

A QUICK INTRODUCTION TO MINITAB 16

Useful also for Student Minitab

The Stern School Statistics Group uses Minitab Release 16 for Microsoft Windows as its course software. This program was chosen specifically for use with course B01.1305.

Courses C22.0103, C22.0001, and C22.0003 will use Student Minitab, which is based on release 14. Student Minitab is limited in total spreadsheet size and in the number of worksheets that may be kept within a project file, but these limitations should not present material difficulties in these courses.

Minitab is designed for MS-Windows operating systems, but it will run through emulators on Apple computers. Please check with Stern's Information Technology group if you have difficulties.

When running Minitab, do **Help** ⇒ **About Minitab**; this will show you the release number (currently 16.1.0).

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This document was prepared by the Statistics Group of the IOMS Department. It is intended primarily as a quick introduction, including discussions of some common situations encountered in course work with B01.1305, C22.0103, C22.0001, and C22.0003. If you have comments or suggestions, please send them to gsimon@stern.nyu.edu.

Preliminary Remarks

In this document, MS-Windows refers to the Microsoft operating system. For most people this will either be MS-Windows XP or later. We will use windows (lowercase) to refer to the rectangular working areas that are set up on your computer screen.

Words and phrases which appear on Minitab screens will be written here in boldface. Sequences of clicks will be separated by the double-line arrow. Thus, the notation **File ⇒ Open Worksheet** indicates that you should click on **File** and then click on **Open Worksheet**. The underlined characters are Minitab's keyboard shortcuts. For example, you can perform **File ⇒ Open Worksheet** as Alt-F, W.

Minitab uses several screen windows, but only one window can be active at any time. The color of the title bar indicates which window is active. Clicking the mouse cursor within any window makes that window active. In Minitab, you can use **Window** to select what you want to be active.

Dealing with Different Minitab Releases

If you are acquiring Minitab for the first time, you want release 16, the latest.

- [1] Releases 13 and earlier are somewhat primitive.
- [2] Student Minitab is based on release 14. If you have acquired Student Minitab in a bundle with your textbook, you can be sure that it will be powerful enough to handle your coursework. Compared to release 16, Student Minitab has these limitations:
 - * Only five worksheets can be kept within a project.
 - * Only 10,000 cells can be used in a worksheet.
 - * Student Minitab will not do the general linear model (GLM) or logistic regression.
 - * Student Minitab will not do all the features of design of experiments, multivariate analysis, survival analysis, and reliability analysis.
 - * Student Minitab cannot assign ***Formulas*** to columns.These limitations (as well as others not listed here) should not be a problem for the core courses C22.0103, C22.0001, C22.0003, and B01.1305. The limitations however may be important for higher-level courses.
- [3] Release 15 is very close in features to release 16, and it is certainly powerful enough for course work at Stern.

- [4] Project files (*.mpj) from releases 16 and 15 are not downward compatible to Minitab 14 or to Student Minitab.
- All file types are downward compatible *except* project files. (The file types are described in the section **Worksheets and Projects** below.) In Minitab 16, the command **File** ⇒ **Save Project** will cause the project to be saved in a form that can only be read by Minitab 16. You can work around this very easily. Use **File** ⇒ **Save Project As** and select the file type “Minitab 14 Project.” A few non-critical features new to Minitab 16 will be lost.
- [5] The Microsoft Vista operating system may or may not be compatible with all releases prior to 16. If you have difficulties, please see www.minitab.com. Under “Support” is a phone number at which you can get help.

Data Files

Minitab uses the word *worksheet* in exactly the way that other programs would use *spreadsheet*.

The most important file formats are these:

*.dat or *.txt	These are ASCII text files, used at times as input to Minitab (but not usually as output from Minitab). In many cases, the analyst will assemble data in text form and then read it into Minitab. Minitab can handle data fields that are separated with commas, spaces, tabs, or other characters. For input, file layout details need to be communicated to Minitab; see the section Reading Worksheet Data into Minitab .
*.mtw	These are Minitab worksheets. These are native to Minitab, meaning that Minitab creates them. In the most common usage, Minitab can be used to save files in this form and read them later. These are encrypted and cannot be used by other programs.
*.mtp	These are Minitab portable ASCII files. These are used in the same style as *.mtw files. Since these are ASCII, you can read them in character form, but there is nothing useful that you can do with them. When you open a file of this type with Minitab 16, you will get this message * NOTE * Opening Minitab Portable files is obsolete. This suggests that future Minitab releases may place restrictions on this file type.
*.mpj	These are Minitab project files. These are native to Minitab, meaning that Minitab creates them. These can hold multiple data sheets, along with graphs, text output, and comments. These are described below. Project files

are *not* downward compatible; this means that project files created in Minitab 16 or in Minitab 15 cannot be read by previous releases of Minitab and cannot be read by Student Minitab. See page 3, point [4], for the work-around solution.

