Using Excel for Statistical Analysis

This document describes how to use the Analysis ToolPak in Microsoft Excel to perform basic statistical procedures. Microsoft Excel is spreadsheet software that is used to store information in columns and rows, which can then be organized and/or processed. In addition to the basic spreadsheet functions, the Analysis ToolPak in Excel contains procedures such as ANOVA, correlations, descriptive statistics, histograms, percentiles, regression, and t-tests. This document describes how to get basic descriptive statistics, perform an ANOVA, a t-test, and a linear regression.

The primary reason to use Excel for statistical data analysis is because it is so widely available. The Analysis Toolpak is an add-on that can be installed for free if you have the installation disk for Microsoft Office. It is also publicly available in the Meyer Library cluster and on designated computers in the Social Sciences Resource Center (SSRC) Reading Room cluster in the Bing Wing of Green Library. To use any of the public computers on campus, you must have a SUNet ID (Stanford University Network Identifier). If you do not have a SUNet ID, visit the Web at http://www.stanford.edu/services/sunetid for information on obtaining one.

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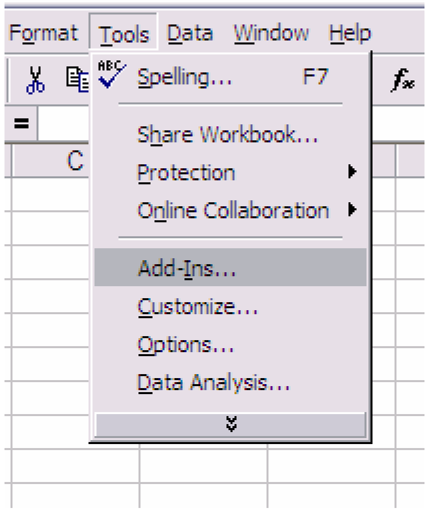
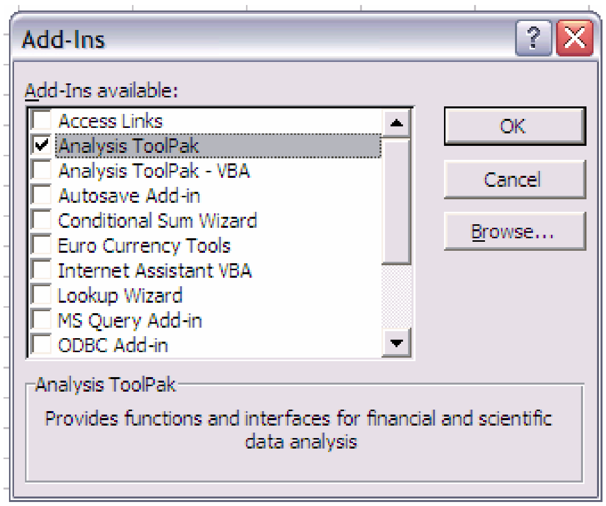
Getting Started with the Analysis ToolPak

To statistically analyze your data in Excel, you need the Analysis ToolPak add-in to be installed in Excel. This was an option when you installed Excel, but you might not have selected it. If you didn't install it, Excel will ask you for the installation CD-ROM, when you try to add the ToolPak.

Choose **Add-Ins** from the **Tools** menu in Excel to see whether the Analysis ToolPak is installed and checked (see graphic below).





You can now use the data analysis functions in Excel.

