Instructions:

The following instructions accompany the excel file "806-Final_project_data-09.xlsx.

This project requires you to combine some basics of Economics, Math and Excel skills. Marks will be for

a) Accuracy and completeness of your results
b) The format and structure you use in setting up your spreadsheet equations, links, and charts
c) Your interpretation on the results you produce.

This project is due on Friday, December 11, 2009 at 4pm by EMAIL to Me. You must send me a working spreadsheet with answers. You may choose to put the answers on a separate page in the spreadsheet or even in another file (i.e. word). You may discuss aspects with your classmates, but the finished work must be your own. Note that there is ways to track files and sheets that have been copied and/or renamed. You may (or may not) be aware of all the electronic "finger prints" but I am.

<u>Question 1: Cost Data Analysis</u>

Go to the work sheet entitled "Cost Data".

You are to complete the columns using Formulas and the correct Cell References.

For example, if you type a formula in cell B2 that produces the value found in cell **A2**, you would type

=A2 this is a relative cell reference (it changes if you copy it to a different cell)

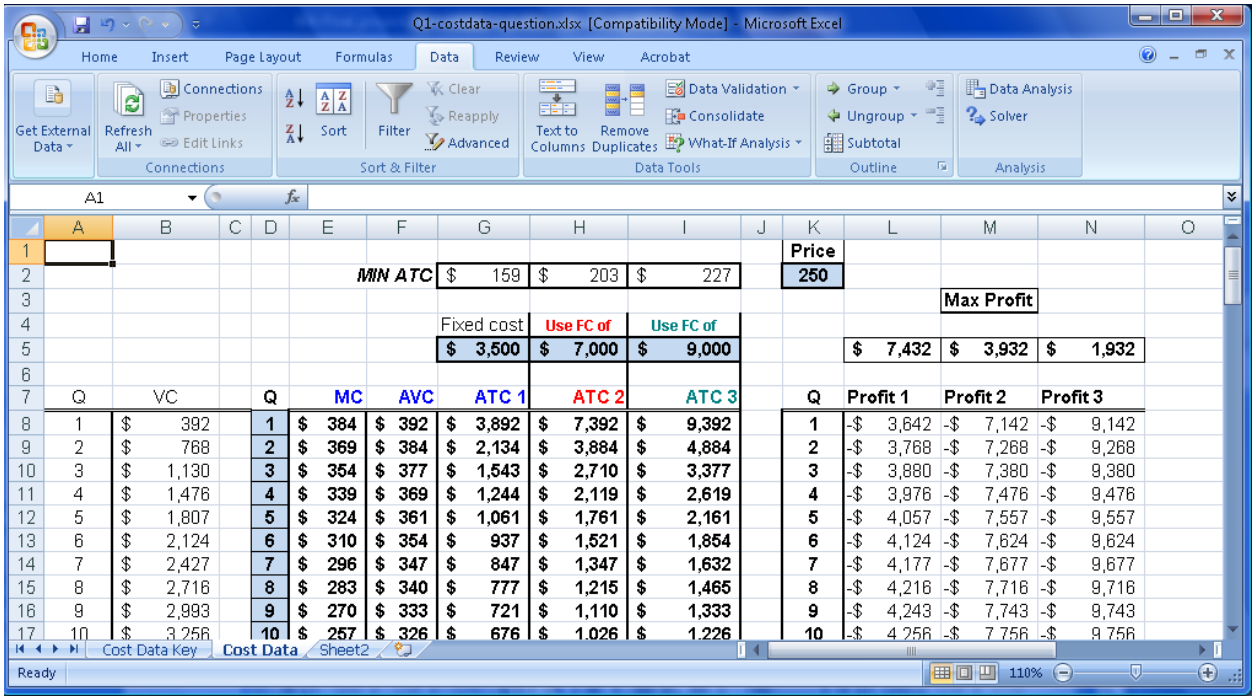
If you typed the formula

=A2 this is an absolute reference, no matter where you copy it, the formula will point to **A2**

