Minitab Directions – 02

Statistical Inference on 2 Samples

Note: If you have *paired* data (e.g. before and after data), use the procedure in section 2.

1. 2-sample *t* test

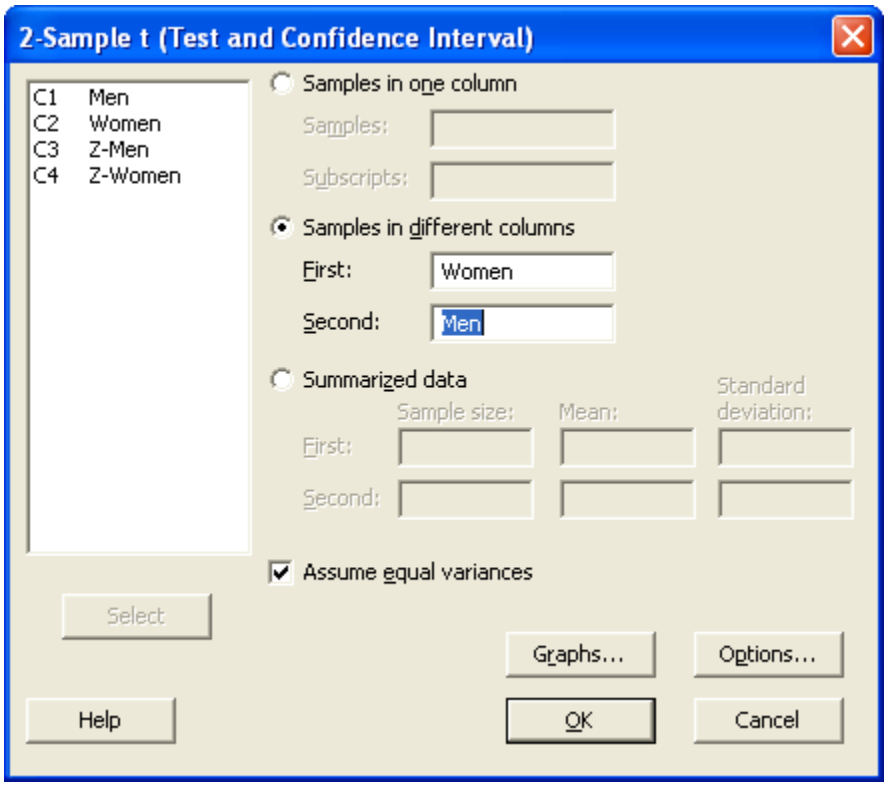
Note: In class we said that when both samples have 30 or more values, then we use the 2-sample *z* test; otherwise, use the 2-sample *t* test. Minitab only defines the 2-sample *t* test. So, you will use that when you have large samples.

1.1. Choose: *Stats/Basic Statistics/2-sample t*

Suppose that you want to test the alternate hypothesis that women study longer than men:

$$H_o\ \mu_{Women} - \mu_{Men} \le 0 \quad vs. \quad H_a\ \mu_{Women} - \mu_{Men} > 0$$

Note the order the data is entered in the columns in the Minitab worksheet: Men, then Women. When you specify the data sets in the dialog below, you should put them in the order that you have specified them in your hypothesis. For the example above, we list "Women" for *First* and "Men" for *Second*.

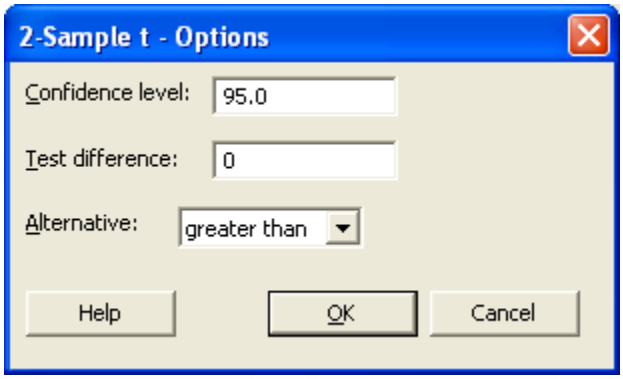


1.2. Select *Samples in different columns* and specify the two data sets. **If** (see below) you can assume equal variances, then check the appropriate box.

