

Minitab

(V1.1)

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Introduction

Minitab is a statistical software package that provides a broad range of basic and advanced data analysis capabilities.

Data can be entered and stored in worksheets from a variety of file formats. To analyse data, commands can be typed in the command line pane, or entered through the graphical user interface. Minitab offers a large range of graphs and graph editing features.

Objectives

The objective of this session is to provide you with the basic skills to use Minitab. Most of the ideas will be reconsidered from a statistical viewpoint in later teaching and workshops. By the end of this course you should be able to demonstrate competence in the following areas:

##### open a Minitab worksheet and understand what all the different panes do

##### enter numeric data and save it either in a worksheet or project

##### use the help system in Minitab

##### know how missing data is indicated and handled

##### know the different data and file types involved

##### manipulate data in rows and columns, stack and unstack

##### use the ‘LET’ command and Calculator

##### use the Random Data facility to generate data for testing

##### import data from an Excel spreadsheet

##### print raw data and graphics

##### export raw data and graphics to Word or PowerPoint

##### display sample data in a variety of graphic forms

##### display multiple sets of data on one graph

##### annotate graphs so that they can be included in publications and presentations

Minitab

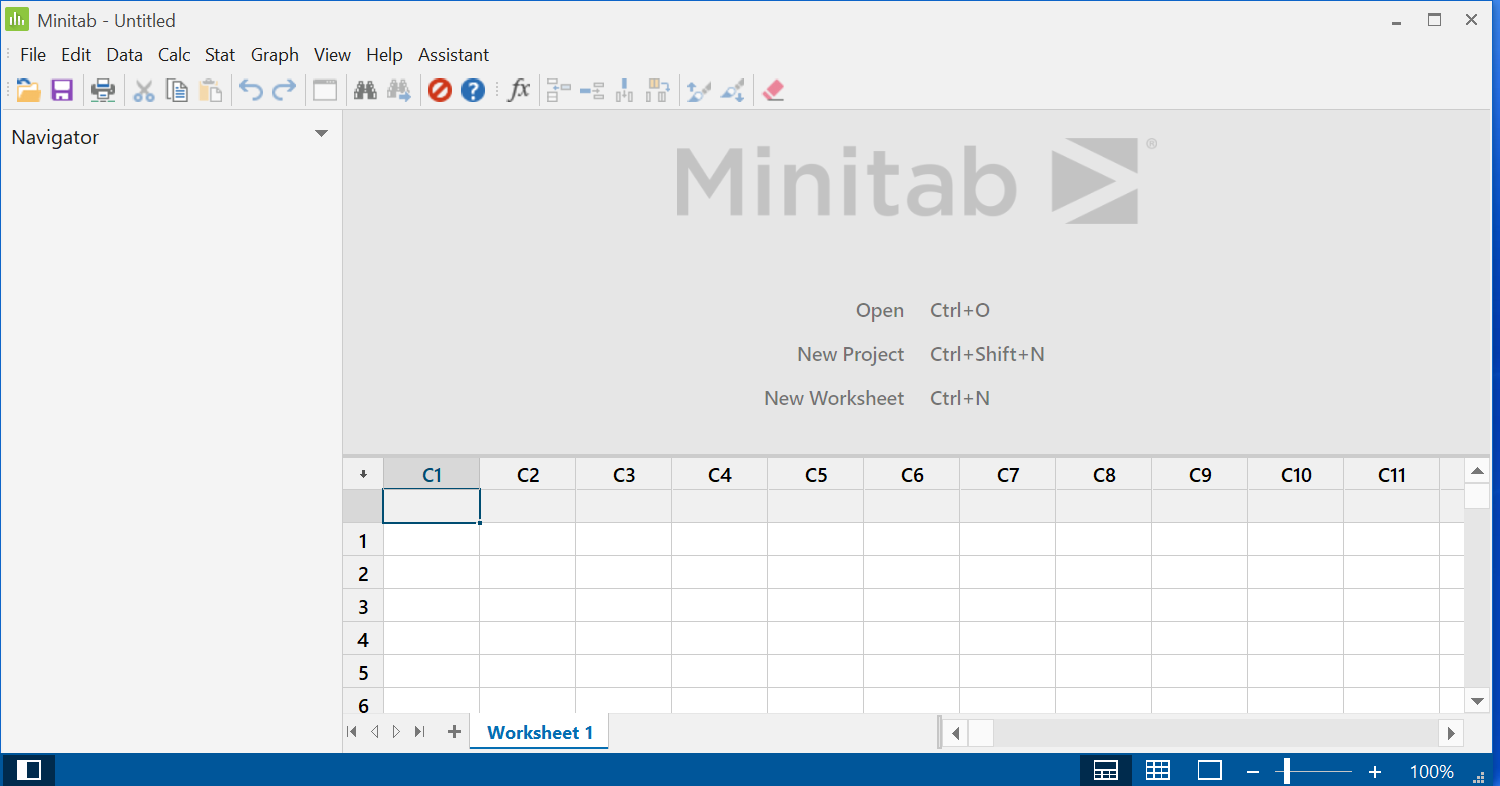
# Starting Minitab

Most PCs on the Common Student Computing Environment will have Minitab installed. The location of **Minitab** on the **Start** Menu may vary by computer lab.

To start Minitab, double click on its desktop icon or go to

Start menu è **Minitab**

When it starts the screen will look something like this.



# Menu Bar and Toolbars and Panes

The Menu Bar at the top of the screen contains several drop-down menus (e.g. File, Edit, Data, Calc) which you will use to access Minitab’s commands and functions. The Toolbar, lying just below, has many icons that can be used as shortcuts to perform common activities. To find out what the icons do, position your mouse pointer over the icon and a label describing its action will appear.