=A$2 this is a partial reference: If you copy it across to D2, it will change to **=C$2**
If you copy it down to B3, it will still be **=A$2** (holds row constant)

=$A2 this is a partial reference: If you copy it across to **D2**, it will still be **=A$2**
If you copy it down to B3, it will still be **=$A3** (holds column constant)

The following picture illustrates what your finished table should look like:



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1											Price				
2						MIN ATC	$ 159	$ 203	$ 227		250				
3													Max Profit		
4							Fixed cost	Use FC of	Use FC of						
5							$ 3,500	$ 7,000	$ 9,000			$ 7,432	$ 3,932	$ 1,932	
6															
7	Q	VC		Q	MC	AVC	ATC 1	ATC 2	ATC 3		Q	Profit 1	Profit 2	Profit 3	
8	1	$ 392		1	$ 384	$ 392	$ 3,892	$ 7,392	$ 9,392		1	-$ 3,642	-$ 7,142	-$ 9,142	
9	2	$ 768		2	$ 369	$ 384	$ 2,134	$ 3,884	$ 4,884		2	-$ 3,768	-$ 7,268	-$ 9,268	
10	3	$ 1,130		3	$ 354	$ 377	$ 1,543	$ 2,710	$ 3,377		3	-$ 3,880	-$ 7,380	-$ 9,380	
11	4	$ 1,476		4	$ 339	$ 369	$ 1,244	$ 2,119	$ 2,619		4	-$ 3,976	-$ 7,476	-$ 9,476	
12	5	$ 1,807		5	$ 324	$ 361	$ 1,061	$ 1,761	$ 2,161		5	-$ 4,057	-$ 7,557	-$ 9,557	
13	6	$ 2,124		6	$ 310	$ 354	$ 937	$ 1,521	$ 1,854		6	-$ 4,124	-$ 7,624	-$ 9,624	
14	7	$ 2,427		7	$ 296	$ 347	$ 847	$ 1,347	$ 1,632		7	-$ 4,177	-$ 7,677	-$ 9,677	
15	8	$ 2,716		8	$ 283	$ 340	$ 777	$ 1,215	$ 1,465		8	-$ 4,216	-$ 7,716	-$ 9,716	
16	9	$ 2,993		9	$ 270	$ 333	$ 721	$ 1,110	$ 1,333		9	-$ 4,243	-$ 7,743	-$ 9,743	
17	10	$ 3,256		10	$ 257	$ 326	$ 676	$ 1,026	$ 1,226		10	-$ 4,256	-$ 7,756	-$ 9,756	

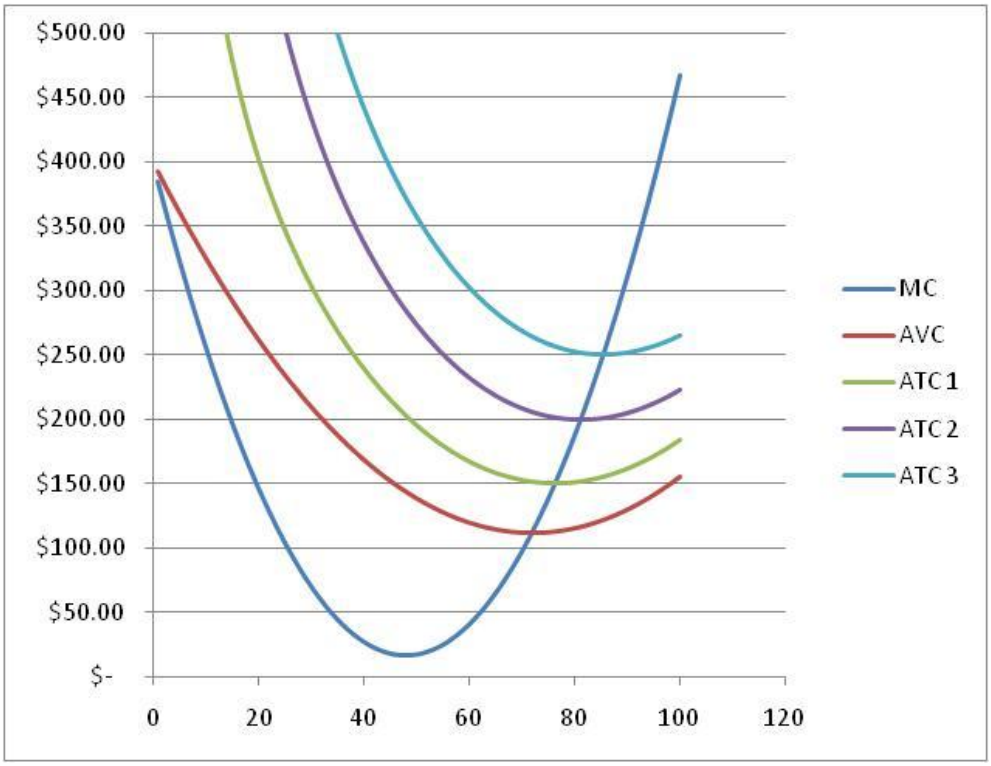
You are given the Marginal Cost and Total Variable Cost for 100 units of output.