In addition, Minitab can read and write Excel, Quattro Pro, Lotus 1-2-3, dBase, and Spreadsheet XML.

Some recommendations for managing worksheets and projects appears below in the section ***Worksheets and Projects***.

Worksheets and Projects

For many uses of Minitab, we work with single worksheets and save any changes as single worksheets. The forms used to save worksheets are *.mtp (text) and *.mtw (encrypted).

Minitab allows the user to keep data as Minitab project files. These files are encrypted, meaning that you can't read them outside of Minitab, and they are identified with the file name extension *.mpj. Project files are very powerful:

- A project can keep multiple worksheets together.

- Projects can hold user-created descriptions and comments. (See the section on ***Project and Worksheet Descriptions***.)

- Projects retain the contents of the session window. (See the section on ***Minitab's Windows***.)

- Projects can hold graphical output.

- Reports can be assembled on the ReportPad and saved with the project.

- Every information panel of Minitab will retain the instructions from its most recent use.

If you use projects, be sure to find the project manager icon on the toolbar. It's the set of cascading windows, identified with the tag **Show Worksheets Folder**.

Project files require careful management, as they can easily grow to contain large quantities of output with less than perfect annotation.

In managing your data files, you should be careful about distinguishing the original forms of the files from any edited versions. For example, in working through a problem you may make modifications in the data, and you should be aware that saving the modified form with the same file name will cause you to lose the original form of the data. Most users handle this problem by saving modified versions as either separate files with new names *or* as separate worksheets within a project. Page 12 tells you how to copy one worksheet to another worksheet within a project.

Project and Worksheet Descriptions

Within Minitab, you can create descriptions for projects or for individual worksheets within projects.

The command **File** ⇒ **Project Description** will allow you to create a description for the project. You can also use this to edit a current description.

The separate worksheets within a project can have their own descriptions, through **Editor** ⇒ **Worksheet** ⇒ **Description**. This can only be done for an active worksheet. As usual in MS-Windows, the taskbar color will indicate whether a worksheet is active. (Note that this uses **Editor** and not **Edit**.)

Worksheet descriptions cannot be used for worksheets saved in *.mtp or *.mtw format. These descriptions are only available for individual sheets within projects saved in *.mpj format.

If you wish to rename a worksheet, click on the **Show Worksheets Folder** icon, or do **Window** ⇒ **Project Manager**, and then move the cursor to the folder icon for the worksheet. Click the right mouse button for the worksheet you wish to rename.

Minitab's Windows

Minitab works through two basic windows but has additional windows to deal with other features of your work. The two basic windows are these:


Session window...All textual (non-graphical) output will appear in the session window. As appropriate, headings will reflect the commands that you have actually created. Sometimes this window will also show the text of the Minitab commands (preceded by >) equivalent to your mouse clicks. While the session window is active, click on **Editor** and then either select or deselect **Enable Commands**.

Data window...The data window holds the spreadsheet form of the data. This includes the data that you've read into the program, and it may also include other variables (columns) or additional data points (rows) that were created or entered during your work. A *project* will have one data window for each of its worksheets, but only one can be active at a time.

Among other windows are these:

Project manager window... The project manager window shows either a schematic layout of all the work currently active (click on **Show Worksheets Folder**, the icon with cascading windows)

or

details about all the columns in the active worksheet (click on , the **Show Info** icon)

Graph windows will be created as needed.

The **History window** can be accessed by clicking on the **Show history** icon on the toolbar. This is the chevron symbol on a spiral notebook. This window provides a log of the activities, and it will include the command forms equivalent to all the mouse actions that you have done.

The **ReportPad window** provides a place in which you can compose and edit details about all the work. You can reach this by clicking on the **Show ReportPad** icon, which is the red letter A on a spiral notebook. You can cut and paste from the session window to the Reportpad, and you can also paste graphical output into this location.

You might like to explore some of the other features on the toolbar.

As with any MS-Windows applications, you can use the double-headed cursor arrows to resize these windows. Click on the **Window** command to get a list of available windows.

Wiping Minitab Clean

When you first start up Minitab, all its work areas will be empty. If you have finished working on a particular task and wish to start another, first be sure that you have saved the results in a form that you want. Then do **File** ⇒ **New** and select **Minitab Project**. This act will empty out all the working areas.