## Navigator pane

Contains the list of output titles in your project sorted from oldest to newest, with the most recent output titles at the bottom of the list. Right-click any output title in the Navigator to rename or export to Word or PowerPoint

## Output pane

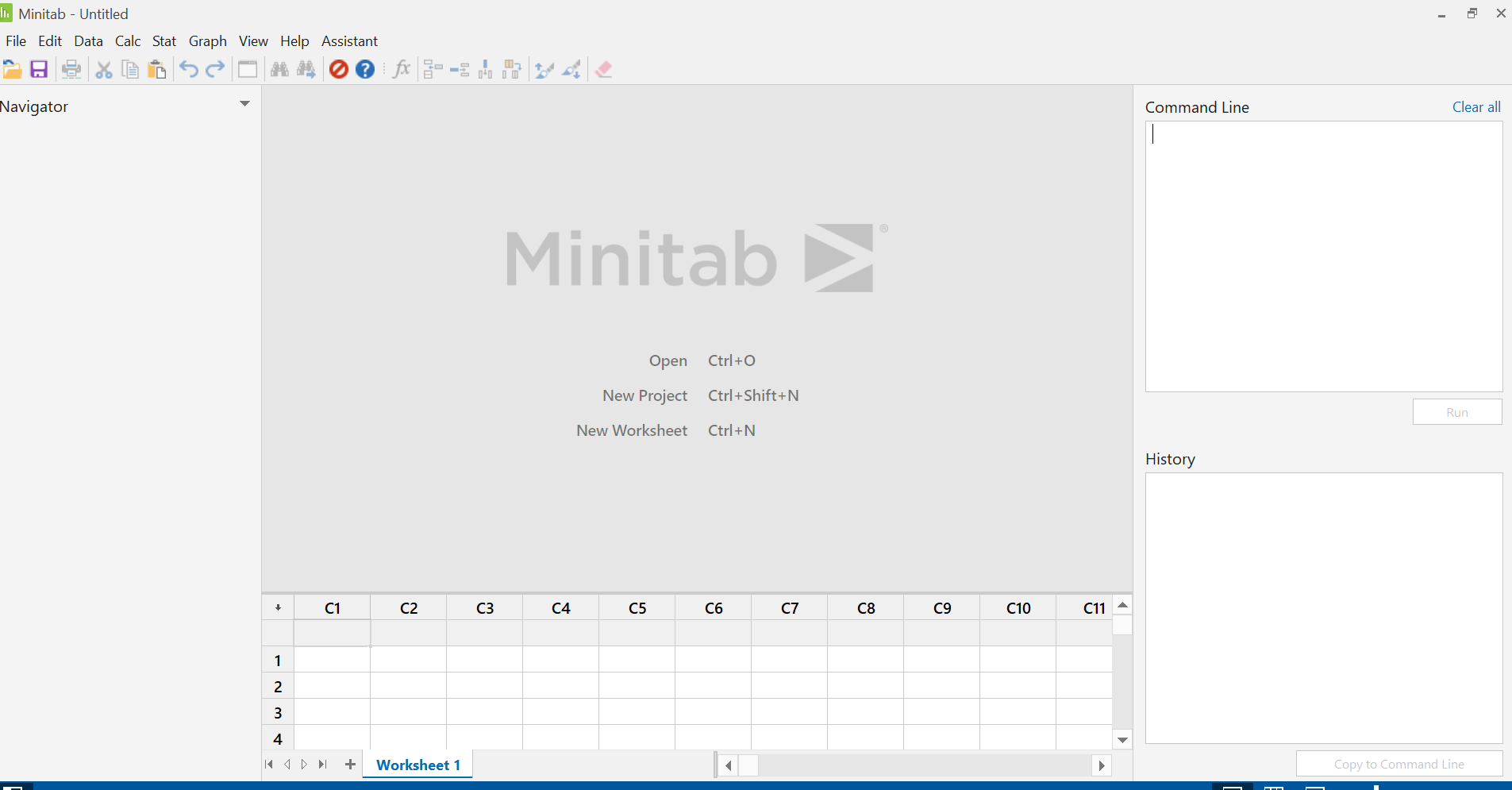
Displays output, such as graphs and tables, after you have run an analysis. Output for each analysis is displayed on a single tab.

## Data pane

Displays the active worksheet (Worksheet 1 in the figure above) and is where you enter your data into cells. It looks much like a spreadsheet and data is entered in a similar way.

In a worksheet, each column can in addition to its column label (e.g. C123) also be given a column name after the variable it represents.

To display the **Command Line** and **History** panes, go to **View** menu and select **Command Line/History.**



## Command Line pane

The Command Line pane is where you can enter or paste command language to perform an analysis.

## History pane

The history pane holds the history of all the commands and subcommands that have been used. You can select and copy commands and subcommands from the History pane to the Command Line pane, where you can edit and run them again.

# Using Help

The Minitab Help Window contains a contents table, an index and a search option to enable you to find out what you want to know.

There are several ways to get help:

##### Press **F1** or choose **Help** menu **è Help**.

##### In the Command Line pane, type HELP and then run.

# Entering Data And Saving Your Work

To begin with we will enter some data and then save it as a worksheet.

A picture containing holding, hand, person, large

Description automatically generatedBefore typing in the data, you can re-size your Data pane if you wish using the re-size cursor

**Task 1**

Enter the weight and height data as shown in the table below. Note that unlike a spreadsheet, there is an extra ‘greyed-out’ row of cells for you to put in column names for your variables.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ê | **C1** | **C2** | **C3** | **C4** |
|  | **WeightM** | **HeightM** | **WeightF** | **HeightF** |
| 1 | 65 | 1.75 | 50 | 1.55 |
| 2 | 70 | 1.80 | 55 | 1.60 |
| 3 | 75 | 1.85 | 60 | 1.65 |

To navigate around the Data pane, you can position the cursor anywhere using your mouse to point and click, or you can use the arrow keys on your keyboard to move the cursor. The Entry Direction, the direction the cursor next moves to after you have typed in data in a cell and pressed Enter, is controlled by direction of the arrow in the cell in the top left-hand corner of the worksheet. In the figure above, the Entry Direction is downwards. This can be changed to across and back to downwards, by clicking on the cell.

**Task 2**

1. Select **File** menu è **Save Worksheet** **As…**.
2. In the *Save Worksheet As* dialog box, type **Minitab task 2** into the *File Name* box è click on **OK**.

