Basic Statistics → 1-Sample Z.** Select the circle next to **Summarized data**. Enter a **Sample size** of 30 and a **Mean** of 21.317. For **Standard deviation, e**nter the assumed value of 3. Select the checkbox next to **Perform Hypothesis Test**, and enter a **Hypothesized mean** of 19. Select the **OPTIONS** button. The Confidence Level field will be defaulted to 95.0, for a 95% confidence interval. This will not need to be edited this unless you would also like to perform a different confidence interval at this time. This will not influence the results of the hypothesis test. Since the alternative hypothesis is "not equal to" for this example, make sure the **Alternative** field has the **not equal** option selected. Click **OK**. Click **OK** on the **1-Sample Z (Test and Confidence Interval)** window.



The results will be displayed in the Session window. In the test of "mu = 19 vs not = 19," Z is 4.23, and the p-value is 0.000. Therefore, for any level of $\alpha > 0$, the correct decision would be to reject the null hypothesis.



Test for a Mean where the Population Standard Deviation is Unknown

In a random sample of 25 men at a large corporation, the number of hours spent at work in the last week was collected. Management is interested in testing if the mean is less than 40 hours per week.

42	51	42	36	49
29	46	37	33	41
47	41	28	39	48
26	35	37	48	39
29	31	44	38	46

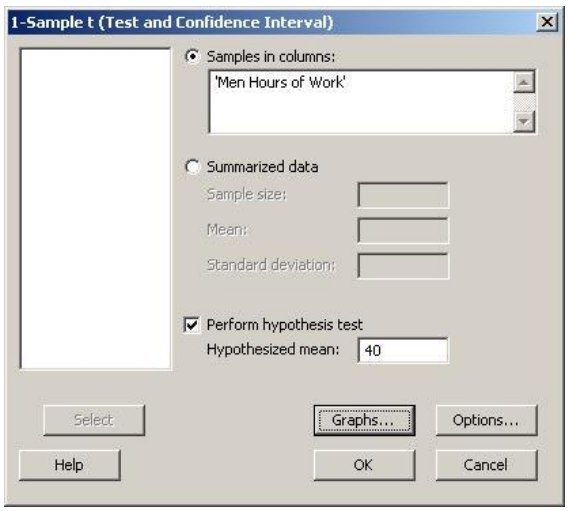
Enter the data into column C1 of a Minitab spreadsheet and label the column "Men Hours of Work."

To test the hypothesis

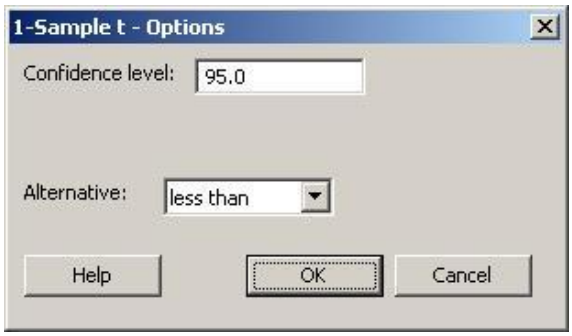
$$H_O : \mu \geq 40$$

$$H_1 : \mu < 40$$

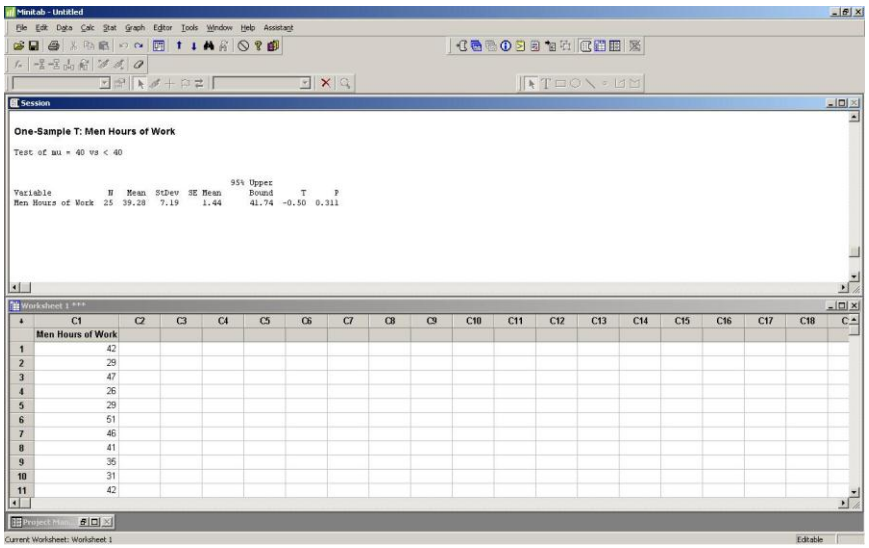
click on **Stat → Basic Statistics → 1-Sample t.** Select the circle next to **Samples in columns** and select the data in column C1. Select the checkbox next to **Perform Hypothesis Test**, and enter a **Hypothesized mean** of 40. Select the **Options** button.



