MONT 104N – Modeling the Environment
Chapter 2 Project
September 21 and 24, 2018

Introduction

The project for Chapter 2 has two goals:

1. To continue our work with ratios, percentages, and proportions on some world population and GDP data from the U.N., and

2. To introduce spreadsheet programs[1] that we will be using extensively in Parts I and II of this text.

The following instructions will lead you through a first practice Excel session working with a spreadsheet file.

Getting Started With Spreadsheets

Launch your spreadsheet program and take a look at the overall layout of the of the window. There are tabs, menus, etc. similar to many standard programs, but there are some differences too. In particular if you are using the Windows Excel 2007 or later version, note the large "Office Button" at the upper left. This is where all of the usual File options are located (i.e. the controls for reading in or saving files, printing, etc.)

Like all spreadsheet programs, Excel gives you a workspace that is composed of a 2D grid of "cells" identified by location, that is, by an *address*. The columns are labeled by capital letters, and the rows are labeled by numbers.

- A single cell is referenced by the column, followed by the row, for instance `B23` is the cell in column `B` and row `23`.

- A range of cells is referenced by giving the "starting cell," a colon, and the "final cell" in the range. For instance `B2:B45` indicates the cells in column `B` and rows `2` through `45`. `B2:F2` indicates the cells in row 2 and columns B through F. Similarly, `B2:D10` indicates all the cells in a *rectangular block* with upper left corner at cell `B2` and lower right corner at cell `D10`.

- The addresses seen so far would all be treated as *relative addresses*. They are set up so that, for example, if we enter a formula to perform an operation in a cell and that formula depends on other entries in the row or column, then it is possible to copy and paste that formula to other rows or columns and the entries *in the new row or column will be used*. If you want to specify a *fixed address* then put in $ characters: `$C$5` means the fixed cell in column `C` and row `5`. We will see several examples of this in a while; if it is not clear why we would

[1] For instance Excel; Google spreadsheets and freely available software such as the LibreOffice suite can also be used here.

want or need this distinction, wait until you see the examples and the way spreadsheets treat formulas containing relative addresses.

The contents of a cell can be a text label identifying what the data in a row or column represents, a number, or a formula indicating how to perform a desired calculation using other information in different cells within the spreadsheet. When you finish entering a formula this way and press the Enter key, the indicated computation is performed and the result is displayed in that cell. One *very nice* feature of spreadsheets is that if you change the contents of a cell that is used to compute a value this way, then the calculation is automatically performed again to update the value displayed. We will also see this in a moment.

A First Worked Example

Enter the following information into a spreadsheet with the names in column `A` starting in row `2`, the project scores in column `B`, starting with the heading in row `1`, then the midterm scores in column `C`, the final scores in column `D`, and the participation grades in column `E`. Think of this

Table 1: First spreadsheet example.

Names	Project	Midterm	Final	Participation
Harrison, George	78	81	93	50
Lane, Penny	85	86	78	100
Lennon, John	74	95	89	60
McCartney, Paul	90	65	68	70
Mustard, Algernon	58	56	49	80
Ono, Yoko	87	89	78	90
Shears, Billy	60	74	90	80
Starkey, Richard	77	92	86	80
Average				

as the grade book for a small class with 8 students (the rows are labeled with their names) who have had four assignments as in the labels for columns `B` through `E`. Note that `A10` has the text "Average" but there are no numbers on that row (yet!). We are going to use Excel to compute the averages on each assignment.

- In cell `B10`, enter the formula `=AVERAGE(B2:B9)`. As you type, you will see this showing up in the cell and in the input box above the grid. When you are done press Enter, and the average will be computed and displayed.

- Now we will use the same method to compute the average on each of the other assignments: Highlight cell `B10`. On a PC, this is done by clicking the left mouse button over that cell; on a Macbook, you press the touchpad with the cursor over the cell. Press Copy (next to the "Office Button") or use CTRL/C (PC) or Command/C (Mac), drag the highlighting box so that all the cells in row `10`, columns `B` to `E` are highlighted, and press Paste (next to Copy) or CTRL/V or Command/V. You should now see the averages for each column.

- In doing the averages we were making use of the *relative addressing* mentioned above. Copying the formula in one cell and pasting it into another also changed the addresses of the cells that the formula was applied to. Now, we are going to perform an operation where we want to use contents of a fixed cell on multiple rows. Start by filling in new information in row 11: Put a text label "Weights" in `A11` and the constants .3 in `B11`, .25 in `C11`, .4 in `D11`, and .05 in `E11`.

- In cell `F1` add the text label "Course Average." In `F2` enter the formula

  ```
  =$B$11*B2 + $C$11*C2 + $D$11*D2 + $E$11*E2
  ```

  You should see the weighted average displayed.

- You can now copy and paste that formula to the other cells in column `F` and rows `3` through `9` to do the same computation for the other students in the class. (Note that the weights always come from the same row, hence the fixed addresses. Can you see what would happen if we did not do it that way?)