The History pane will now show you the name of your new file and the file path to its location. The .**mwx** extension tells you it is a Minitab Worksheet file.

You can save one or more worksheets plus accompanying command line, comments and history pane as a **Project** file. Chose **File** è **Save Project** to save a Project**.**

It is good practice to save all associated work as a project, so when you re-open your Minitab project file, in addition to loading the data again, you will be able to review your previous work to remind yourself of what tests you have performed and the results you obtained.

# Re-Opening your Saved File

You exit the program by clicking on the **File** menu è **Exit**. Minitab will ask you if you wish to save changes to the untitled project.

**Task 3**

1. Exit Minitab now. Click on **No** when you are asked if you wish to save changes.
2. Now that you have shut Minitab down you should open it again and you can proceed to re-open your saved file. Once Minitab is running again, click on the **File** menu è **Open** è navigate to where you have saved Minitab task 2, select it and click **Open**.

The History pane will note that the file was retrieved and tell you when your work was last saved.

# Types of Data

Worksheet columns can store three types of data: numeric, date/time, and text.

##### Numeric data consist of number characters (0 1 2 3 4 5 6 7 8 9) and (\*), the missing value symbol. The number can have positive and negative signs and can contain a decimal separator. A number up to ± 1.0 x 1018 can be entered using exponential notation, e.g. 1E18. If a column contains any character other than numbers or \*, Minitab interprets the entire column as text (unless it has been entered in a recognised date/ time format).

##### Date/time, for example 1/1/90 or 00:00:01. A column containing date/time data will have ”-D” appended to its column label, e.g. “C3-D”

##### Text consists of letters, numbers, spaces, and special characters, up to 80 characters long, e.g. "10 qwerty %^&…!". Text data is often used to specify the levels of categorical variables. For example, a column containing the gender of participants in an experiment may use the text values “Male” and “Female” as data options. A column containing text will have ”-T” appended to its column label, e.g. “C3-T”

##### When you want to change data type in column, choose **Data** menu **è Change Data Type è …** to convert from one type to another.

**Task 4**

1. Try typing in a couple of numbers as data. Use the **Enter** key to move between cells.
2. Change the Entry Direction and enter two more numbers.
3. Change the data type in one column then change it back again.

## Missing Data

Many data sets are missing in one or more observations. When you enter numeric data, type an asterisk (**\***) in place of the missing value. If you ask Minitab to do a calculation that is impossible it will automatically set the answer to **\***. All Minitab commands automatically take asterisk into account when they do an analysis. If after you have entered the data, you discover a value that is clearly wrong, you can change that value to an **\***.

When importing data from other programs Minitab uses the missing value code **\*** for missing values in numeric and date/time columns, and a blank for missing values in text columns. Normally, Minitab will interpret missing values correctly without any specific instructions from you but it is good practice to check known missing values to see how they were brought in, and only make adjustments if they were not read in correctly.

## Manipulating Data in Rows and Columns

Columns should be named, this serves two purposes: the column may be referenced by that name and it’s often easier to remember the name of a variable rather than the label number of a column. Also, all output is labelled with the name making output easier to interpret again long after you’ve done the analysis.

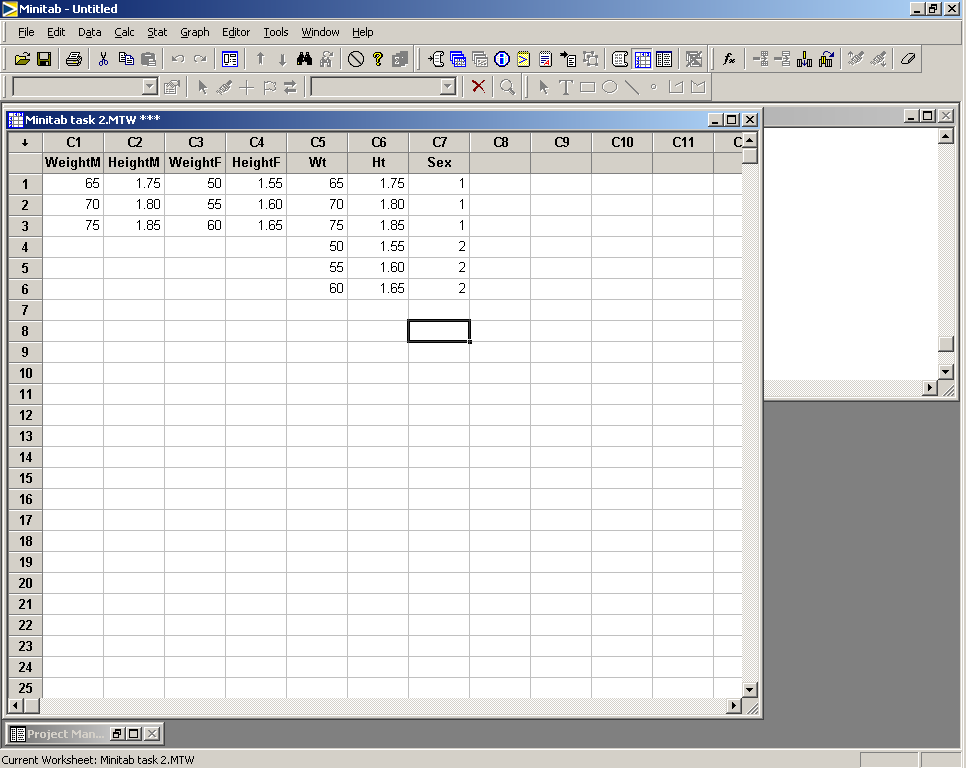
To enter data, type using the keyboard as described earlier, or import from another file (e.g. an Excel spreadsheet). To clear, delete, copy, cut and paste data, highlight the cells and then use **Edit** menu, icons or keyboard shortcuts to move the data to its new location. Note that clearing data replaces the cell contents with an asterisk  or the word missing  whilst deleting data causes the remaining cells to shift to take up the deleted space.