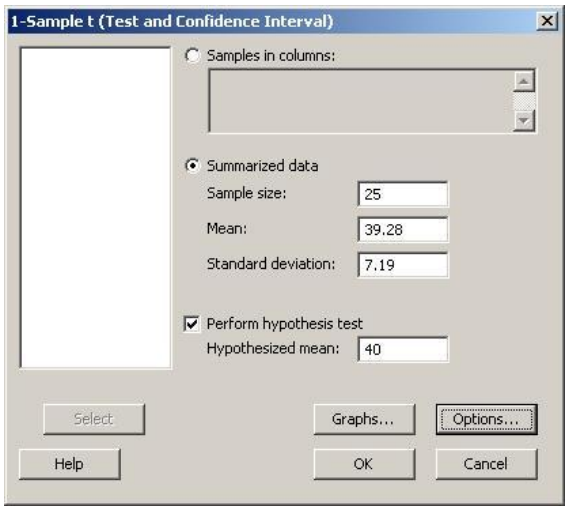
The Confidence Level field will be defaulted to 95.0, for a 95% confidence interval. This will not need to be edited this unless you would also like to perform a different confidence interval at this time. This will not influence the results of the hypothesis test. Since the alternative hypothesis is "less than" for this example, make sure the **Alternative** field has the **less than** option selected. Click **OK**. Click **OK** on the **1-Sample t (Test and Confidence Interval)** window.



The results will be displayed in the Session window. In the test of "mu = 40 vs < 40," *T* is -0.50, and the *p*-value is 0.311. Therefore, for any level of $\alpha < 0.311$, the correct decision would be to not reject the null hypothesis.



In the above example, the data was entered in raw format. If instead you have the summary data, click on **Stat → Basic Statistics → 1-Sample t.** Select the circle next to **Summarized data**. Enter a **Sample size** of 25, a **Mean** of 39.28, and a **Standard deviation** of 7.19. Select the checkbox next to **Perform Hypothesis Test**, and enter a **Hypothesized mean** of 40. Select the **OPTIONS** button. The Confidence Level field will be defaulted to 95.0, for a 95% confidence interval. This will not need to be edited unless you would also like to perform a different confidence interval at this time. This will not influence the results of the hypothesis test. Since the alternative hypothesis is "less than" for this example, make sure the **Alternative** field has the **less than** option selected. Click **OK**. Click **OK** on the **1-Sample t (Test and Confidence Interval)** window.



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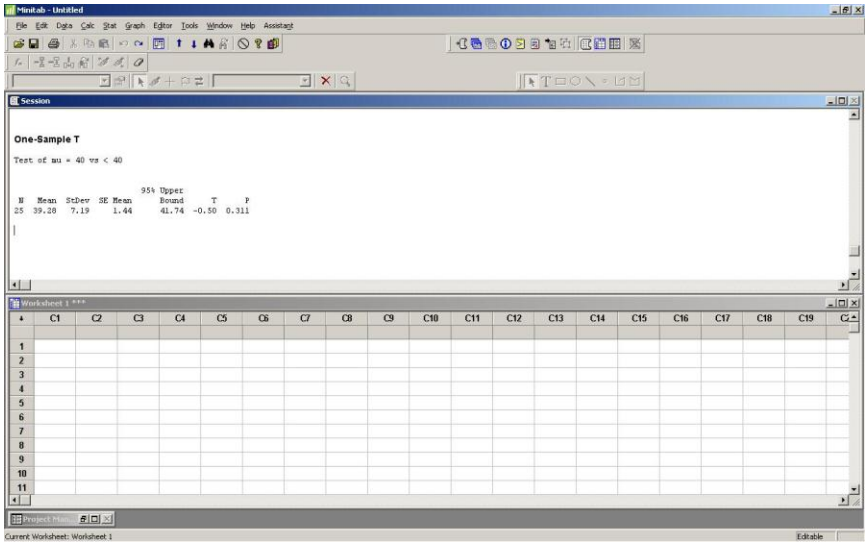


Test for a Proportion

In a random sample of 40 adult Americans, it was found that 26 have credit card debt. A researcher wants to test if more than 60% of adult Americans have credit card debt.