Note: A rule-of-thumb, for our class, is to assume equal variances if the standard deviation for one data set is at least twice as large as for the other. Otherwise, we will not assume equal variances.

1.3. Choose: *Options....* Specify the *Confidence level*, *Test difference* and *Alternative*.

Note: The *Test difference* and *Alternative* correspond with the hypothesis in step 1.1.



1.4. Choose *OK,* then choose *OK* again and the inference results will be displayed.

Two-Sample T-Test and CI: Women, Men

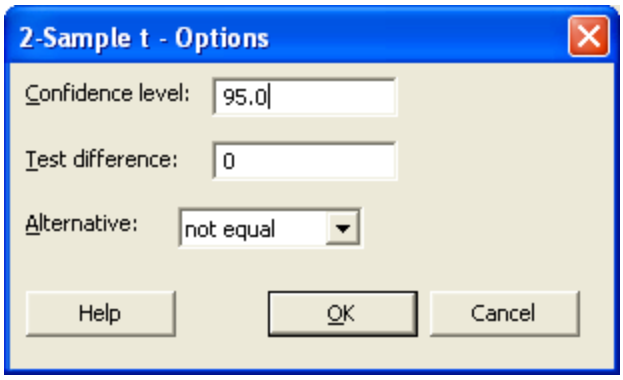
```
Two-sample T for Women vs Men

        N   Mean  StDev  SE Mean
Women  40  45.42   7.68      1.2
Men    40  39.15   9.21      1.5


Difference = mu (Women) - mu (Men)
Estimate for difference:  6.27
95% lower bound for difference:  3.11
T-Test of difference = 0 (vs >): T-Value = 3.30  P-Value = 0.001  DF = 78
Both use Pooled StDev = 8.4795
```

Note: We get a one-sided confidence interval because we specified a one-sided alternative (>).

1.5. Generate a (two-sided) confidence interval, if necessary. Choose: *Stats/Basic Statistics/2-sample t* and then *Options...*. There, choose the "not equal" *Alternative*.



1.6. Choose *OK,* then choose *OK* again and the inference results will be displayed.

Two-Sample T-Test and CI: Women, Men

```
Two-sample T for Women vs Men

          N   Mean  StDev  SE Mean
Women    40  45.42   7.68      1.2
Men      40  39.15   9.21      1.5


Difference = mu (Women) - mu (Men)
Estimate for difference:  6.27
95% CI for difference:  (2.49, 10.04)
T-Test of difference = 0 (vs not =): T-Value = 3.30  P-Value = 0.001  DF = 78
Both use Pooled StDev = 8.4795
```

1.7. Copy the confidence interval only into your report immediately below the one-sided confidence interval.

This is the end of *2-sample statistical inference.*

2. Paired *t* Test

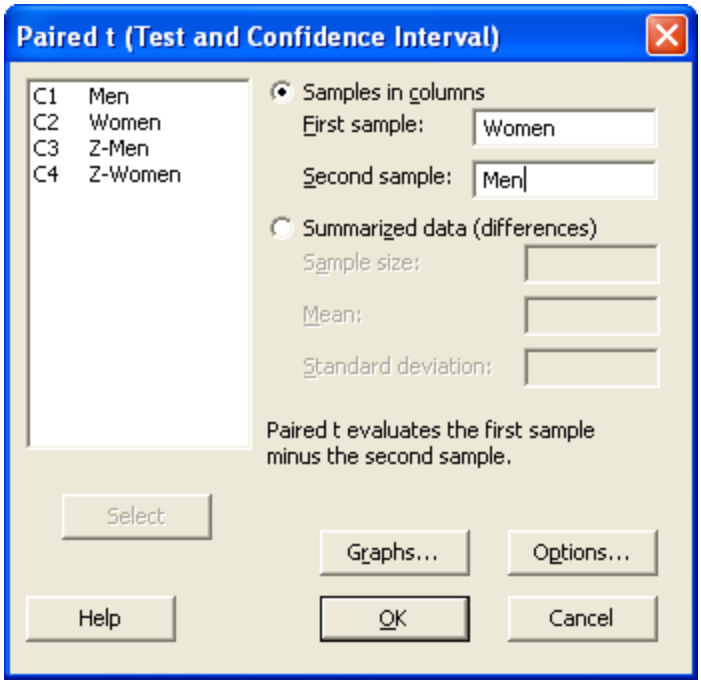
Note: Use this procedure if you have *paired* data (e.g. before and after data).