## How to Stack and Unstack Data

There are two related methods of organising grouped data in a worksheet. One method or the other may be more convenient while collecting data or while analysing data in Minitab

The data we have entered so far is unstacked data. Each column contains observations from one group; the weight data for males and females are in separate columns (WeightM and WeightF), and the height data for males and females are in separate columns (HeightM and HeightF).

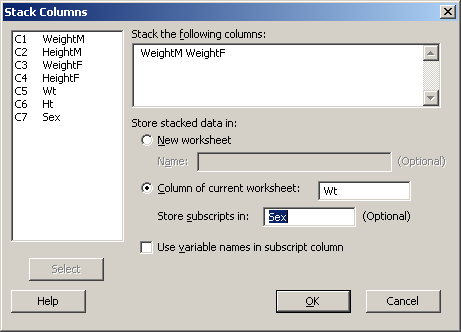
In stacked data, all groups are placed in a single column with a corresponding column of labels, the subscripts, that identifies the group. In the example below, the data for the two groups, males and females, are stacked together in columns weight (Wt) and height (Ht). The subscript column Sex indicates which cases are males (Sex = 1) and females (Sex = 2).



To change between them we can use the Stack and Unstack commands. In the next task, we will stack the data.

**Task 5**

1. Name c5 **Wt**, c6 **Ht**, and c7 **Sex**
2. Go to **Data** menu **è** **Stack è Columns…**
3. Stack the following columns **WeightM** and **WeightF**, by double-clicking on them.
4. Under the *Store the stacked data in* box enable **Column of current worksheet**   
   **è** click inside the box to make the named columnsappear on the left   
   **è** select **C5** **Wt**.
5. In the *Store subscripts in* box select **C7 Sex** – our grouping variable.
6. **Un**-check *Use variable names in subscript column*.
7. The *Stack Windows* dialog box should look like the figure below. Now, click **OK.**
8. Now stack the height data into column **C6**.
9. Select **File** menu è **Save Current Worksheet** **As…**.   
   è in the *Save Worksheet As* dialog box, name the file **Minitab task 5** è **OK**.



## Simple Commands for Manipulating Data

The LET command can do basic arithmetic and uses the following symbols.

**+** add

**-** subtract

**\*** multiply

**/**  divide

**\*\*** raise to a power

To use the LET command you need to use the Command Line pane. To display the Command Line pane, Select **View** menu è and select **CommandLine/History**

**Task 6**

1. We are now going to calculate the Body Mass Index for the weight and height information we have. Give column **C8** the name, **BMI**
2. In the **Command Line** pane type

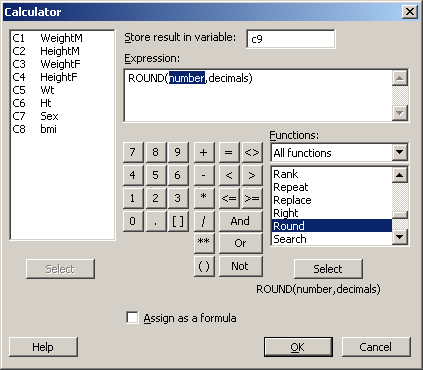
**LET C8 = C5/(C6\*\*2)** **è** press **Run**

1. Another way to perform calculations is to use the built-in calculator, go to the **Calc** menu **è Calculator…**.

On the left hand side of the Calculator window, columns containing data are indicated.

At the top is the *Store result in variable* box you must always have a column reference here, to tell the calculator where to place your result.

Under this is the *Expression* box, in this you place the function or calculation you wish to perform.



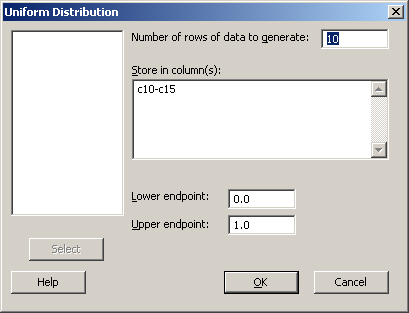
**Task 7**

1. Using the Calculator, we will round off BMI in column C8 to two decimal places, and put the results in column C9.  
     
   In the *Store result in variable* box, type **C9   
   è** under *Functions* (*Arithmetic*) choose **Round** then click the **Select** button  
   **è** select **C8 BMI** from the variable list on the left   
   **è** type **2** in the *Expression* box so it is ROUND(‘bmi’,2) **è**  **OK**.
2. Try this once more, only this time store the result in C8 BMI. This should over-write your previous result with the rounded data.
3. Look at the History pane and note the commands for this.
4. Save Current Worksheet As…. **Minitab task 7**.

## Generation of Random Data

Minitab offers the facility to generate random numbers from a variety of distributions under Random Data sub-menu.

In the next task create six random samples, each containing twenty observations, from a uniform distribution of 0.0 to 1.0.



**Task 8**

1. Go to the **Calc** menu è **Random Data** è **Uniform…**

è In the *Number of rows to generate* box, type **10**

è In the *Store in column(s)* box, type **C10-C15**

**è** Click the **OK** button

1. Repeat this task, but this time create a **Normal** distributed set of random numbers in columns **C20-C25**.

# To print a worksheet:

#### Click on your worksheet, then choose **File** menu è **Print** and make the necessary changes in the *Worksheet Print Options* dialog box è **OK** and the print dialog will appear

#### Pull printing is available round campus – just go to any pull printer to print out your file. If it is not available, you should see the local printer named in the dialog window.