What you should know before you begin

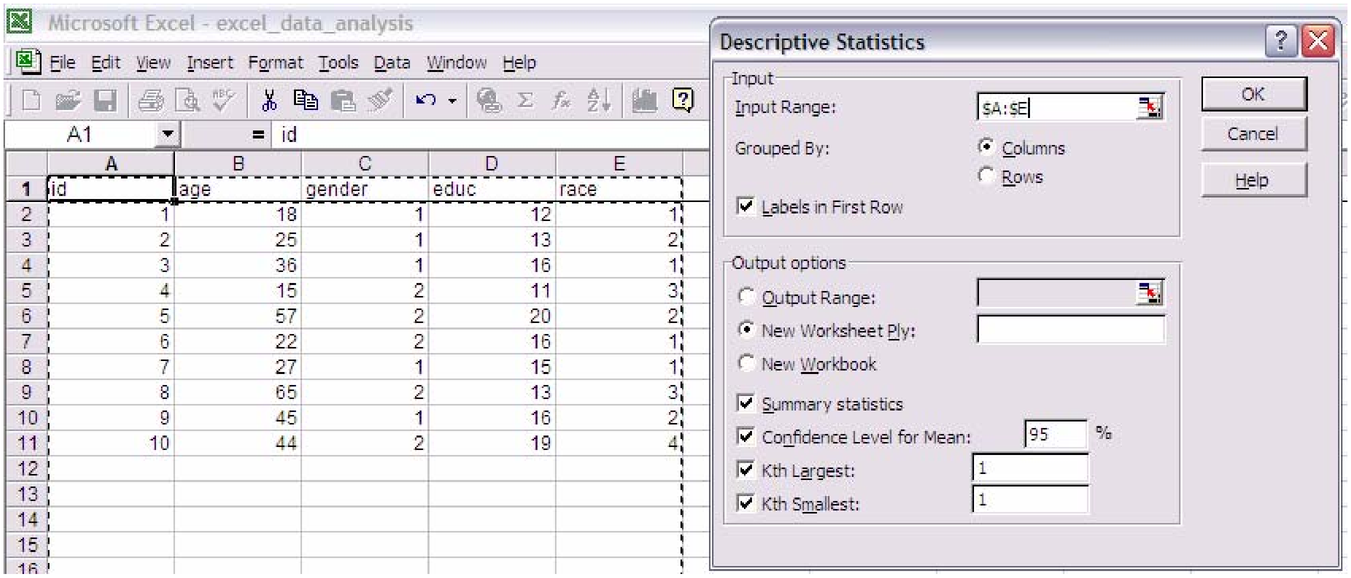
Statistical data analysis in Excel is not recommended for analyzing datasets with a large sample size or a large number of variables, performing advanced statistical analyses, or for projects in which a number of procedures need to be performed. In addition, Excel requires the data be set up differently than most other statistical software packages (e.g., SPSS, Stata, and SAS). As such, we recommend against using Excel for simple procedures and subsequently using statistical software for advanced procedures. It is more efficient to use statistical software for the entire analysis if you know you will need it for any part of the project (please see our "getting started" guides for these statistical packages on the SSDS web site).

In sum, Excel is a useful tool for answering basic questions for free. There are a number of disadvantages worth considering before using Excel for statistical analysis.

- Missing values are handled inconsistently, and sometimes incorrectly.
- Data organization differs according to analysis, which forces you to reorganize your data in many ways if you want to do many different analyses.
- Many analyses can only be done on one column at a time, which makes it inconvenient to do the same analysis on many columns.
- There is no log or record of how an analysis was accomplished.
- Excel lacks many important features for advanced analyses. For example, there are no regression diagnostics, collinearity diagnostics, hierarchical regression, weighting cases, etc.

Descriptive Statistics

To obtain descriptive statistics such as the mean and standard deviation, select **Data Analysis** from the **Tools** menu and select **Descriptive Statistics** from the list of analysis tools. A dialog box appears:



The first box is the **Input Range**. Here we tell Excel about the data we want to analyze. If you want descriptive statistics for all variables in your dataset as in the example above, then select columns from A to E. You can either type this information in directly as “$A:$E”, or you can select the appropriate data from the spreadsheet.

If each column represents a variable, then click on **Columns** in the **Grouped By** checkbox. Also because we have included row 1, which includes the variable name, we are going to have to tell Excel this, by clicking on the **Labels in First Row** checkbox.

Next under **Output Options** we tell Excel where we want the results to be written. It is best to ask for a new sheet by clicking **New Worksheet Ply** - you don't want to accidentally overwrite some of your precious data.