This action will always get the question “Save changes to the project ‘Untitled’ before closing?” even if there is nothing to be saved.

Reading Projects into Minitab

If you wish to use a project previously assembled by Minitab, use command **File** ⇒ **Open Project**. There are no choices or options in reading projects, so this process is very simple.

Reading Worksheet Data into Minitab

Suppose that you would like to read a single worksheet into Minitab. Single worksheets (of the type *.mtp and *.mtw) were previously assembled by Minitab and are simple to read. Files assembled outside of Minitab require some care to read properly. The most common types are *.dat, *.txt, *.csv, *.xls, and *.xlsx.

First note whether a project is currently active. If so, any worksheet that you bring in will become part of this project. This may, at times, be exactly what you want. If you want the new file separated from other data, please see the section *Wiping Minitab Clean*.

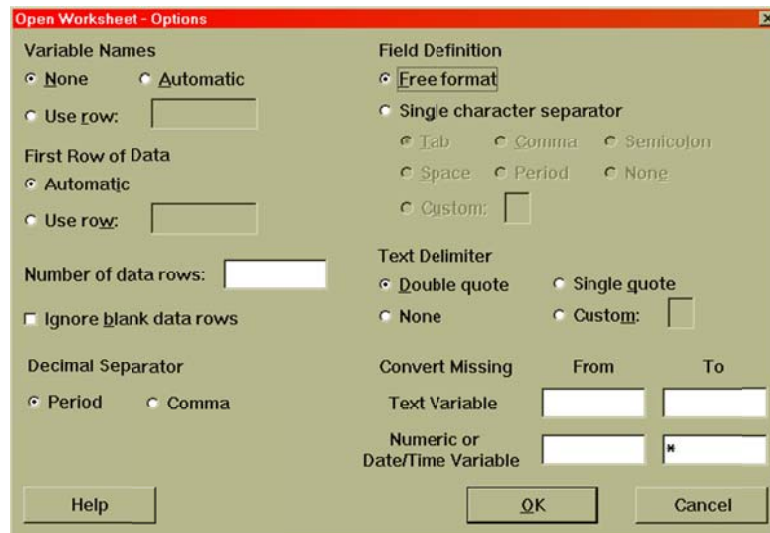
Begin with **File** ⇒ **Open Worksheet**.

The file type must show in the **Files of type** panel. If the file type does not show, click on the drop-down symbol ▼ to display all the file types.

The **Options** panel becomes available when ask to read a spreadsheet of any variety *other* than *.mtp or *.mtw. In such cases, you will need to provide information so that Minitab knows how to read it.

If you are unsure about the formatting of your file, you might find it helpful to examine it in a text processor such as WORD or WordPad or NotePad.

Clicking on **Options** will lead you to this panel:



You will need to examine the files to see what formatting details need to be supplied to Minitab. Watch out for

- * whether or not the file has a row of variable names
This is related to the **Variable names** section.
Select **None** if there are no names and the data values begin in row 1.
Select **Automatic** if there is a header row with the names of the variables.

- * the strategy by which the file separates fields (open space for “free format,” tabs, commas, or other characters)
This is related to the **Field definition** section.
Select **Free format** if data values are separated by one or more blanks spaces and rows end with hard carriage returns.
Select **Single character separator** if a particular character is used to separate values. The most commonly used separators are tabs, commas, and single spaces.

- * whether or not alphabetic information contains internal blanks that might conflict with spaces used as separators
This is related to the **Text delimiter** section. You might need to put city name “Los Angeles” in quotes so that it will be interpreted as a single item of information. (It is usually easier to use tab-separated fields to prevent this problem.)

- * the technique that is used to denote missing data
This is related to the **Convert missing** section. Minitab uses the asterisk * as its missing data marker. If, for example, your input file uses NA for missing data, you should ask to convert NA to *.

Now click **OK** and then supply the file name. You can use **Preview** to see if the file will be read as anticipated.

If you read a file without variable names, you should supply names based on your understanding of the data. Save the file in storage space that you control.

At times, the data read this way can end up as the wrong type (text rather than numeric). This issue is addressed as the final item on page 19.

Managing the Minitab Screen

Minitab always has its two basic windows, but it often creates many other windows as well. Screen management is highly idiosyncratic, in that computer users seem to have very different opinions about what a screen layout should look like. Most users are reasonably familiar with windows management.