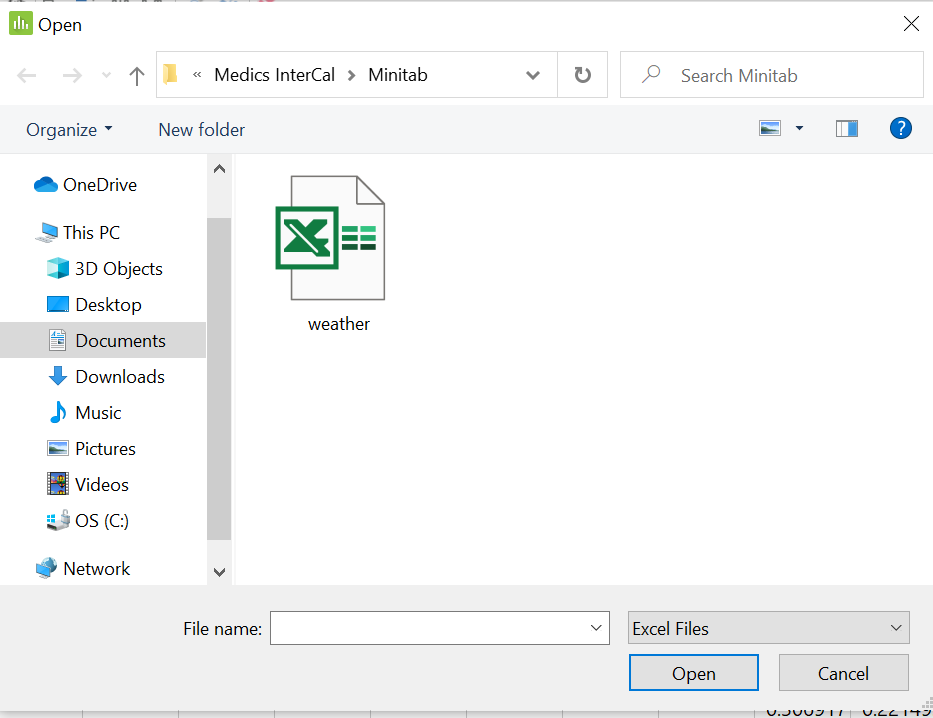
# Importing numerical data from a spreadsheet

Download the Excel file called **weather.xls** from the [IT Services spreadsheet work file examples page.](https://www.gla.ac.uk/myglasgow/it/training/courseresources/#goingfurtherwithspreadsheets)

Minitab can import data from files created by many other applications. For example, you can open and save data files in the formats of Excel and Lotus 1-2-3 for. Minitab can also open plain text (ASCII) files, which usually have an extension of .txt (for text) or .dat (for data).

Files created by other applications may have data arranged in ways different from the row and column format used by Minitab worksheets. For example, variable names may not always be in the first row. You can open the file as is, then clean it up in Minitab, or you can use options in the Open Worksheet dialog box to control how Minitab will interpret the data before you open the file.

To open files from other applications, you use the same menu command you use to open Minitab worksheets, the **File** è **Open** command.



In the *Open Worksheet*dialog box as seen above, using the **Files of type** drop-down menu you can choose the type of file you wish to open.

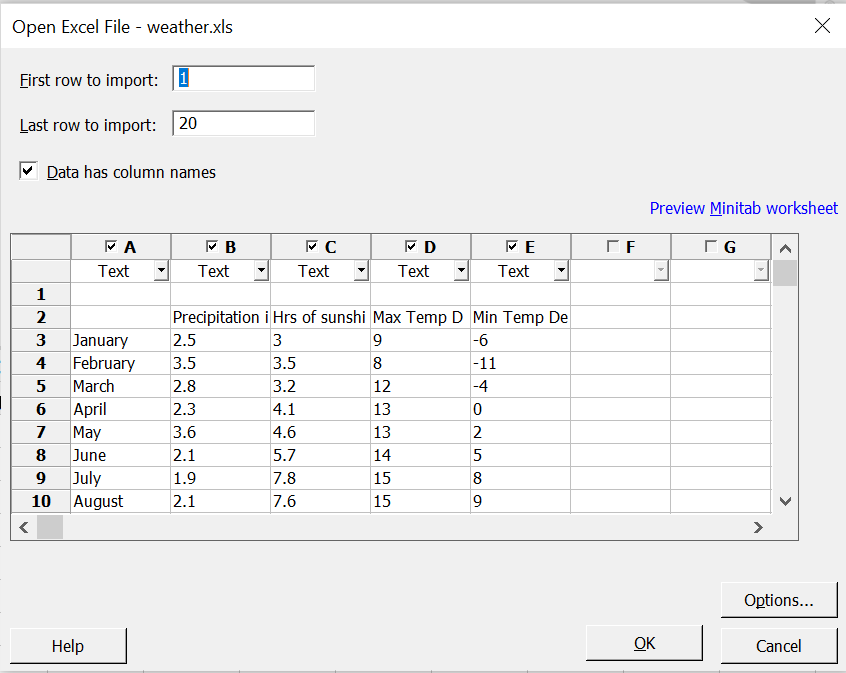
Opening a non-Minitab file may involve previewing the file, changing options, previewing again, and so on, until you see that Minitab will interpret the data exactly as you want.

Another way to import files into Minitab is to use copy and paste. Copy data from the spreadsheet package. In the Minitab worksheet, click the cell where you want to begin the paste, then choose **Edit** menu è **Paste Cells**.

Copy and Paste is fine if you have simple groups (columns/rows) of one type of data but otherwise (especially if you have headings) you are better to open the file, Preview it first and choose suitable Options to make sure the data is interpreted correctly.

**Task 9** (refer to the screen shot below)

1. Go to **File** è **Open** è choose **Excel** file type  
    è navigate to the downloaded **weather.xls** file, select it.
2. In the **Open Excel File** window
   1. Enter 2 into **First row to import**
   2. Enter 14 into **Last row to import**
   3. Check that **Data has column name** is selected
3. **Preview** the file è if the data appears as you want it, click **OK**.