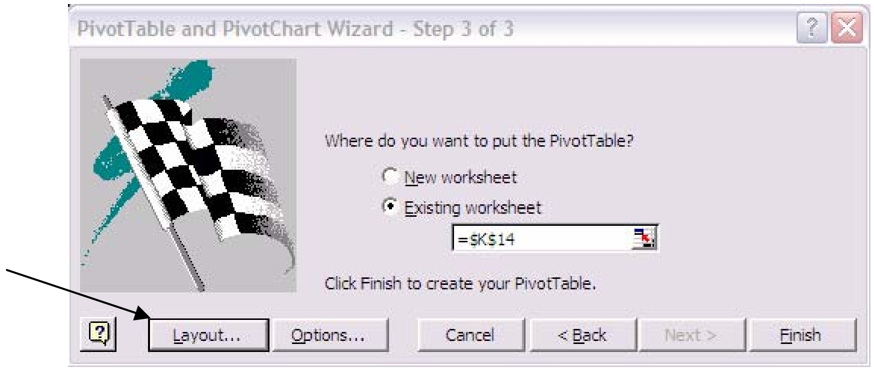
Finally, select which descriptive statistics you would like. In the above example, we have selected all statistics and set the **Confidence Level for Mean** to be 95% (this is the default).

Click **OK** and the new results will appear in a new worksheet.

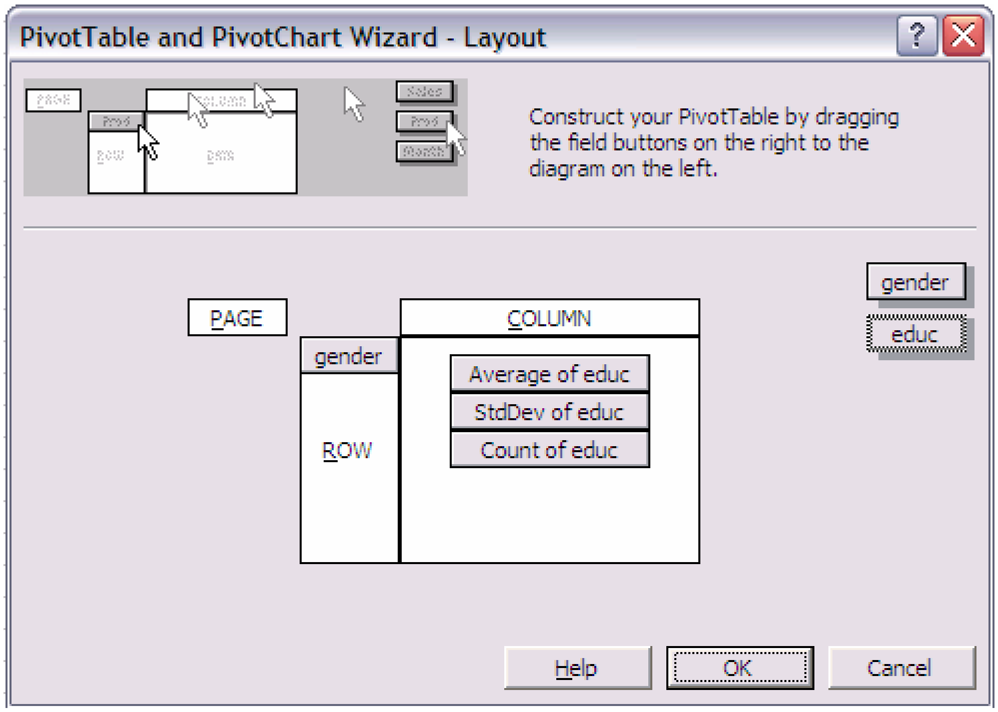
Using the Pivot Table

Excel also has a useful tool called the Pivot Table for getting descriptive statistics by groups (or conditions). For example, if you wanted to know the average and standard deviation of education for men and women, you would use the Pivot Table.

Go into the **Data** menu and select **Pivot Table**. This will open the **Pivot Table and Pivot Chart Wizard**, which will guide you through the process of selecting the data and choosing where to place the output. Once you have completed the first two steps, in Step 3, click on the **Layout** button to set up your Pivot Table:



A dialog box will appear:



In the above example, the Pivot Table is set up to report the average, standard deviation, and number of observations for the education variable by gender. To do this, choose **gender** as the **Row** variable and **educ** as a **Data** variable by dragging them to the appropriate locations. Double click on "Count of educ" and change it to Average. Drag **educ** into the **Data** box again, and this time change “Count” to “StdDev”. Finally, drag **educ** in one more time, leaving it as “Count” of **educ**. This will give us the men’s and women’s average, standard deviation and number of observations for education.