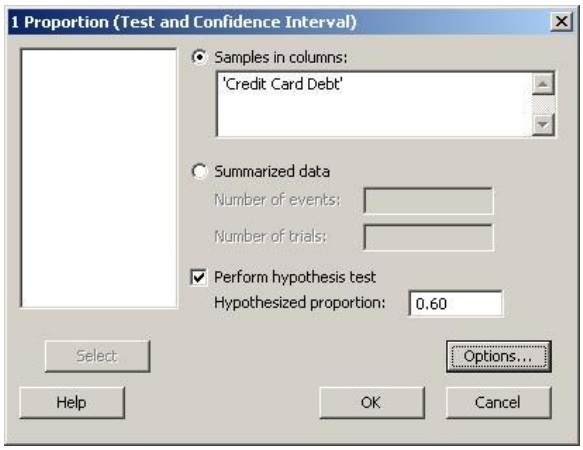
Enter the data into column **C1** of a Minitab spreadsheet and label the column "Credit Card Debt." The data will be 40 rows, with 26 "Y" and 14 "N", where Y indicates credit card debt and N indicates no credit card debt.

To test the hypothesis

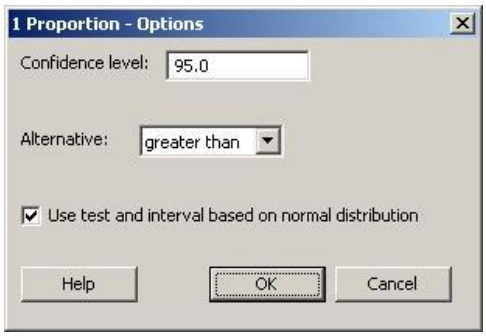
$$H_O : p \leq 0.60$$

$$H_1 : p > 0.60$$

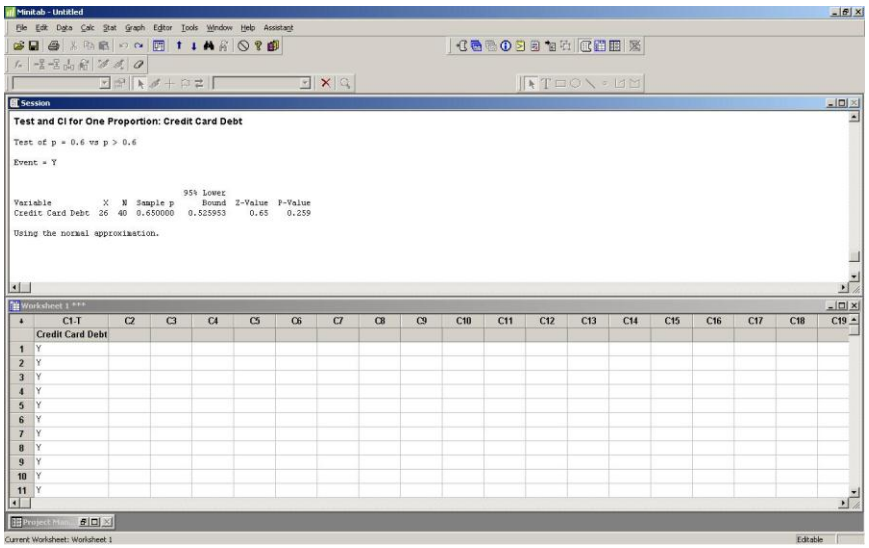
click on **Stat → Basic Statistics → 1 Proportion.** Select the circle next to **Samples in columns** and select the data in column C1. Select the checkbox next to **Perform hypothesis test** and enter a **Hypothesized proportion** of 0.60. Select the **Options** button.