2.1. Choose: *Stats/Basic Statistics/Paired t*

Suppose that you want to test the alternate hypothesis that women study longer than men:

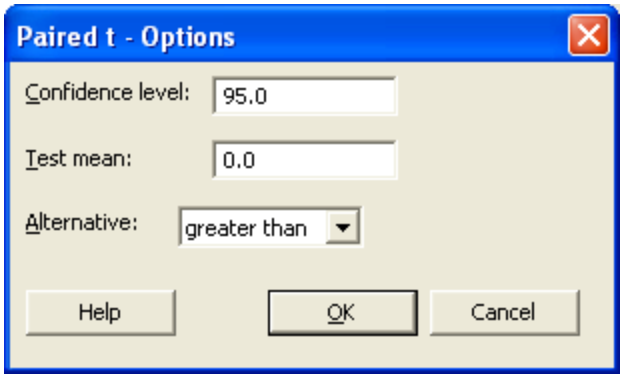
$$H_o\ \mu_{Women} - \mu_{Men} \leq 0 \quad vs. \quad H_a\ \mu_{Women} - \mu_{Men} > 0$$

Note the order the data is entered in the columns in the Minitab worksheet: Men, then Women. When you specify the data sets in the dialog below, you should put them in the order that you have specified them in your hypothesis. For the example above, we list "Women" for *First* and "Men" for *Second*.



2.2. Select *Samples in columns* and specify the two data sets.

2.3. Choose: *Options….* Specify the *Confidence level*, *Test difference* and *Alternative*.



2.4. Choose *OK,* then choose *OK* again and the inference results will be displayed.

Paired T-Test and CI: Women, Men

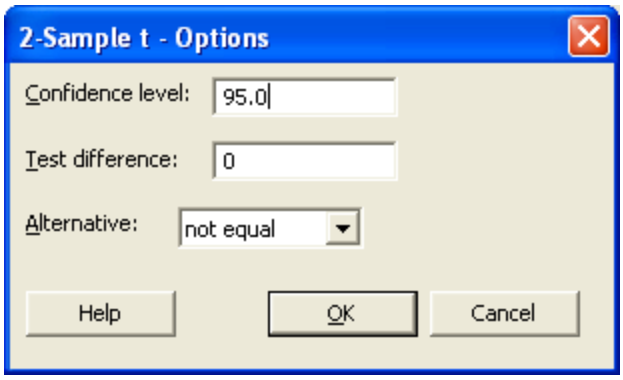
```
Paired T for Women - Men

              N   Mean  StDev  SE Mean
Women        40  45.42   7.68     1.21
Men          40  39.15   9.21     1.46
Difference   40  6.265  3.578    0.566


95% lower bound for mean difference: 5.312
T-Test of mean difference = 0 (vs > 0): T-Value = 11.08  P-Value = 0.000
```

Note: We get a one-sided confidence interval because we specified a one-sided alternative (>).

2.5. Generate a (two-sided) confidence interval, if necessary. Choose: *Stats/Basic Statistics/2-sample t* and then *Options...*. There, choose the "not equal" *Alternative*.



2.6. Choose *OK,* then choose *OK* again and the inference results will be displayed.

Two-Sample T-Test and CI: Women, Men

```
Two-sample T for Women vs Men

        N   Mean  StDev  SE Mean
Women  40  45.42   7.68      1.2
Men    40  39.15   9.21      1.5


Difference = mu (Women) - mu (Men)
Estimate for difference:  6.27
95% CI for difference:  (2.49, 10.04)
T-Test of difference = 0 (vs not =): T-Value = 3.30  P-Value = 0.001  DF = 78
Both use Pooled StDev = 8.4795
```

2.7. Copy the confidence interval only into your report immediately below the one-sided confidence interval

This is the end of *2-sample statistical inference.*