

APM 153 LECTURE SIXTEEN – More Excel Basics, Multi-Step Algorithm

Dates in Excel

- (1) December 1st, 2006 will fall on a Friday. Open up a blank worksheet in Excel and type in the date **12/1/2006** in the first cell in the first column. Type in the word **Friday** into the first cell at the top of the second column.
- (2) Click on the little black square at the lower right hand corner of the cell with the date and pull it down until the last date is January 12th, 2006.
- (3) Click on the little black square at the lower right hand corner of the cell with the word Friday in it and pull it down to where the date is January 12th, 2006.

Numbers

- (4) Enter the number 100 into the cell at the top of the third column. In the next cell down, enter the number 200.
- (5) Using your mouse highlight the two cells and then use your mouse to pull down the column of numbers until the last number is 3500.
- (6) Click on the cell at the top of the next column and then click in the white space in the toolbar to the right of the = sign.
- (7) Type in the following = ln(C1). Press enter and then click and pull the column of numbers down to generate the natural log of all the numbers in the C column.
- (8) What would I have to type in to generate the Log 10 for the same numbers? Look in the “Formula” box under Insert to find the correct syntax for generating the Log 10 and calculate the Log 10 of Column C in column E.

Logic

- (9) Given the new column of numbers in column E, click on the first cell in column F and then enter the following equation into the white space in the tool bar.

IF (E1 < 3, “Stop”, “Go”)

This equation says that if the value in column E is less than 3, print out the word “Stop”, else, print out the word “Go”

Questions

What other math, statistical and logic operations can you do in Excel? (Hint: Take a look!) Go to **Insert** on the toolbar. Click on **Function** and take a look at the different types of functions that are available. Answer the following questions.

(10) Under the Statistical functions, what does the function CHIDIST do?

(11) Under the Logical functions, how does the IF statement work (hint, click on IF and write down what it does.)

(12) Under the Financial functions, which function calculates the “payment on principal for a given investment”?

(13) Under the Math/Trig functions, which function is used to round a number up to the next highest integer?

(14) Under the Math/Trig functions, which function is used to raise Euler’s “e” to the power of a number? (Hint, in Matlab, this was the exp(x) function)

(15) What are the “relational operators used in IF-Then statements in Excel?

Multi-Step Algorithms in Excel

(16) This week in lab we will be using Excel to solve a multi-step algorithm to calculate the change in the boiling point of water with elevation.

(17) If you have ever been hiking or camping in the mountains, you know that the air gets “thinner” the higher you climb because **air pressure decreases as altitude increases**.

(18) The normal boiling point of a liquid is defined as the temperature at which the vapor pressure reaches “standard” atmospheric pressure. Standard atmospheric pressure at sea level can be defined using one of several different units.

standard pressure	= 101.325 kPa	kilo Pascals
	= 1013.25 mbar	millibars
	= 760 mm Hg	millimeters Mercury
	= 29.92 in of Hg	inches Mercury

(19) As the air pressure decreases, the boiling point of water also decreases. If you are very high up, say 10,000 feet or higher, water boils so easily, you can’t even cook food!

(20) This week we will be using two equations to solve for the relationship between altitude, pressure, and boiling point. The first equation relates air pressure to altitude.

(21) The relationship between altitude and air pressure is given by the formula:

$$\log_{10}(P) = 1.16686 - 1.55689 \times 10^{-5} - (6.53731 \times 10^{-11} \times h^2)$$

where P is pressure in psi and h is the altitude in feet.

(22) For lab this week we will start with a column of altitude in meters from 0 to 10,000 meters in 500 meter increments, and through a series of steps, we will calculate the change in the boiling point of water as a function of altitude.

(23) If we start with meters, and the equation above uses altitude in **feet**, what should be the first thing we calculate?

We should _____

(24) The change in boiling point as a function of pressure is calculated using the **Antoine equation**

$$\log_e (P) = A - (B / (T + C)) \quad (\log_e \text{ is the natural log or "log to the base e"})$$

where P is the atmospheric pressure in mm Hg
T the absolute temperature in degrees Kelvin
and A, B, and C are the constants.

$$A = 18.3036 \qquad B = 3816.44 \qquad C = -46.13$$

giving the equation $\log_e (P) = 18.3036 - (3816.44 / (T - 46.13))$

(25) Our goal is to eventually create one graph showing the change in boiling point in degrees C versus the change in altitude in meters, and another graph showing the change in pressure in kilopascals versus the change in altitude.

altitude in meters pressure in kPa boiling point of water in °C

(26) To get there, we will have to do some conversions. For example, the Antoine equation calculates temperature in degrees Kelvin and we eventually want to **convert degrees Kelvin to degrees C**.

Temperature in °K = temperature in °C + 273.15
so 0 °K = -273.15 °C (absolute zero)

(27) Also, if we start with altitude in meters and our pressure vs altitude equation uses feet, we will have to **convert meters into feet**.

1 foot = 0.3048 meters
1 meter = 3.28084 feet

(28) We will also have to convert between two or three units for pressure.

1 kilopascal (kPa) = 0.1450377 psi 1 psi = 6.894759 kPa
1 mmHg = 0.133322 kPa 1 psi = 0.919223 mm Hg

Steps for Boiling Point versus Altitude

- Step One – Make a column of numbers from 0 to 10,000 by increments of 500 representing altitude in meters
- Step Two – Convert column of altitude in meters to altitude in feet
- Step Three - Use equation from 21 above to calculate pressure versus altitude in feet. This equation yields pressure as the $\log_{10}(P)$ where P is in psi.
- Step Four - Convert column of $\log_{10}(P)$ into P (in psi)
- Step Five - Convert P in psi to P in mm Hg
- Step Six - convert P in mm Hg to the $\log_e(P)$
- Step Seven - Use the values of $\log_e(P)$ to solve the Antoine equation.

(29) If we know the values for $\log_e(P)$, A, B, and C, how can we rearrange the Antoine equation to solve for T? Use the blank lines below to solve for T. (In other words,,,

if $\log_e(P) = A - (B / (T + C))$ then $T = \text{??????????????}$

(30) Bring your solution (and the answers to the question on page two) to lab on Friday.

(31) Finally, given the series of “steps” above, how would we write our algorithm as pseudocode and as a flowchart? Bring your algorithm to lab on Friday as well.