[1] You need to fill in the AVC column with a formula based on VC and Q..

[2]Next, fill in each of the ATC columns with the formula for ATC = AVC + AFC (where AFC = FC/Q) You want to use an absolute cell reference that links Fixed costs found in G5, H5, I5. If you have done it correctly, the values in each cell of the ATC columns should change when you change the FC values in row 5.

[3] Use the appropriate formula in cells G2, H2, I2 to find value of the lowest ATC for each column.

[4] Chart the cost data. You are going to create a graph using scatter plot (with lines) option to create a graph that looks exactly the one below.



First you need to select the Block of date in the range H7 to i107. (hi-lite with mouse). Then select "Insert" and "scatter plot" with line option.

The initial graph will be hard to read. This because the default range on the Y-Axis is too big. Therefore you need to format the vertical Axis and set the max value to 500 (see chart).

[5] You should have found that the Minimum ATC's found in cells G2 to I2 are 159, 203 227.In the graph you can see that the minimum average total cost for ATC 1, ATC 2, ATC 3 are 150, 200, 250 respectively.

Use goal seek to change G2 (Min ATC) to 150 by changing FC (cell G5). Repeat the steps for columns H and I.

[6] Charting the Profit functions.

Profits can be written as TR – TC, or (Price – ATC)xQ. In cell K2, the price is currently 250.

Go to cell L8 and type the formula for profit using (P – ATC1)xQ The cells you will use are K2, G8, K8.

Note: you will need to use the cell reference rules at the top of the first page. Once the formula is finished, you will copy it across (M8, N8) and then down all three columns.