# Graphing Sample Data in Minitab

Most of the graph commands can be accessed from the *Graph* menu. In Minitab you can

**Edit** the graph: modify and add text, shapes, and other graph elements with point-and-click tools

**Brush** the graph: highlight data points to identify corresponding observations in the Data pane

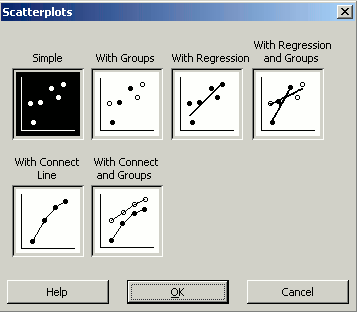
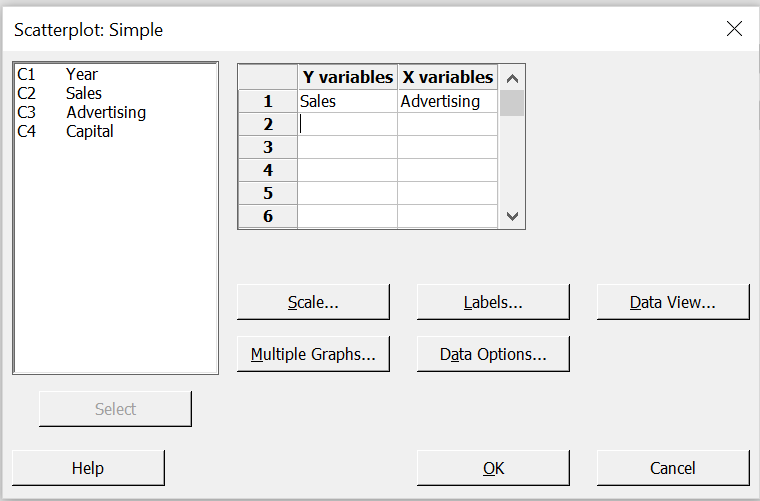
**Print /Save** graph: graphs can be saved for re-editing later

The graph commands can quickly create graphs of various types: scatter plots, time series plots, charts, and more. Some of the most common types are reviewed below, *but Minitab provides excellent online help about to create any of them*, explaining how to complete all the components of the dialog boxes for each type. See more from [Minitab support.](https://support.minitab.com/en-us/minitab/18/help-and-how-to/help-and-how-to-overview/)

Help can be obtained via the dialogue box that appears when you select any kind of plot or chart from the **Graph** menu. Click on the **?** icon on the tool bar for help, or use the **Help** button at the bottom of the dialog box you are in.

In each of the examples below the data is from the file **Market.mwx**, which can be found here at the [IT Training Minitab and SPSS file store](https://www.gla.ac.uk/myglasgow/it/training/courseresources/#minitabandspss).

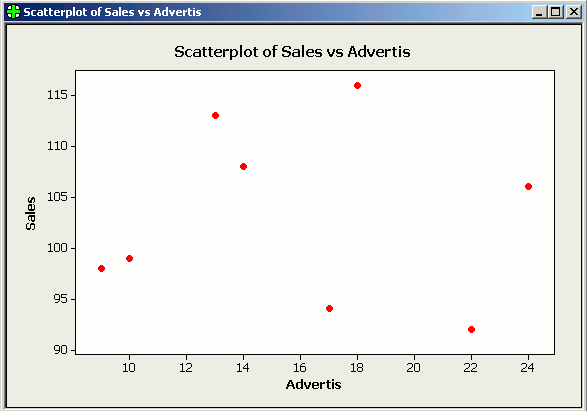
A plot displays points at paired co-ordinates from two variables: one variable provides the co-ordinates for the vertical y-axis, and the other variable provides the co-ordinates for the horizontal x-axis. The default form of a plot is a scatter plot, which displays symbols for those data points.



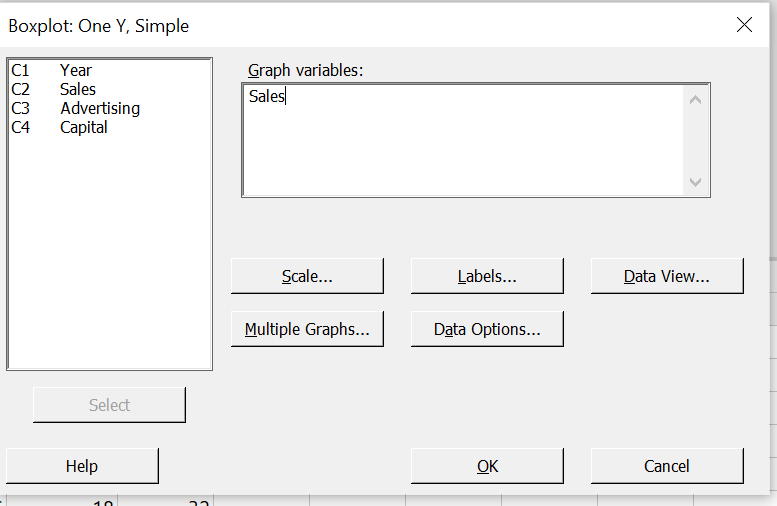
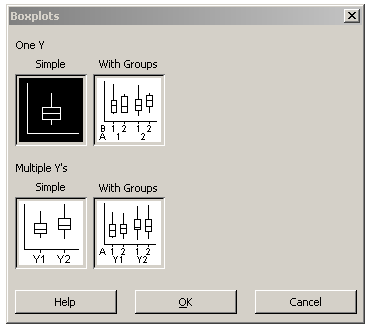
**Task 10**

1. Go to **Graph** menu è **ScatterPlot** è choose **Simple** in the window that opens (see above) è **OK**
2. Another window will open to allow you to choose the columns you want. You add a column to the *Y and X variables* by double clicking the columns on the left.   
   In *row 1* of *Y variables* enter **C2 Sales**è in *row 1* of *X variables* enter **C3 Advertising** è **OK**.

