Introduction to Excel

Exercises marked with a ‘∗’ are based on material from A Guide to Microsoft Excel 2002 for Scientists and Engineers, Bernard Liengme, 2005. Note that in INFO1903 we will use Excel 2010. Even if you have used Excel before, make sure you know your way around the Excel installed in the labs — this is what you will be examined on.

3.1 Walkthrough examples

This section is designed to walk you through the main things you need to be able to do with Excel. Follow the steps given and ask us if there is anything you don’t understand.

3.1.1 Walkthough 1: Displayed and Stored values∗

This exercise demonstrates that formatting only changes the way the data is displayed, not the way it is stored. When you have finished the final worksheet should look like this:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Displayed and stored values</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Value</td>
<td>=Value</td>
<td>=Value+2</td>
<td>=2*Value</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1.2</td>
<td>1.234</td>
<td>3.234</td>
<td>2.468</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>The result is different when formatting is done first</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>1.2</td>
<td>1.2</td>
<td>3.2</td>
<td>2.468</td>
<td></td>
</tr>
</tbody>
</table>

1. Begin by typing in the text in A1:D3. Note that if you start a cell with '=' Excel thinks you are entering a formula. Starting text with an apostrophe avoids this problem (eg. ‘=Value).

2. In row 4 enter the following
   - A4 the value 1.234
   - B4 the formula =A4
   - C4 the formula =A4+2
   - D4 the formula =A4+2

3. Format cell A4 to display 1 decimal place.

4. Make cell A4 the active cell (click on it). Notice in the formula bar 1.234 (the real value) is displayed, but in the cell 1.2 is displayed because of the formatting.

5. Now enter the text in row 6

6. In A7 enter the value 1.234 and format it to 1 decimal place

7. In B7 enter the formula =A7 and in C7 enter the formula =A7+2

8. Notice that in both these cases the new cell is given the same formatting properties as the original (A7).

9. In D7 enter the formula =A7+2. This time the answer is displayed to 3 decimal places.

When a formula is typed into a cell which has not been previously formatted and the formula contains only (i) references to other cells and (ii) only the addition and subtraction operators, then the cell with the formula gets the format of the referenced cells.
3.1.2 Walkthrough 2: Relative and Absolute referencing

This exercise, in which we create a multiplication table, demonstrates the difference between relative and absolute referencing when formulae are copied. Remember from the lecture that there are four types of cell reference:

- A1 — row and column may change
- A$1 — row remains constant, column may change
- $A1 — row may change, column remains constant
- $A$1 — both are forced to be constant

A cell reference of the form A1 is called a relative reference while one of the form $A$1 is called an absolute reference. When you have finished this exercise the final worksheet should look like this:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>12</td>
<td>14</td>
<td>16</td>
<td>18</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>12</td>
<td>15</td>
<td>18</td>
<td>21</td>
<td>24</td>
<td>27</td>
<td>30</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>16</td>
<td>20</td>
<td>24</td>
<td>28</td>
<td>32</td>
<td>36</td>
<td>40</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
<td>35</td>
<td>40</td>
<td>45</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>12</td>
<td>18</td>
<td>24</td>
<td>30</td>
<td>36</td>
<td>42</td>
<td>48</td>
<td>54</td>
<td>60</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>14</td>
<td>21</td>
<td>28</td>
<td>35</td>
<td>42</td>
<td>49</td>
<td>56</td>
<td>63</td>
<td>70</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>16</td>
<td>24</td>
<td>32</td>
<td>40</td>
<td>48</td>
<td>56</td>
<td>64</td>
<td>72</td>
<td>80</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>18</td>
<td>27</td>
<td>36</td>
<td>45</td>
<td>54</td>
<td>63</td>
<td>72</td>
<td>81</td>
<td>90</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>50</td>
<td>60</td>
<td>70</td>
<td>80</td>
<td>90</td>
<td>100</td>
</tr>
</tbody>
</table>

1. Begin by entering the values 2 and 3 in B1 and C1. To fill the rest of the series highlight cells B1 and C1 then click on the bottom right hand corner of the filled region (the cursor should turn into a little cross). Pull this across the row.

2. Repeat this for the data in column A (fill in A2 and A3 then drag down).

3. In B2 we need the formula =A2*B1. However if you enter this then copy the formula to a different cell you will find that the result is incorrect.

4. We want to ensure that when the formula is copied across the row the reference to column A remains constant. To do this we can use $A2 instead of A2.

5. Likewise when the formula is copied down a column, the reference to row 1 should remain constant. To do this we can use B$1 instead of B1.


7. Now copy this from B2:J10 and the results should be correct.
3.1.3 Walkthrough 3: A What-If analysis

This exercise demonstrates how to do a What-If analysis using Excel. A What-If analysis involves changing the input parameters in a given scenario and seeing what effect that has on the results. For example, using a spreadsheet giving your marks for the year, you might want to ask a question like:

What if... I got 90% in my next exam, how would that affect my final mark?