Minitab, like other MS-Windows programs, can arrange its own screen. Click on **Window** at the top of the screen and see what happens when you select any of the choices **Cascade**, **Tile**, or **Minimize All**.

The two basic Minitab windows can be made full screen, partial screen, or reduced to icons, but they cannot be closed. These windows are only closed when you quit Minitab.

Use the **Show graphs folder** icon on the toolbar to manage your graphs. This symbol is the pale-colored set of cascading windows. The sequence **Window \Rightarrow Close A**ll Graphs**** will let you eliminate all graph windows at once.

Saving Minitab's Output

You will of course want to save the results of your work. The usual methods are to cut and paste to another MS-Windows application or to save to file. Minitab also allows you to save to the Minitab ReportPad.

Text output is moved through the copy or cut-and-paste methods common to MS-Windows applications. If you are working with a project file (*.mpj) then you can also paste the selected text in the ReportPad. This is accessed through the icon which is the red letter A on a spiral notepad.

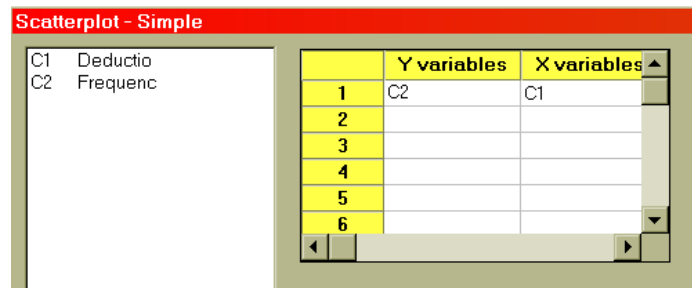
If a graph window is active, you can use **Edit \Rightarrow Copy graph** or Ctrl+C to place the image on the MS-Windows clipboard. The image can then be pasted in another document or placed on the Minitab ReportPad.

Pressing Alt+PrtScr copies a bitmap of the active window onto the MS-Windows clipboard. This can be useful if you wish to describe how you did something in Minitab. The figures in this document were produced in exactly this way.

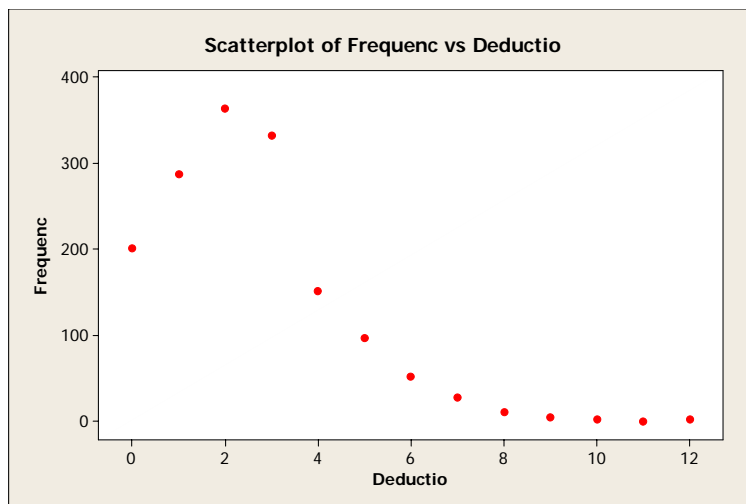
If the active window is a dialog box, Alt+PrtScr copies just the dialog box to the Clipboard. If the active window is Minitab itself, Alt+PrtScr copies the Minitab frame window and all visible subwindows (such as the Data window and Graph windows) to the clipboard.

Preparing a Minitab Graph

The data in this illustration are from Exercise 3.69 of Hildebrand, Ott, and Gray, file Ex0369.mtw. The data set notes the numbers of tax forms making various numbers of deductions, ranging from 0 to 12. We'd like our graph to have deductions on the horizontal axis and frequencies on the vertical axis. Use **Graph** ⇒ **Scatterplot**, then select **Simple**. and then put this into the resulting panel:



If you take the default settings, you'll get this:




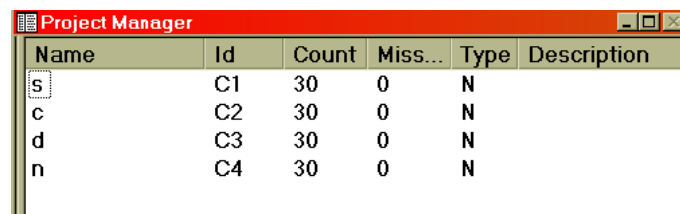
There are many ways in which Minitab will allow you to change the appearance of this graph. When the graph window is active, use the mouse to double-click on any feature that you would like to edit. If you double-click on a symbol (meaning the circles here), you can change the shape, size, and color of the symbols. You can similarly edit captions and scales, and you can insert grid lines.