You should get something like the scatter plot shown:

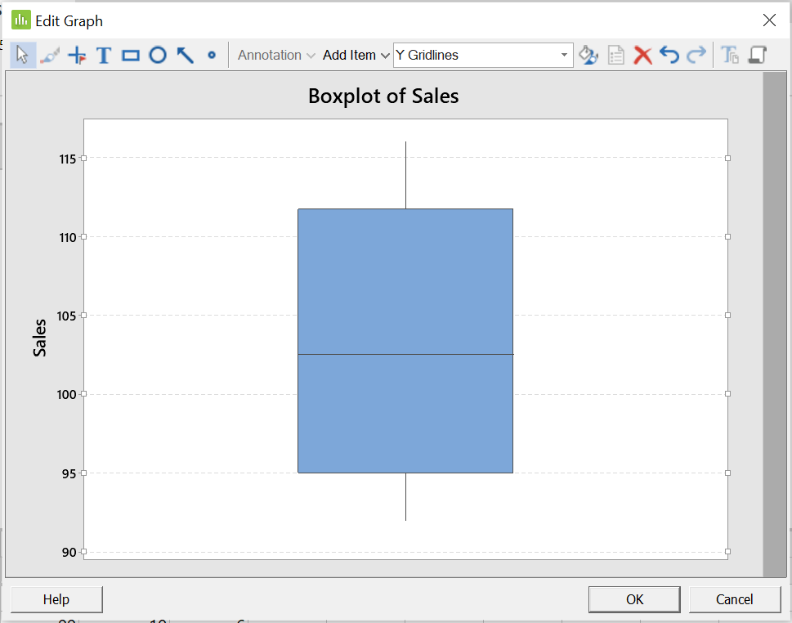


## Creating a Boxplot chart

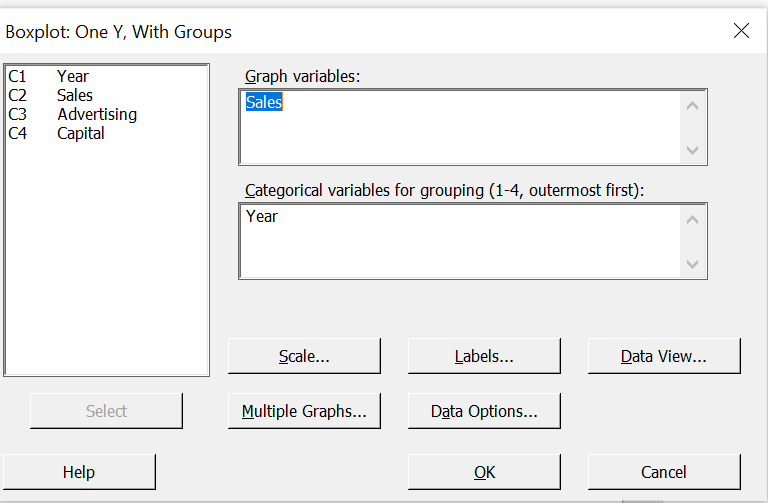
You can produce many kinds of graphs/charts, including Line charts, Stem and Leaf charts, Histogram charts, and Boxplot charts. A Boxplot is a way of summarizing a set of data measured on an interval scale. It is often used in exploratory data analysis. It is a type of graph that is used to show the shape of the distribution, its central value, and variability.

**Task 11**

1. Choose **Graph** menu è **Boxplot...**è in the *Boxplots* dialog box, choose **Simple** under *One Y* è **OK**è in the *Boxplots – One Y, Simple* dialog box, select **C2 Sales** è **OK**
2. You can add detail to the graph by selecting the graph and then clicking on the drop-down arrow at the top right side of the graph and selecting **Edit Graph**. Right click on the graph and choose **Add** (then one of the options that appears)  
   è Choose **Gridlines** è select **Y** **major ticks** è **OK**.

The Boxplot that appears should look something like the following image.

Now we will look at doing a Boxplot graph with groups. When you choose groups you will see the following dialog box. This allows you to add a categorical variable to the Boxplot.



**Task 12**

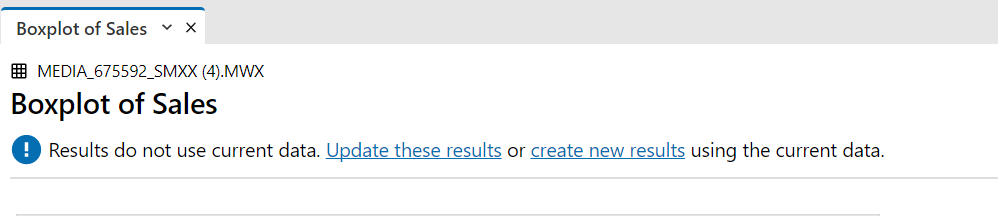
1. Choose **Graph** menu è **Boxplot...**è in the *Boxplots* dialog box, choose **With Groups** under *One Y* è **OK**
2. In the *Boxplots – One Y, With Groups* dialog box,
   1. click in **Graph variables**   
      è select **C4 Sales**
   2. è click in **Categorical variables**è select **C3 Year**
   3. Click è **OK**.
3. If you like, and if there is time, repeat the exercise and use some of the other dialog box options, such as **Scale…**.
4. Go to **File** menu è **Save Project As…**, and under *File name* enter **ITTS Minitab** and save your project.

You should have created a Boxplot something like the one below:



## Updating graphs

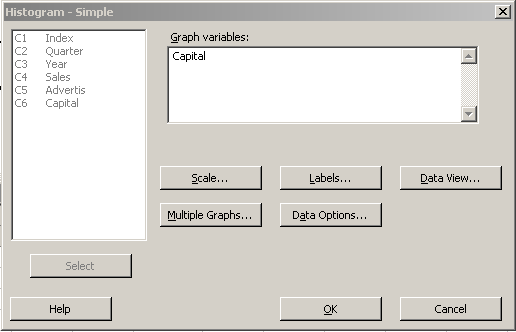
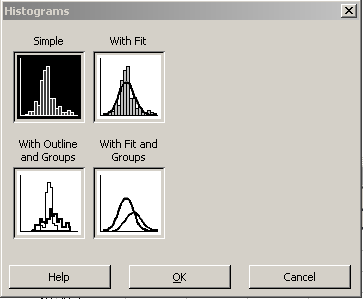
If you change the source data for the graph, you can update open graphs to display the changed data. To do this select one of the options from the note that appears at the top of the output pane:-



1. *Update these results*: Update the graphs in the current tab to reflect the current data in the worksheet.
2. *Create new results*: Reproduce the graphs in a new tab. The graphs in the new tab reflect the current data.