An advantage of spreadsheets is that you can see the answer to this type of question on-the-fly. This exercise also demonstrates naming cells and using built-in functions (IF, SUM, COUNT, AND).

**The Scenario:** Acme Inc. makes widgets which are tested before being sold. The testing gives two values, P and Q. The requirements are that P be at least 1.25 and Q be no more than 0.5. Using some sample data, Acme wants to know how many widgets pass the tests and how the results would change if the specifications were to be altered slightly.

When you have finished your worksheet should look like this:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Acme quality control</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>pmin</td>
<td>1.25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>qmax</td>
<td>0.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>P</td>
<td>Q</td>
<td>P test</td>
<td>Q test</td>
<td>Two test</td>
</tr>
<tr>
<td>6</td>
<td>1.24</td>
<td>1.08</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>1.36</td>
<td>0.50</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>1.44</td>
<td>0.40</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>1.57</td>
<td>0.54</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>1.09</td>
<td>0.82</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>11</td>
<td>1.52</td>
<td>0.65</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>12</td>
<td>1.23</td>
<td>0.75</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>13</td>
<td>1.65</td>
<td>0.62</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>14</td>
<td>1.24</td>
<td>0.36</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>15</td>
<td>1.05</td>
<td>0.55</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>16</td>
<td>Pass</td>
<td>50%</td>
<td>30%</td>
<td>20%</td>
<td></td>
</tr>
</tbody>
</table>

1. To begin enter the text in cells A1:E5.
2. Name the cells C2 and C3. The easiest of way of doing this is to highlight the cell and enter a name in the box to the left of the formula bar.
3. Enter the numeric values in A6:B15.
4. Enter the following formulae to test the values of P and Q:

   \[
   C6 = \text{IF}(A6>=\text{pmin}, 1, 0)
   \]

   \[
   D6 = \text{IF}(B6<=\text{qmax}, 1, 0)
   \]

   \[
   E6 = \text{IF}(\text{AND}(A6>=\text{pmin}, B6<=\text{qmax}), 1, 0)
   \]

5. Copy these formulae down to row 15.
6. Enter the text in B16 and right align it.
7. In C16 enter the formula \[=\text{SUM}(C6:C15)/\text{COUNT}(C6:C15)\].
8. Copy the formula from C16 to D16 and E16.
9. Format cells C16:E16 so that they show percentages.

We can now do the “What-If” analysis. By changing the value of C2, you can answer:

What percentage of widgets would pass if the acceptable value of P was (i) raised to 1.4 or (ii) lowered to 0.22?
3.1.4 Walkthrough 4: Using VLOOKUP

This exercise demonstrates some features of the Excel function VLOOKUP. To begin, download to your desktop the Excel file bird_info.xlsx, which you can find either on the info1903 class site, or in the info1903 site on eLearning.

The first sheet here contains data on birds, including their names (both common and scientific), and observations of their weights. This data comes from Encyclopedia of Life http://eol.org regarding the taxon Aves (the birds).

The next sheet contains data on the number of sightings of birds, taken on one winter day over a number of years, in a 70 km area at Smithsonian Institute’s Smithsonian Environmental Research Center (SERC). The date of each survey is at the head of the column. You can see more about this at http://www.serc.si.edu/research/longterm_data/bird_data.aspx

Open the spreadsheet in Excel. Notice that the second sheet gives birds only by common names. We will aim to use VLOOKUP to add a column to this sheet giving the scientific name of the bird involved.

Before we can do this, notice that there are some difficulties. We want to lookup the common name (as found in column A of the Sightings sheet, and find the row (or rows) where it appears in column C on the Names sheet, and get the scientific name from column B in that row. However VLOOKUP requires the identifier being matched to come at the leftmost column of a group of columns. So we need to change the first sheet so common name comes before scientific name in each row. Also, we want to clean up the text in each name, to make matching more likely (notice that capitalisation and spacing can be varying in these text columns).

So, insert a new column to the left of the existing column B in the Names sheet. To do so, click on the ”B” at the top of the column, and then use Insert … Columns form the available menus. Now an empty column B is there, and the existing column B has been renamed C, and the former C has been renamed D, etc. In each cell of column B, we want a clean version of the text from the common name, so enter the formula “=TRIM(UPPER(D2))” into cell B2, and then fill this through the whole column.

Now on the sheet Sightings, insert a new column to the left of existing column B, and put ”Scientific Name” as its heading in row 1. In cell B2, enter the formula =VLOOKUP(TRIM(UPPER(A2)),Names!B:C,2,false) to get the scientific name (from column C, as the second in the subtable of Names!B:C).
3.2 Exercises

This section contains a range of exercises. Try to complete as many as you can before looking at the solutions (which will be available on the web from next week).