You can get additional editing power through **Tools** ⇒ **Toolbars** ⇒ **Graph Annotation Tools**. Editing features such as text insertion, lines, circles, ellipses, and so on will then be available on the Minitab toolbar when graph windows are active.

Using Minitab to do a Regression

Let's illustrate the use of regression through the file XM1216.mtw from Hildebrand, Ott, and Gray. This is a Minitab worksheet file, and it can be read easily by Minitab. Please see the instructions given in the section *Reading Worksheet Data into Minitab*.

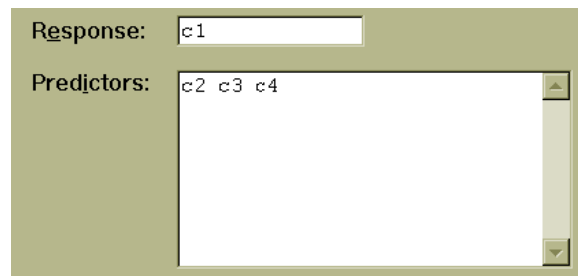
The Project Manager window (obtained by clicking on , the **Show info** icon on the toolbar) will have this information:



Name	Id	Count	Miss...	Type	Description
s	C1	30	0	N	
c	C2	30	0	N	
d	C3	30	0	N	
n	C4	30	0	N	

This is summary information about the data set. It gives the variable names, the corresponding Minitab columns, number of values in each column (and how many of those are missing) and also the variable type. Here N stands for numeric. Column C1 is named s (for *sales*) and this will be the dependent variable in our example regression.

To start the regression, do **Stat** ⇒ **Regression** ⇒ **Regression**. Set up the next panel to show this:



Response: c1

Predictors: c2 c3 c4

Click on **Graphs**, and then select **Residuals versus fits** and **Residuals versus order**. Return by clicking **OK**, and then click on **Options**; choose **Variance inflation factors** and **Durbin-Watson statistic**. Click **OK**. This will return you to the main regression panel, and you click **OK** again.

This action selects C1 as the dependent variable, with the other three variables used as independent variables. This has also asked to see two graphs and some incidental calculations as well.

The numerical output will appear in the session window, and you will also get two graphs. A little screen management will be needed to examine all of these.

Regression is a fairly intense operation, and there are many secondary calculations and displays that are of some interest. We'll discuss a few of these.

Suppose that you wanted to list the individual residuals for your data set. The initial procedure would include an additional step from the panel reached by **Stat** ⇒ **Regression** ⇒ **Regression**. That step consists of clicking on **Storage** and then selecting **Residuals**.

When the regression is completed, a new column RESI1 will appear in the data window. (Subsequent uses will create RESI2, RESI3, and so on.)

Suppose that your work with the data set has indicated that you might want to omit certain data points (rows) from the analysis. Perhaps such data points were destructive outliers or were simply miscoded. You'd prefer not to delete the rows completely, since you might want to restore them later. A plausible solution (but not the only solution) is to create a copy of the worksheet so that you can delete selected rows in the copy. Once you've created multiple worksheets, the work should be saved in project *.mpj format.

You can make a copy by doing **File** ⇒ **New** ⇒ **Minitab worksheet**. At this point a blank worksheet will appear. Now go to the original worksheet and place the cursor in the name box for the first column, C1. Hold down the shift key and use the arrow keys to mark the entire worksheet as a block. Go to the blank new worksheet, place the cursor in the name box for the first column and press Ctrl+V. A copy will now appear in the new worksheet, and you can edit it as appropriate. You can give a name to this copy; access the name by clicking on the **Show Worksheets Folder** symbol on the toolbar. Then click with the right mouse button on the icon, and select **Rename**. It is strongly recommended that you leave yourself a description as to exactly how this new worksheet differs from the original. Use **Set Description** to write notes about this worksheet.

If you wish to delete a row in the copy, you use **Data** ⇒ **Delete Rows**. Be extremely careful if you are deleting more than one row. Each use of **Data** ⇒ **Delete Rows** will cause the remaining rows to be renumbered! If you want to delete multiple rows, it's recommended that the operation be done all-at-once, rather than one row at a time.

