Additional Notes for Minitab – Please add to the current "Guide to Minitab"

Exercise (A) from Course Notes:

Researchers suspect that the exposure to toluene will increase the levels of NE in the brain.

Let group 1 be the toluene group, and let group 2 be the control.

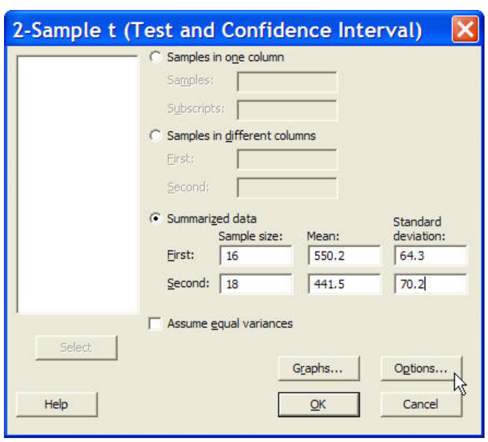
Hypotheses of Interest: $H_0 : \mu_1 = \mu_2$ versus $H_a : \mu_1 > \mu_2$.

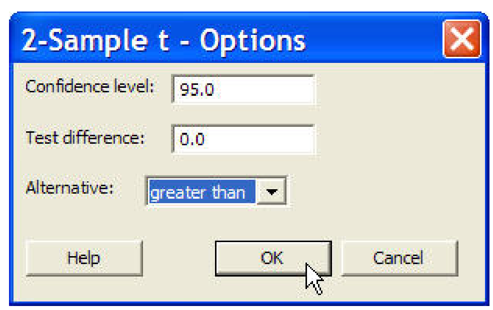
The summary statistics are shown here:

	n	mean	SD
Toluene	16	550.2	64.3
Control	18	441.5	70.2

Using Minitab – If the raw data values are NOT available, but summary statistics are given such as those shown above, then we use Minitab in the following way:

- Click on `Stat -> Basic Statistics -> Two Sample t`. In the dialogue box which appears, type in the appropriate information for 'Summarized data' (see below left)
- Under 'Options', if testing the hypothesis $H_0 : \mu_1 = \mu_2$, ensure you input `0` into 'Test difference'. Select the appropriate setting for 'Alternative' depending upon the form of H_a (**greater than** or **less than**) (see below right)





- Click on 'OK' to generate the result of the hypothesis test. Note that the value of the test statistic and the corresponding p-value will be reported in the **Session** window.

Minitab Output

```
Two-Sample T-Test and CI

                          SE
Sample   N   Mean  StDev  Mean
1       16  550.2   64.3    16
2       18  441.5   70.2    17


Difference = mu (1) - mu (2)
Estimate for difference:  108.7
95% lower bound for difference:  69.6
T-Test of difference = 0 (vs >): T-Value = 4.71  P-Value = 0.000  DF = 31
```

Minitab Output

In the exercise we computed the following:

1. test statistic: $\boldsymbol{t_s} = 4.71$
2. DF = 15 (using our conservative method)
3. p-value < 0.0005

Notes:

1. When Minitab reports the `P-value = 0.000`, this really means the actual p-value is less than 0.001.
2. The degrees of freedom is **not** equal to the conservative value we use in class. The DF Minitab uses is based on the complicated formula discussed in the book (Equation 7.1 on Page 227).

Exercise (B) from Course Notes:

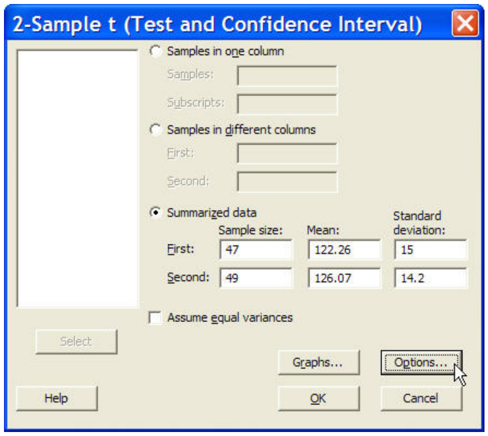
The National Center for Health Statistics has been tracking the mean systolic blood pressure for males 35 to 44 years of age. Let us denote this as μ_1. *Do the executives of a large company have a different mean blood pressure?*

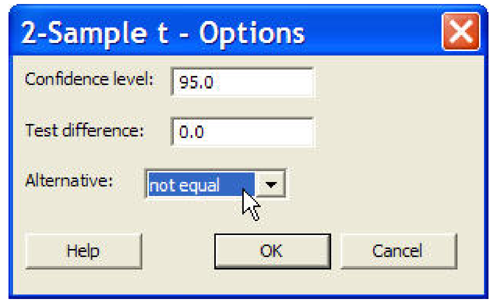
The summary statistics are shown here:

	n	mean	SD
Regular	47	122.26	15.0
Executives	49	126.07	14.2

Using Minitab – Following the same steps we have:

- Click on `Stat -> Basic Statistics -> Two Sample t`. In the dialogue box which appears, type in the appropriate information for 'Summarized data' (see below left)
- Under 'Options', if testing the hypothesis $H_0 : \mu_1 = \mu_2$, ensure you input `0` into 'Test difference'. Select the appropriate setting for 'Alternative' depending upon the form of H_a (**not equal**) (see below right)





- Click on 'OK' to generate the result of the hypothesis test. Note that the value of the test statistic and the corresponding p-value will be reported in the **Session** window.

Minitab Output

```
Two-Sample T-Test and CI

Sample    N   Mean  StDev  SE Mean
1        47  122.3   15.0      2.2
2        49  126.1   14.2      2.0


Difference = mu (1) - mu (2)
Estimate for difference:  -3.81
95% CI for difference:  (-9.73, 2.11)
T-Test of difference = 0 (vs not =): T-Value = -1.28  P-Value = 0.205  DF = 93
```

Minitab Output

In the exercise we computed the following:

1. test statistic: t_s = -1.27
2. DF = 46 (using our conservative method)
   (a) Table 4 requires that we use DF=40
3. 0.20 < p-value < 0.40

Notes:

1. Minitab reports `T-Value = -1.28` which is not exactly what we obtained by hand. If you round the denominator of the test statistic to 2.98, then the value of t_s is -1.28. The exact value, however, should be -1.27. No big difference here ... our conclusions would be the same.
2. Once again, note that the degrees of freedom is **not** equal to the conservative value we use in class. The DF Minitab uses is based on the complicated formula discussed in the book (Equation 7.1 on Page 227).

Confidence Interval

Under 'Options', you can determine the two-sided corresponding 95% confidence interval by setting the 'Confidence level' to 95% and by setting 'Alternative' to 'not equal'.
Based on our output above, the 95% CI for $\mu_1 - \mu_2$ is **(-9.73, 2.11)**.