Click **OK** and **Finish**. The Pivot Table will appear:

gender	Data	Total
1	Average of educ	14.4
	StdDev of educ	1.816590212
	Count of educ	5
2	Average of educ	15.8
	StdDev of educ	3.834057903
	Count of educ	5
Total Average of educ		15.1
Total StdDev of educ		2.923088169
Total Count of educ		10

Significance Tests

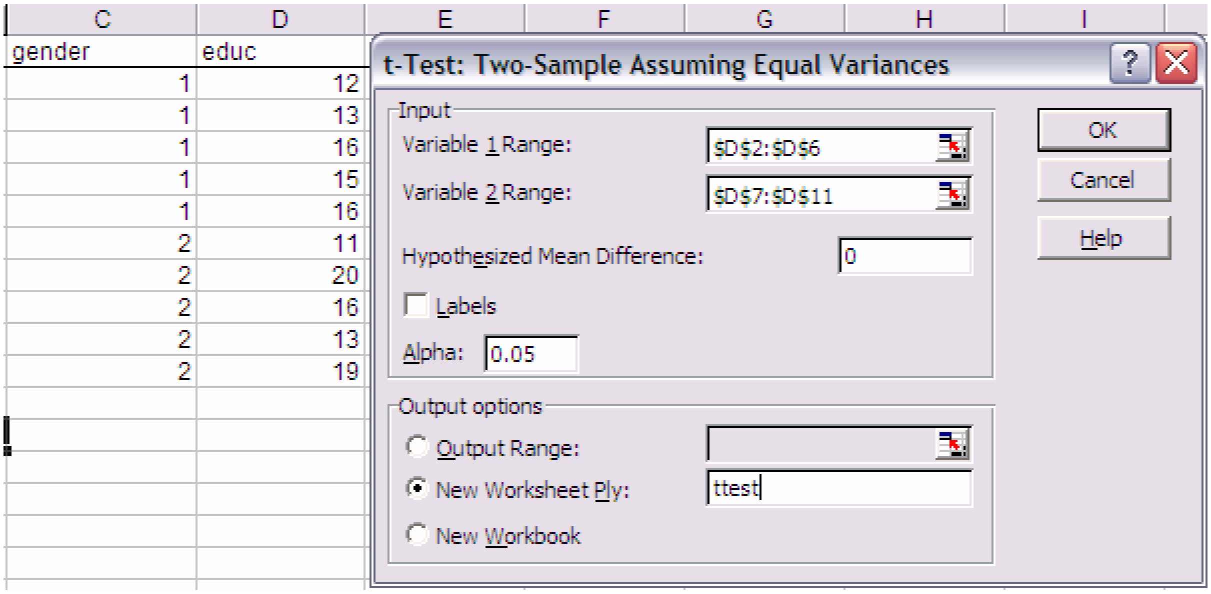
Excel offers a number of statistical tests of significance such as ANOVA, t-tests, F-tests, and z-tests. This document summarizes how to obtain two of the most commonly used significance tests: a two-sample t-test and a single factor ANOVA.

Two-Sample t-tests

To perform a two-sample t-test, you need to either create two columns for each sample or sort the data on the grouping variable. For example, if you wanted to test for significant differences in education levels for men and women, you either have to reorganize your data so that there is a men's education column and a women's education column, or sort the data by gender first.

To sort the data, first highlight all of the data so that when you sort, the data for each observation remains intact. Next, go into the **Data** pull-down menu and select **Sort**. A dialog box appears where you can select the variable to sort by and the order in which to sort the data. In this example, you would select gender and click on the **Ascending Order** radio button. Click **OK** and the data will sort. Now you are ready to perform a t-test.

In the **Tools** pull-down menu, select **Data Analysis**, and then scroll down to **t-Test: Two Sample Assuming Equal Variances** (or select the unequal variances option or paired sample t-test as appropriate). Click **OK** and a new dialog box will appear:



For the **Variable 1 Range**, select the rows in the education column that correspond to all gender-labeled rows assigned values of 1. For the **Variable 2 Range**, select the rows in the education column that correspond to all gender-labeled rows assigned values of 2.

To test the null hypothesis that there is no significant difference between men's and women's education levels, enter -0- into the **Hypothesized Mean Difference** box.

Do NOT check the **Labels** box since you are comparing sorted data and Variable 2 is not labeled.