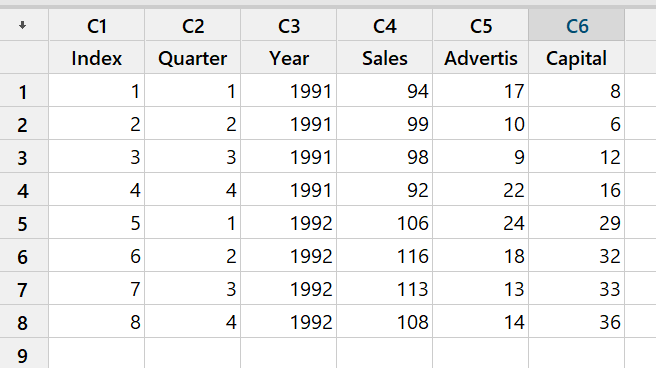
## Creating a Histogram

Histograms, like charts, show bars for each group in an x-axis variable. But while the groups in a chart correspond to the discrete categories of the x-axis variable (e.g. 1991, 1992)*,* the groups in a histogram are intervals of continuous data in an x-axis variable. For example, all the values between 0.5 and 1.5 might be grouped in an interval labelled “1,” all the values between 1.5 and 2.5 might be grouped in an interval labelled “2,” etc.

Histograms separate the data into appropriate intervals on the x-axis. For each interval, Minitab draws a bar whose height, by default, is the number of observations, called the frequency, that fall in that interval.

**Task 13**

1. Enter the following data into a new file and save it as MarketData.mwx



1. Access the **Market.mtw** work file once again. Choose **Graph è Histogram** and in the dialog window choose **Simple** and click **OK**.
2. In the **Graph variables** box, enter the column containing the continuous data *(e.g.* **Capital***)*. Click **OK** and the **Histogram** will appear. Save the project.

You should get end up with a histogram like this:



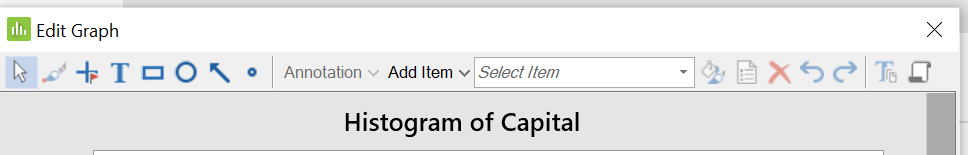
Note that if you do not specify the number of intervals you require then Minitab will assign a value of its own accord to your dataset.

# Exporting Raw Data and Graphics to Word or PowerPoint

One of the easiest ways to use Minitab graphs in another software package is to click on the drop-down arrow to **Send to Word** or **Send to Powerpoint** or alternatively choose **Copy Graph** and then paste.

## Editing graphs for use in publications and presentations

Graph editing is useful for putting text, lines and marker symbols anywhere on an existing Graph. You can also edit and change the attributes of objects generated with the existing graph. Graph editing affects the current graph. To edit a graph, use the options found in the tool bar of the Edit graph window, under the Editor menu when the newly created graph is selected. You can add gridlines, reference lines, data labels, footnotes etc.



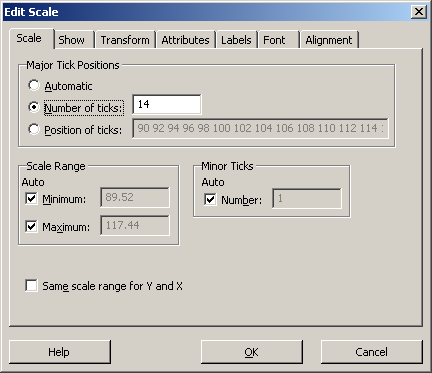
If you create the graph again, the new graph will not contain your editing changes, so if the original is to be used for publication then it should be saved.

We will work through a simple example to demonstrate some useful options. Open the scatterplot graph of sales versus advertising from task 11.

## Graph editing example

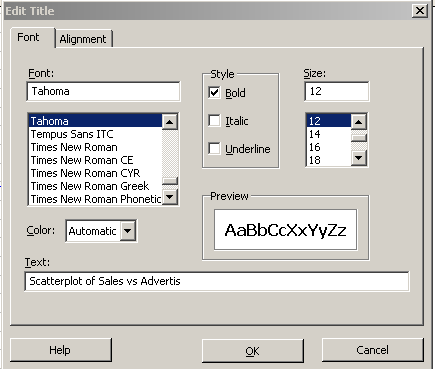
**Task 15**

1. Access your *Scatterplot* chart again and select to **Edit Graph**. To add gridlines, go to the **Add item** drop down list and choose **Gridlines** In the dialog box which opens, select the boxes **X-minor ticks** and **Y-minor ticks**. You now have a grid which gives you a clearer idea of the values of the plot points.
2. Double click on the **Y axis** and make some changes to the Y scale**;** click on the **X axis** and make some changes to the X scale.



**Task 15 (continued)**

1. Now double click on one of the **dot** symbols and choose a new **Type**, a new **Color** and a bigger **Size**.
2. Now double-click on the **Title** and make some changes. Do the same for the **X axis** label. Note that you can change the font, size of the text, and alignment in the same dialog box.



There are also subtitle and footnote options when you click on the **Add item** drop-downarrow to allow you to add some extra information about the graph.



# Printing Graphics

Remember that most of the graphs you produce may only ever be seen or printed in black and white, so think carefully about appropriate symbols (open or closed, circles, squares etc.), line styles (dashed, broken, solid etc.) and weights (avoid very fine lines).

Minitab prints the contents of each Graph window on a single page. Make the **Graph** window active è **File** menu è **Print Graph**. You will see the standard Windows printing dialog box, which contains printing options for Pull Printing or a local printer.

The printed graph has the same aspect ratio (ratio of width to height) as the graph has on your screen.

# Further Training

If you wish to take your IT Training further, the University offers a wide range of free courses. Check our [IT Training web pages](https://www.gla.ac.uk/myglasgow/it/training/) for more information.