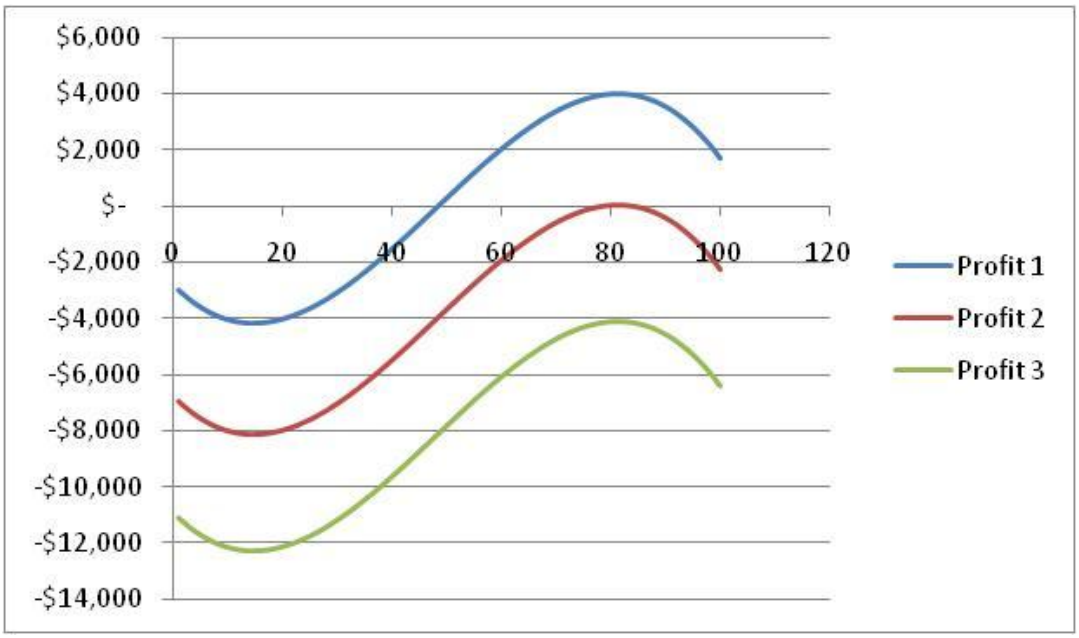
If you did your cell referencing correctly, the formula in each cell will use K2 for price, but the appropriate rows for ATC and q.

[7] Now go to cell L5 and enter the formula to find the Maximum value of the profits in column L. Copy the formula to M5 and N5.

If you have done everything correctly, you should find the maximum profits for each row to be

$7,432 $3,932 $1,932

[8] Now use the scatter plot to generate a chart of output and all three profit column in one graph (columns K, L, M, N). Your graph should look like the one below.



[9] Use goal seek to change the Maximum profit (cell L5) to 4000 by changing price (K2)

Save your work.

Question 2: Capital Costing Problem

You are a "Benevolent" Social Planner. Having mastered the concept of CV, EV and consumer surplus, the Premier has made you the Deputy Minister of "capital costs projects". Your first assignment is to solve the problem of traffic congestion in and around the town of Spuzzum. Recent growth has created a need for a river crossing. You are to decide on whether to introduce a ferry system or build a bridge. Further, your colleagues in the ministry have learned that you a graduate of the SFU MPP program and that your BEST course was MPP 806 and you are renowned for your "Spreadsheet Skills"

The demand for daily crossings is given by P = 40 – 0.1Q. It is assumed that the demand will be the same every day of the year (365 days). The cost of a bridge is $15. 2 Million And will have an annual maintenance cost of $110,000. The bridge will take 3 years to build. For budget purposes, the $15.2 million is divided evenly over the first three years. The live of the bridge is 25 years (including the 3 years needed to build it)

Alternatively, you can buy a ferry for $2.24 million. The ferry is available at the beginning of the first year and will last 5 years, and then it will need to be replaced. You will have to replace the ferry every 5 years for as long as you use them. To operate the ferry, it costs $12 per person. This is the only operating cost.

Instructions: go to the worksheet entitled "NPV Public Good". You are to build the costing model for the two alternatives: Bridge and Ferry. There are two important factors you need to consider when building your model.

1. You will be marked on how well you use cell referencing and equations. An example of the suggested layout is below. Ideally, the section called "Assumptions" is where you type any "numbers". In the section called "conclusions" you should ONLY have equations and CELL references.
2. Once the model is built, you will be using "GOAL SEEK" on various cells in the Assumptions section. Specifically, any interest rates, capital costs, prices etc.

Benefits: The goal is to maximize social welfare. In the absence of externalities, this is equivalent to maximizing the sum of consumer and producer surplus. In the case of the Bridge, all costs, including annual maintenance are Fixed Costs, so there is only Consumer Surplus. Further, we assume that there is an indivisibility issue (bridge only comes in one size) and population is small enough that the demand does not exceed the capacity. This means that the marginal cost of an additional driver across the bridge is zero. Net benefit for the bridge is consumer surplus at a price of zero per trip net of fixed costs.