Select the appropriate **Alpha** (e.g., .05 or 5%) and finally, choose where to place your output. In the above example, we have selected a **New Worksheet Ply** that we will call "ttest". Click **OK** and the results will appear in the new worksheet:

t-Test: Two-Sample Assuming Equal Variances		
	Variable 1	*Variable 2*
Mean	14.4	15.8
Variance	3.3	14.7
Observations	5	5
Pooled Variance	9	
Hypothesized Mean Difference	0	
df	8	
t Stat	-0.73786	
P(T<=t) one-tail	0.240838	
t Critical one-tail	1.859548	
P(T<=t) two-tail	0.481677	
t Critical two-tail	2.306006	

Single Factor ANOVA

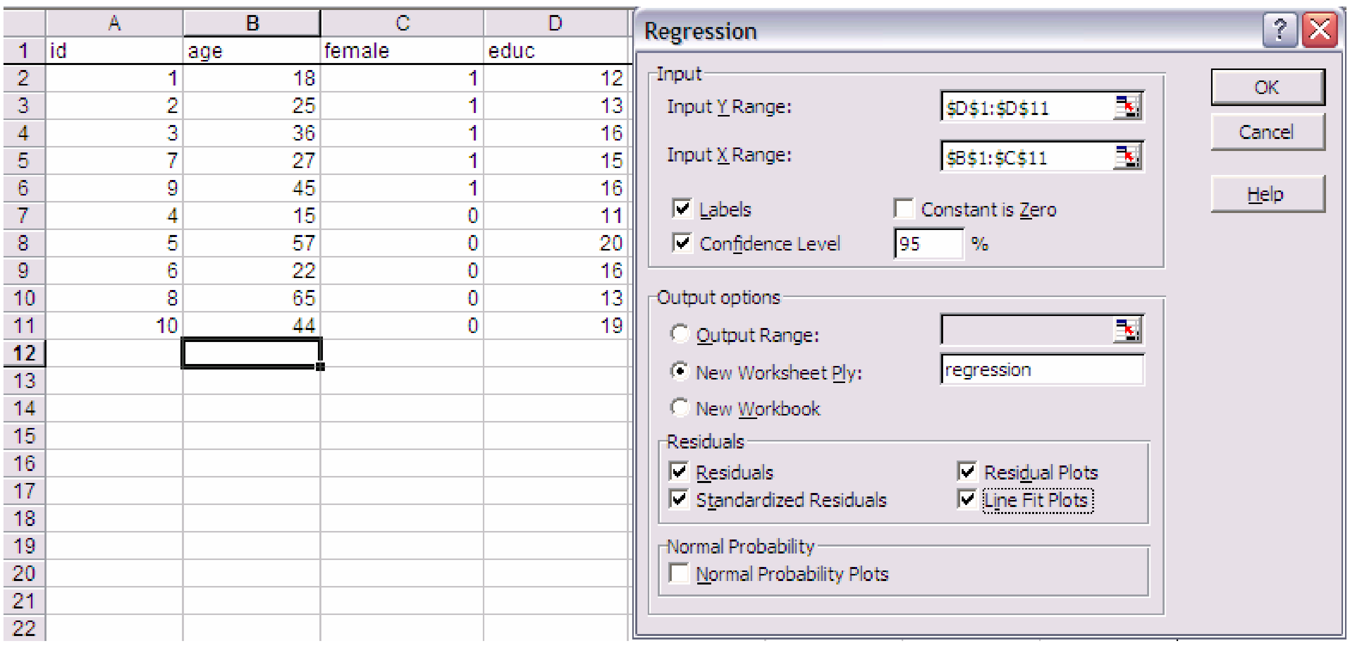
To use ANOVA, the procedures are the same as those to obtain a t-test except for one important difference in how you organize the data. Whereas with the t-test, you can sort the data by the grouping variable and then select the two different groups of the dependent variable, for the ANOVA, you must create a separate column for each group. For example, if we want to use ANOVA to compare men's and women's education levels as with the previous t-test example, the dataset must contain a column with the men's education levels and a separate column with the women's education levels. You would then select both columns as the input range.

Note that this type of data organization is different from how you would set up your data if you were going to use a statistical software package such as SPSS, Stata or SAS.