3.2.1 Question 1: Permutations

The number of ways of permuting \( n \) distinct objects taken \( m \) at a time is given by

\[
P = \frac{n!}{(n-m)!}
\]  

(3.1)

Remember that \( n! \) is called \( n \)-factorial and is defined as

\[
n! = n \times (n-1) \times (n-2) \times \ldots \times 3 \times 2 \times 1
\]  

(3.2)

For example, how many ways can we select 2 letters from a group of 4 letters (A, B, C, D), without repetition?

\[
P = \frac{4!}{(4-2)!}
\]  

(3.3)

\[
= \frac{4 \times 3 \times 2 \times 1}{2 \times 1}
\]  

(3.4)

\[
= 12
\]  

(3.5)

i.e. AB, AC, AD, BA, BC, BD, CA, CB, CD, DA, DB, DC

Create a formula to calculate \( P \) given \( n \) and \( m \).

**Hint:** you should check Excel’s internal functions first :)

3.2.2 Question 2: Compound Interest

If \( P \) dollars are invested in a savings account with an interest rate of \( R \) per year, compounded \( m \) times a year, then at the end of \( t \) years the accumulated interest is

\[
I = P(1 + R/m)^{mt}
\]  

(3.6)

Construct a table showing the accumulated amount for annual interest rates of 5, 6, 7, 8, 9 and 10% with interest compounding monthly, quarterly and semi-annually. Which strategy produces the best result after 5 years?

**Hints:**

- You should use named cells where possible.
- You might need a mix of fixed and relative references in your formulae.
- Cells containing currencies and percentages should be formatted correctly

3.2.3 Question 3: Trigonometry

\[
\sin(a) = \frac{o}{h}
\]  

(3.7)

Given the length of \( o \) and \( h \), create a formula to give the angle \( a \) in

1. radians
2. degrees
3.2.4 Question 4: AAM

The University of Sydney defines the Annual Average Mark (AAM) for a student as being

\[
AAM = \frac{\sum (\text{mark} \times \text{credit point value})}{\sum \text{credit point value}} \tag{3.8}
\]

In first semester John got the following marks:

- Calculus (3 cr pts) — 76
- Algebra (3 cr pts) — 65
- Chemistry (6 cr pts) — 51
- Physics (6 cr pts) — 77
- Software (6 cr pts) — 90

John was hoping to get a distinction average (75+) but after a disappointing result in chemistry his first semester average didn’t quite make it. John dropped chemistry and picked up astronomy in second semester. He carried on his study in each other subject from first semester.

1. Do a What-If analysis to see what mark he needs to get in astronomy to improve his AAM to over 75. You can assume that in his other subjects he gets the average of his first semester results, ignoring chemistry.

2. What is the highest AAM he can get for the year?

3.2.5 Question 5: Bird sightings

This exercise uses the same Excel file birds-info.xlsx from Walkthrough 4 above. For each calculation below, choose a cell to put the answer in, and clearly identify what is being stored there, by text in a neighbouring cell.

1. Calculate how many individual birds were seen on October 1, 1999.

2. Calculate how many different species were seen on October 1, 1999.

3. Calculate how many species were sighted more often on October 1, 1998 than on October 1, 1999.

4. Calculate how many individuals were seen in total on October 1, 1999 among those species that were sighted both on October 1, 1998 and on October 1, 1999.

3.2.6 Question 6: Marks for this course

Make a spreadsheet that calculates whether or not a student has passed this course, given all their assessment marks and the assessment schedule on the course website http://www.it.usyd.edu.au/~info1903/assessment.shtml. You should take into account the condition that a student must get at least 40% in the exam and at least 40% in the non-exam assessment in addition to getting 50% overall.

3.2.7 Challenge Question: Jackpot!

Now for something fun use Excel’s random number generator to create a Jackpot game. Here are some hints to get you going:

- In cell A2 use the built-in function RANDBETWEEN() to randomly generate an integer between 1 and 6. You can generate a new number with SHIFT-F9. Or you can use the calculator icon on the Formula panel.
- Now select 9 cells in a 3x3 block (e.g. B2:D4). Create a border around these cells, and change their colour.
- You can create a dot using character 108 in the famous WingDings font. For example, if you type =CHAR(108) into B2 and then change the cell font to WingDings you should see a dot in the cell.
Now use this information to create the Jackpot game with three dice. The result might look something like this when the dice are different

![Dice 1, Dice 2, Dice 3]

and like this when they are the same

![Dice 1, Dice 2, Dice 3]

### 3.3 Capability checklist

When you’ve finished this lab, check that you know how to...

1. Set the format of cells/columns
2. Sort data on a selected column
3. Enter your own formulae
4. Copy formulae using relative referencing
5. Copy formulae using absolute referencing
6. Use Excel’s builtin functions
7. Name cells
8. Interpret Excel’s error messages and know how to correct them
9. Use IF statements in formulae
10. Use AND/OR/NOT in conditional expressions
11. Use the SUMIF function
12. Use the COUNTIF function
13. Import/export data from/to csv format
14. Perform a What-If analysis
15. Use the VLOOKUP function

If you don’t know how to do any of these things once you have completed the lab, please come and ask us. You should also use this checklist when you are revising for the practical test.