Creating New Variables through Transformations

There will be many occasions in which you need to create new variables which are functions of other variables. For example, you might need to create log(SALES), the base-*e* logarithm of the variable SALES, which is in C1. Click on **Calc** ⇒ **Calculator**. In the box next to **Store result in variable** type in the name Logsales. (If you type C1 in this spot, the calculation will overwrite the original values.) In the box for **Expression** type in LOGE(Sales) or type in LOGE(C1) and click on **OK**.

As a result of this process, a new column Logsales will appear in the data window. You can of course overwrite an existing column, but then the original information in that column will be lost.

This use of the calculator option is simple, but there are some subtleties:

You need not remember function identifications such as LOGE for base- e logarithms. The **Calculator** has a **Functions** panel that lists the available choices.

If you make an entry-by-entry calculation, as in the example above, then the result is a new column in the worksheet. If you calculate a single-valued function of a column (such as the median), then your transformation will create just one number, occupying one position in the data window worksheet.

Logical operations take the values 0 and 1, so that you can use these to make transformations of the “if-then-else” form. Suppose, for example, that you’d like variable C3 to be defined as follows:

$$C3 = \begin{cases} 5 & \text{if } C2 \leq 5 \\ C2 & \text{if } C2 > 5 \end{cases}$$

The expression that makes this work is

$$5*(C2 \leq 5) + C2*(C2 > 5)$$

The yes-or-no logical statement ($C2 \leq 5$) will either take the value 0 or the value 1, as will the yes-or-no logical statement ($C2 > 5$).

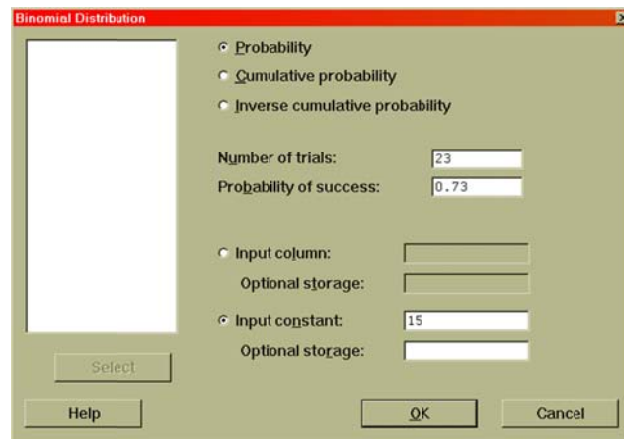
Missing values get passed along as missing. If you are creating a new column C6 from columns C2 and C3, and if a value is missing in row 28 for either C2 or C3, then the row 28 entry for C6 will also be missing, shown as * in the data window.

Invalid calculations end up as missing. Thus LOGE(0) will result in a missing value, as will LOGE(*negative number*). These will be shown as * in the data window. Minitab gives you a warning when you create missing values in this style, and thus you get an opportunity to reconsider the appropriateness of the transformation. (Releases 13 and previous did not give the warning.)

Be sure to see also the section on **Formulas**, page 16.

Using Minitab to Find Probabilities

You can use Minitab to find many probability calculations. For instance, if you want to find the probability that a binomial random variable with $n = 23$ and $p = 0.73$ takes the value 15, you call up **Calc** \Rightarrow **Probability Distributions** \Rightarrow **Binomial**. Then set up the resulting panel as follows:



When you click **OK**, the session window will then show the following:

Probability Density Function

Binomial with $n = 23$ and $p = 0.73$

x	P(X = x)
15	0.123375

This indicates that your desired probability is 0.123375.

If you had wanted to find the probability of a value *less than* or equal to 15, you'd do exactly the same as the above, except that you would click on the **Cumulative Probability** button.

That result shows up in the session window as

Cumulative Distribution Function


Binomial with $n = 23$ and $p = 0.73$

x	P(X <= x)
15	0.265051

This gives you probability as 0.265051.

It's also possible to give the complete probability distribution. Suppose that you wanted to see the whole set of probabilities for the binomial random variable with $n = 23$ and