Regression

While Excel can do the regression procedure, it does not report standardized coefficients, important regression diagnostics or information about collinearity. For this reason, we recommend that users who are doing anything more than exploratory research use a statistical software package such as SPSS, Stata, or SAS for regression analysis.

In the **Tools** pull-down menu, select **Data Analysis**, and then highlight **Regression**. Click **OK** and a new dialog box will appear:



For the **Input Y Range**, select all of the values of the dependent variable. The dependent variable must be 1 column wide, and N rows long (where N is the number of observations in the sample). In this case, we have selected education to be the dependent variable.

The next stage is to input the independent variables in the **Input X Range** box. The independent variables must be a block of data, of k columns (where k is the number of independent variables) and N rows (where N is still the number of observations). In this example, age and an indicator variable for females are the independent variables.

Click on the **Labels** box since the first row of data is the variable label and once again choose to have the output written to a new spreadsheet.

You can also request that the residuals and the standardized residuals be saved by clicking the appropriate boxes.

Finally, it is also useful to get a **residual plot**, which will draw scatter plots of each independent variable on the x-axis, and the residual on the y-axis and a **line fit plot**, which will draw scatterplots of each independent variable on the x-axis, and the predicted and actual values of the dependent variable on the y axis.

Click OK and the results will appear in the new worksheet:

	A	B	C	D	E	F	G
1	SUMMARY OUTPUT						
2							
3	*Regression Statistics*						
4	Multiple R	0.53318577					
5	R Square	0.284287065					
6	Adjusted R Square	0.079797655					
7	Standard Error	2.804035987					
8	Observations	10					
9							
10	ANOVA						
11		*df*	*SS*	*MS*	*F*	*Significance F*	
12	Regression	2	21.8616753	10.93084	1.390229	0.310160174	
13	Residual	7	55.0383247	7.862618			
14	Total	9	76.9				
15							
16		*Coefficients*	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
17	Intercept	12.3255095	2.677417013	4.603508	0.002474	5.994428828	18.6565902
18	age	0.085578584	0.058265879	1.46876	0.185349	-0.052198229	0.2233554
19	female	-0.509982729	1.874097352	-0.27212	0.79338	-4.941515606	3.92155015

Once again, these results should only be used for exploratory purposes. In order to trust that regression results are reliable, it is necessary to perform a number of regression diagnostics that are not available in Excel. Below is a partial list of what statistical software packages will do that Excel does not do when performing a linear regression.

- Report standardized coefficients
- Produce standard diagnostic graphs, e.g. the normality plot of the residuals, the scatterplot of residuals against predicted values, skew statistics for datasets with more than 30 cases.
- Measure collinearity among the independent variables, which would help you to understand what is happening in the data (e.g., highly significant R^2, but no significant parameters in the model).

For More Information and Assistance

Excel Help

Excel has a Help system built into the software. To get help with a specific procedure, click on the Help button in the Dialog box for the procedure you would like to run.

There are also add-ins that you can purchase that solve some of the weaknesses in using Excel for statistical data analysis. In particular StatPlus, which comes with the Berk and Carey textbook listed in the next section on **Documentation**, is a popular one.

Documentation

Social Sciences Data and Software (SSDS) has a reference library of textbooks and software manuals about qualitative and statistical analysis, located in the Velma Dining Room on the first floor of the Green Library Bing Wing. Stop by to browse our collection or consult the SSDS website at http://ssds.stanford.edu, where you can browse by title, subject and call number. The SSDS collection does not circulate, but check the online catalog Socrates for copies in other locations.

The following books contain useful information about using the data analysis tools in Excel. You can purchase the books at the Stanford Bookstore and some manuals are also available to be checked out from Green Library.

Books

Berk, Kenneth and Patrick Carey. 2003. *Data Analysis with Microsoft Excel : Updated for Office XP (with StatPlus CD-ROM)*

Middleton, Michael R. 2004. *Data analysis using Microsoft Excel: updated for Office XP.*

Nelson, Steven L. 2002. *Excel Data Analysis for Dummies*.

Consulting

If you have questions about using the Analysis ToolPak in Excel, please contact the SSDS Software Consultants via our web site at http://ssds.stanford.edu. The software consultants are available during the academic year on a walk-in basis or by appointment. Please see our web site for our current walk-in hours.