The Confidence Level field will be defaulted to 95.0, for a 95% confidence interval. This will not need to be edited this unless you would also like to perform a different confidence interval at this time. This will not influence the results of the hypothesis test. Since the alternative hypothesis is "greater than" for this example, make sure the **Alternative** field has the **greater than** option selected. Select the checkbox next to **Use test and interval based on normal distribution.** Click **OK**. Click **OK** on the **1 Proportion (Test and Confidence Interval)** window.

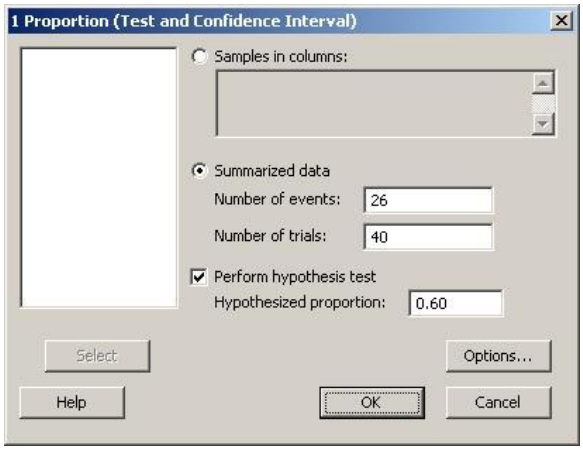


The results will be displayed in the Session window. In the test of "p = 0.6 vs p > 0.6", Z is 0.65, and the p-value is 0.259. Therefore, for any level of $\alpha < 0.259$, the correct decision would be to not reject the null hypothesis.



In the above example, the data was entered in raw format. If instead you have the summary data, click on **Stat → Basic Statistics → 1 Proportion.** Select the circle next to **Summarized data**. Enter 26 in the **Number of Events** field and 40 in the **Number of Trials** field. Select the checkbox next to **Perform hypothesis test** and enter a **Hypothesized proportion** of 0.60. Select the **Options** button.

The Confidence Level field will be defaulted to 95.0, for a 95% confidence interval. This will not need to be edited this unless you would also like to perform a different confidence interval at this time. This will not influence the results of the hypothesis test. Since the alternative hypothesis is "greater than" for this example, make sure the **Alternative** field has the **greater than** option selected. Select the checkbox next to **Use test and interval based on normal distribution.** Click **OK**. Click **OK** on the **1 Proportion (Test and Confidence Interval)** window.



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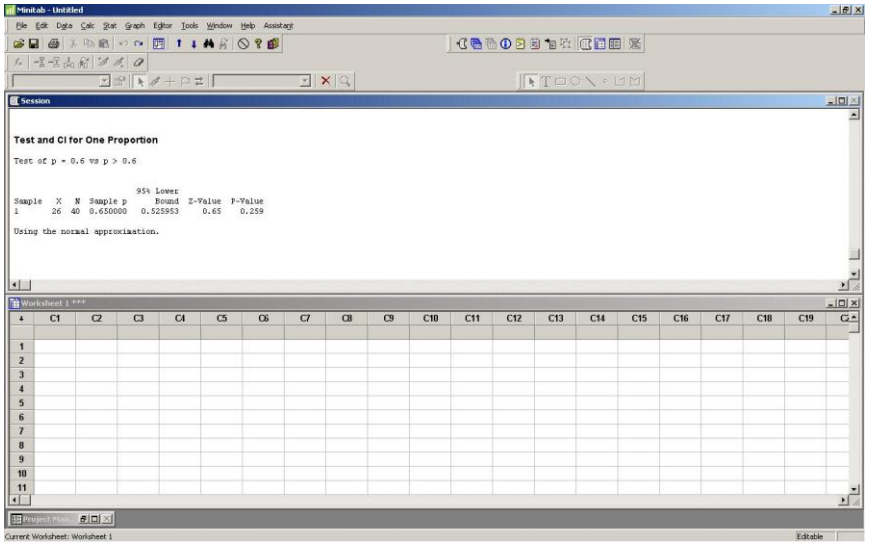

Suggested Exercises

Section 9.2

9.31, 9.35, 9.37, 9.39, 9.41, 9.43, 9.45

Section 9.3

9.59, 9.61, 9.63, 9.65, 9.69, 9.71

Section 9.4

9.87, 9.88, 9.91, 9.93, 9.95

Supplementary Exercises

9.103, 9.107, 9.108, 9.113, 9.114, 9.115, 9.124

Technology Assignments

TA 9.1, TA 9.3, TA 9.5, TA 9.7