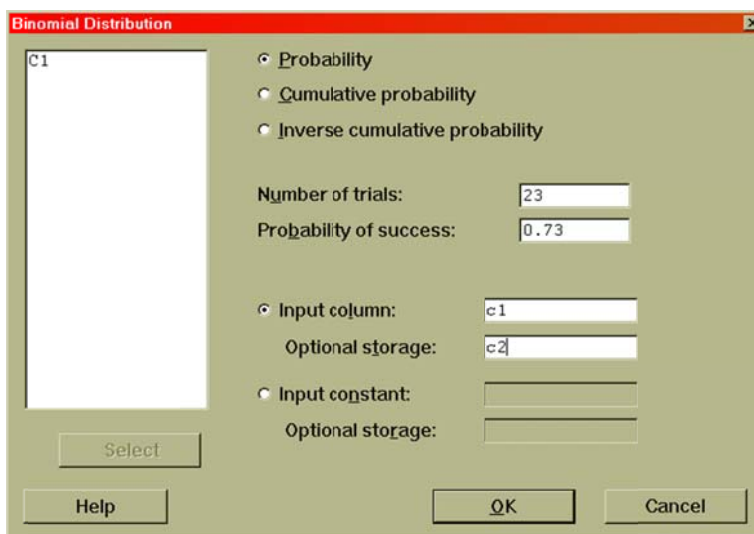
$p = 0.73$. This is done by setting up a data column for the integers 0, 1, 2, ..., 23. Click on **Calc** \Rightarrow **Make Patterned Data** \Rightarrow **Simple Set of Numbers**. Set up the resulting panel as follows:



The 'Simple Set of Numbers' dialog box is shown. It has a title bar 'Simple Set of Numbers' with a close button. On the left is a large empty rectangular area. To its right are several input fields: 'Store patterned data in:' with 'c1' entered; 'From first value:' with '0' entered; 'To last value:' with '23' entered; 'In steps of:' with '1' entered; 'List each value' with '1' entered and 'times' to its right; and 'List the whole sequence' with '1' entered and 'times' to its right. Below the large area is a 'Select' button. At the bottom are 'Help', 'OK', and 'Cancel' buttons.

There is another way to do this. In column C1, type 0 in position (C1, row 1) and 1 in position (C1, row 2). Mark these two boxes and then place the mouse cursor at the lower right position until the symbol so that the + symbols appears. Drag downward and the column will fill up with consecutive integers. This is the style used in Excel. The **Calc** \Rightarrow **Make Patterned Data** \Rightarrow **Simple Set of Numbers** sequence is needed for more exotic number patterns such as 1 1 2 2 3 3 4 4 .

Then with **Calc** \Rightarrow **Probability Distributions** \Rightarrow **Binomial**, set up the panel as indicated:



The 'Binomial Distribution' dialog box is shown. It has a title bar 'Binomial Distribution' with a close button. On the left is a large empty rectangular area with 'C1' written in the top left corner. To its right are radio buttons for 'Probability' (selected), 'Cumulative probability', and 'Inverse cumulative probability'. Below these are 'Number of trials:' with '23' entered and 'Probability of success:' with '0.73' entered. Further down are 'Input column:' with 'c1' entered, 'Optional storage:' with 'c2' entered, 'Input constant:' (empty), and 'Optional storage:' (empty). Below the large area is a 'Select' button. At the bottom are 'Help', 'OK', and 'Cancel' buttons.

This illustration assumes that columns C1 and C2 are not being used for other purposes. At the completion of this command, the worksheet in the data window would have columns C1 and C2 showing the following information (slightly rearranged here):

0	0.000000	12	0.017214
1	0.000000	13	0.039381
2	0.000000	14	0.076053
3	0.000000	15	0.123375
4	0.000000	16	0.166785
5	0.000000	17	0.185680
6	0.000003	18	0.167341
7	0.000022	19	0.119063
8	0.000117	20	0.064382
9	0.000526	21	0.024867
10	0.001993	22	0.006112
11	0.006367	23	0.000718

Here we can see, for example, that the probability of exactly 15 successes is 0.123375.

The feature **Calc ⇒ Probability Distributions** will allow you to deal with many different probability distributions.

Formulas

Embedded formulas were introduced with release 15. These are not available in Student Minitab or in Minitab 14 or any earlier releases.

An embedded formula is an Excel-type task, and Minitab and Excel are used in different styles. So be careful. Please be aware that, as noted in Minitab help, “In addition, formulas cannot be imported or exported to or from Excel or other programs.”

You can assign formulas only to columns or to constants. (Constants are not discussed in this document.) The formulas are precisely those of **Calc ⇒ Calculator**. Thus, you could assign column C9 as `SQRT(C8)`.

You cannot assign C9 as the residuals from a regression.

Column assignments must be based on all rows.

Let’s say that you want C3 to be the sum C1+C2. With the cursor in any cell of column C3, use **Editor ⇒ Formulas ⇒ Assign Formula to Column**. A small + will appear in the header cell for column C3.

Missing data positions in C1 or in C2 become missing positions in C3. If columns C1 and C2 have different lengths, the length of C3 will be the smaller value.

