Appendix 5: Microsoft Excel 2013 Tutorial

Spreadsheets are widely used to record, plot and analyze experimental data due to their power and ease of use. They are very common technical computer software tools used by engineers to tackle sophisticated computations and produce detailed optimization studies of real data. This introductory document will provide the means to start producing proper engineering reports that can be reviewed and understood by other engineers. In this instance, the computer software to be used to create and manipulate spreadsheets is Microsoft Excel 2013.

The majority of the material covered in this tutorial will be used in the APSC-100 Module 2 course; however, many formatting and computational techniques will be used throughout your entire engineering career. Particular attention should be given to the graph and table labelling sections as these are of paramount importance in professional documentation. The marking of assignments and reports will reflect this importance. The first section (Section 5.1) is intended only for those who have never used Excel. Other students may begin the tutorial at Section 5.2. There is also an important summaries in Section 5.5 and Section 5.6 that can be used as quick refreshers for upper year students.

5.1 Entering Data into Excel

This section is a brief introduction to making tables and performing calculations in Excel and is intended for those who have never used Excel.

- Launch Microsoft Excel 2013.
- Select (**left-click**) the cell where you wish to place the worksheet title. This title usually exists in cell A1.
- Type in the title and press **<Enter>** (pressing *Enter* indicates you are finished editing the contents of a cell).
- Type in column titles in the same manner, while ensuring units are included. The arrow keys can be used to move between cells.
  - An important visual characteristic of your Excel tables is the column width. For cells with longer entries, put the cursor on the line separating the letters at the top of the Excel window, changing the cursor to a vertical line with arrows pointing in opposite directions. Click and drag the cursor to the right to adjust the column width manually, or double-click to auto-adjust the column width to the longest entry.
- Type in all raw data by selecting the cell under the correct column and typing in the numbers only, NO UNITS.
  - If there is a pattern to the raw data you are entering (i.e.: you want to calculate the areas of circles with radii of 1m, 2m, 3m, 4m etc.), type in the first few entries into the column. Then, select all the column entries thus far by clicking the middle of the topmost cell and dragging until all the column entries are highlighted and surrounded by the green border, as shown in Figure 1. Release the click, then move your cursor to the bottom right of your selected cells where there is a small green square, changing the cursor to a black plus sign. Click and drag down to populate as many lower cells as you intend.

Figure 1: Selecting a group of cells.

- To enter a formula (calculation) into a cell, select the cell and begin by typing "=". Use parentheses, operations (+, -, *, /, ^) and click on cells you wish to reference in the formula, and evaluate the cell by pressing **<Enter>**. An example formula can be seen in Figure 2.

Figure 2: Typing in a formula into a cell.

   o When you press enter, your cell will evaluate and the formula will disappear. To edit the formula at a later time, select the cell in which the formula was used and press **F2** or click in the formula bar just above the column headers.

- To copy a formula to a group of rows, select the cell containing the original formula, then move the cursor to the bottom right corner of the cell where the small green square is located, changing the cursor to a black plus sign. Click and drag the cursor down to the last row in which you want the formula, or double-click to have the formula populate automatically to the lowest row with data. One can also copy the cell (select the cell and press **<Ctrl> and C**) and the paste it in the cells intended for evaluation (select all the cells you wish the formula to populate, then press **<Ctrl> and V**)

   o When copying a formula to multiple rows, Excel will keep shifting the cells used in the formula down by one row. This method is called relative referencing. If you wish to always

evaluate the formula referencing one particular cell (absolute referencing), edit the formula such that instead of calculating using cell **B4**, the formula will read ***B4*** (try this method so that the cell containing π will always be used in each row!)

- To adjust the number of decimal places a cell shows, select the cells you wish to format and use the **One Less Decimal** or **One More Decimal** buttons located in the **Number** group of the **Home** tab, as shown in Figure 3.
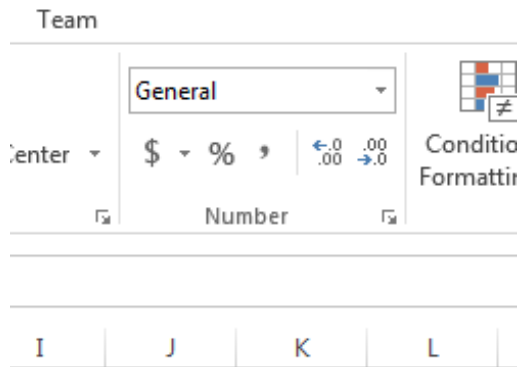

Figure 3: The Number category of the Home tab at the top of the Excel window.

- o You can also define what type of number the cell contains using the drop down menu in the same **Number** group in the **Home** tab. You can select from **General, Number, Scientific, Percentage**, and others. Use this formatting to show your data in the most appropriate method (in most cases, General will suffice).
- o You can also format cells further by selecting the group of cells you wish to format, **right-clicking** to bring up the Quick Menu, and selecting **Format Cells…**

5.2 Displaying Experimental Data

In this section, some of the fundamentals of Excel will be explained, including the following operations:

- Setting up a spreadsheet with a proper identification section
- Creating, editing and saving a file
- Creating properly structured/formatted graphs
- Printing a spreadsheet and a graph
- Plotting theoretical curves and experimental data on the same graph

It is recommended that you create a separate folder for the exercises performed in this tutorial for future reference. A useful title for this folder would be "*APSC100 Module 2 Excel Tutorial*".

It is most useful to become familiarized with Excel through the use of real situations, such as the collection of data during a first year physics experiment called The Super Ball Lab.

5.2.1 Basic Spreadsheet Operations

You are asked to compare the **Elasticity** of a ping pong ball and a rubber ball from the data collected during a lab. Elasticity is defined as the ratio of bounce height, h_b, to initial drop height, h_i. The initial and

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