Here is some other useful information:

- There are a number of standard mathematical functions that can be applied to numerical contents of spreadsheet grids. In an Excel formula you can square the contents of a cell by saying, for instance `B13^2`.

- If you want to take the square root of something computed from information other cells, you use `SQRT()`. For instance, to compute the square root of the sum of `B13^2` and `C13^2`, you could enter

  ```
  = SQRT(B13^2 + C13^2)
  ```

  in another cell of the spreadsheet. When you press Enter, the value will be computed and displayed in that cell.

The Data

The country-by-country population information in Table 2 (on the last page) comes from Table 3 of the 2015 United Nations Demographic Yearbook. Notes:

1. Only a selection of the roughly 200 nations are listed. The first seven nations are located in Africa, the next seven are in North and South America (including the Caribbean), the seven following those are in Europe, and the last seven are in Oceania and Asia.

2. The male and female populations are according to the most recent available national census (which varies by year according to the nation), and are in units of 1000s.

3. The 2010 and 2015 midyear populations are estimates given in units of 1000s

4. The surface area is in square km.

5. Unavailable data is marked by a $*$

6. GDP is the market value of all final goods and services produced in a year. The given figures are estimates for 2015, in units of trillions of U.S. dollars.

Questions

Create a spreadsheet, enter this data, then make the following computations.

(A) For each of these 28 nations, compute the male population as a percentage of the total population *according to the most recent national census*. In which nations is the male percentage greatest? In which is it smallest? Do you notice any patterns that might account for this?

(B) For each of the 28 nations, compute the percentage difference between the male and female populations.

(C) Compute the *percentage change* in the populations of each of these nations between 2010 and 2015. (You won't be able to do this in two cases because of missing data; just ignore those nations for this question.) How many of these nations are losing population, and which has the largest percentage decrease? Which has the largest percentage increase?

(D) Compute the population densities in people per square kilometer for each of these nations. Use the 2010 mid-year estimates, since some data is unavailable for 2015. Which nations have the largest population densities among the 28 listed here? Note: the highest population densities actually tend to occur for smaller, especially island, nations.

(E) What are the 5 richest and 5 poorest of these countries, and how should you make a fair comparison?

(F) Recall that the GDP figures are estimates for 2015. Assuming that the per capita GDP was unchanged from 2010 to 2015 (that is that the proportion of GDP to population was the same both years), estimate the GDP figures for each of the countries in 2010.

(G) What proportion of the total estimated 2010 population of the world, 6.9 billion, is accounted for in the 28 countries listed in Table 2?

Assignment

Submit your final spreadsheet showing the calculations asked for. Answer the questions above in a separate text file or document.

Table 2: Extracts from 2015 U.N. Demographic Yearbook and 2015 GDP Figures

Nation	Male	Female	2010 Mid.	2015 Mid.	Area	GDP
Egypt	37,219	35,579	78,685	88,958	1,002,000	.282
Kenya	19,192	19,418	40,406	45,509	591,958	.061
Mozambique	9,747	10,506	22,417	25,728	799,380	.017
Namibia	1,022	1,091	2,143	2,281	824,116	.013
Niger	8,519	8,620	15,204	19,125	1,267,000	.008
Nigeria	71,345	69,086	159,619	$*$	923,768	.568
Senegal	6,428	6,445	12,509	14,357	196,712	.016
Argentina	19,524	20,593	40,788	43,137	2,780,400	.543
Brazil	93,407	97,349	195,498	204,451	8,515,767	1.77
Canada	16,414	17,062	34,005	35,849	9,984,670	1.55
Chile	7,448	7,669	17,094	18,006	756,102	.258
Dominican Rep.	4,739	4,706	9,479	9,980	48,671	.064
Honduras	4,052	4,251	8,046	8,577	112,492	.019
Mexico	54,855	57,481	114,256	121,006	1,964,375	1.14
U.S.	151,781	156,964	309,347	321,419	9,833,517	18.03
Austria	4,094	4,308	8,361	8,576	83,871	.437
Croatia	2,066	2,219	4,295	4,225	56,594	.057
France	29,715	31,685	62,918	64,395	551,500	2.42
Germany	39,146	41,074	81,757	81,198	357,376	3.36
Greece	5,303	5,513	11,121	10,858	131,957	.238
Poland	18,420	19,624	38,517	38,006	312,679	.545
U.K.	31,126	32,254	62,759	64,875	242,495	2.86
Armenia	1,347	1,525	3,256	3,011	29,743	.011
Australia	10,737	10,990	22,032	23,778	7,692,024	1.23
China	686,853	652,872	1,337,700	1,371,220	9,600,000	11.16
India	623,270	587,585	1,182,105	$*$	3,287,263	2.12
Iran	37,906	37,244	74,340	78,773	1,628,750	.425
Japan	61,829	65,281	128,070	126,958	377,930	4.38
Pakistan	67,840	62,739	173,510	191,710	796,095	.251
Saudi Arabia	15,307	11,830	27,563	31,016	2,206,714	.653