You generally want formulas to be updated automatically. In this example, you would like a change in either C1 or C2 to be reflected instantly in C3. (Here “instantly” means

“as soon as the cursor leaves the cell that was changed.”) The instant change is Minitab’s default strategy, as noted in **Editor ⇒ Formulas ⇒ Calculate All Formulas Automatically.**

If you turn this feature off, then

- * A small – will appear in the header cell for a column which needs an update.
- * Updating can be done through **Editor ⇒ Formulas ⇒ Calculate All Formulas Now. This does all updating; you cannot do updating for just one formula column.**

You can convert a formula column to an ordinary column. Use **Editor ⇒ Formulas ⇒ Remove Formulas from Selected Columns.**

Formulas are very effective if you might have to correct errors in the input data, as any corrected values will be transformed automatically. Suppose that you have a new data set, with 5 columns and 244 rows. You want to develop a multiple regression of C1 on (C2, $\log_e(C3)$, C4, C5). Assign formula $\text{LOGE}(C3)$ to column C6. If you repair input errors in C3, the corresponding corrections will be made automatically to the logarithm in C6.

If you copy all or part of a worksheet to a second worksheet, then the columns with formulas become ordinary columns in the second worksheet.

Graph Updating

In certain cases you might want Minitab’s graphical output to be revised if data values in the worksheet are changed. The symbol at the left end of a graph’s title bar will reveal its status with regard to updating.

A green cross in a white circle indicates that the graph is up to date.

A yellow circle indicates that the worksheet values were changed and that the graph is not up to date.

A red X in a white circle indicates that the worksheet has been altered in a way that prevents the graph from being updated. The problem must be resolved in the worksheet.

A green cross on a solid square background indicates that the graph is up to date, but that it cannot be updated if it becomes out of date.

A white X on a solid square background indicates that the graph is out of date and cannot be updated.

If you have a graph that needs updating, then right-click on the graph and

select **Update Graph Now** to bring it up to date

select **Update Graph Automatically** to bring it up to date and continue to bring it up to date automatically for all future steps

Minitab’s Assistant

Release 16 has introduced the **Assistant** as a guide to statistical analysis. This will provide some general advice in the form of flow charts. This is not fully developed, and it seems to be a tease regarding future releases.

A little bit of new capability is in **Assistant** \Rightarrow **Regression**. For a regression with a single predictor, one can use **Choose for me** to automatically choose among linear, quadratic, and cubic models.

Special Problems

There are a number of problems commonly encountered by users of Minitab. This list may provide some help.

I wanted to delete rows 3, 11, 19, and 21 from my worksheet, so I sequentially asked to delete these row numbers. However, Minitab did not remove the rows I wanted.

After each deletion, Minitab will renumber the remaining rows. If you remove row 3, the original row 11 will be moved up to row 10. Minitab will successfully remove the target rows if all are provided in a single operation. See page 12.

The data window was active. The cursor, unknown to me, was in row 14, column C3. As I started to type, I realized that the number originally in row 14, column C3 had disappeared. How do I get it back?

Use the standard MS-Windows “undo,” which is Ctrl-Z.

I just read a text file, and then I discovered that the source used unusual phrases for missing data. The entire column was treated as **Text** and now I can’t use it in numerical calculations. How do I recover this?

Click on **Data** \Rightarrow **Change Data Type** \Rightarrow **Text to Numeric...** The unusual phrases will be converted to *, the missing data code. You will also receive a message in the session window indicating explicitly how Minitab did the conversion. The common missing data representations (*, missing, N/A, unknown, ?) will be converted to * automatically. Since the reading of missing data is vulnerable to confusion, the Minitab image of your file should be checked carefully.

I get the message

Save changes to the project 'Untitled' before closing?

but there is nothing to save.

You can this message through **F**ile ⇒ **N**ew ⇒ **M**initab project or **F**ile ⇒ **E**xit. This is a last question to make sure that you realize that your action will discard material that you might have wanted to save. You can even get this message when the session window and all worksheets are completely empty!

I get the message

"...." is not a valid numerical value

but the entered value is clearly a number.

As you make the first entry into a worksheet column, Minitab infers the type (numeric, text, date). If you enter 13.6 in position (C8, row 1), and if this is your first entry into C8, then numeric type will be inferred. If you then enter "more than 20" in position (C8, row 2), this message will appear. The solution is to change the data type. Use **D**ata ⇒ **C**hange **D**ata **T**ype; use **T**ext to **N**umeric or **N**umeric to **T**ext, according to your situation.

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