For the Ferry, there is a constant variable cost of $12 per passenger. You will use a fee (or price) per passenger equal to $12. Since the AVC = MC is constant, the Benefit is simply the Consumer Surplus at a price of $12.

Discounting: You are to use simple annual discounting. The formula is $X = Y_t/(1+r)^t$ where Y is the future benefit, r is the interest rate (or discount rate) and t is the number of years. The total net present value

is the sum of all discounted future benefits. When building your model, assume the initial discount rate is 10%

"Assumptions"		
Interest Rate	**10.0%**	
Discount rate Ferry	10.0%	
Discount rate Bridge	10.0%	
Demand		
Intercept	40	
slope	0.1	
Price (user fee)	Demand/Day	
0	400	*Bridge*
12	280	*Ferry*
Benefit	**Daily**	**Annual (365)**
CS Bridge	$ 8,000	$ 2,920,000
CS Ferry	$ 3,920	$ 1,430,800
Bridge:		
Capital (Fixed)	$ 15,200,000	
Maint. (Fixed)	$ 110,000	
Ferry:		
Price of Ferry	$ 2,240,000	

"Conclusions"								
				ferry-bridge	$2,412,275			
			NPV Ferry	**$8,922,491**			**NPV Bridge**	**$6,510,216**
Year	Benefit	Cost	Net Benefit	Discount	Benefit	Cost	Net Benefit	Discount
0	$1,430,800	$2,240,000	-$809,200	-$809,200		$5,066,667	-$5,066,667	-$5,066,667
1	$1,430,800	$0	$1,430,800	$1,300,727		$5,066,667	-$5,066,667	-$4,606,061
2	$1,430,800	$0	$1,430,800	$1,182,479		$5,066,667	-$5,066,667	-$4,187,328
3	$1,430,800	$0	$1,430,800	$1,074,981	$2,920,000	$110,000	$2,810,000	$2,111,195
4	$1,430,800	$0	$1,430,800	$977,256	$2,920,000	$110,000	$2,810,000	$1,919,268
5	$1,430,800	$2,240,000	-$809,200	-$502,450	$2,920,000	$110,000	$2,810,000	$1,744,789
6	$1,430,800	$0	$1,430,800	$807,649	$2,920,000	$110,000	$2,810,000	$1,586,172
7	$1,430,800	$0	$1,430,800	$734,227	$2,920,000	$110,000	$2,810,000	$1,441,974

"What If" questions (Scenarios)

1. Use goal seek to find the internal rate of return (IRR) for each project. The IRR is the discount rate that drives the net PV to Zero. (hint: for the ferry, target cell H24 by changing cell B4 and for the bridge, target cell L24 by changing cell B5
2. Now you want to use the same interest rate for both projects (hint: enter an interest rate in cell B3, then, in Cells B4 and B5 type "=B3"). Which option is preferred when r = 5%, 10%, 15%, 20%
3. Find the interest rate where you would be indifferent between the two projects (Hint: use goals seek on cell i24)

Save your work.

Question 3: Student Success Analysis

The British Columbia Institute of Technology (BCIT) has one of the largest business schools in Canada (8,000 full and part time students). It has a reputation for having a very intense and demanding diploma program (years 1 and 2). All students in the program are full time with 7 courses per term (no electives). Each student is admitted and grouped by their choice of major (see below). However, all students take a common core in the first year. The attrition rate is high relative to other institutes.

Included in the excel file is date on GPA's of first year business students at BCIT from 1999-2004. Student information includes Gender, Age, Major, Hometown, Math 11 grade, English 12 grade and prior education at other institutes (college, university etc). All of which are suspected of having influence

The Major codes are as follows:

BMGT	Business Management
FMGT	financial Management
HRMG	Human Resource Management
INTT	International Trade and Transportation
MKTG	Marketing Management
OPMT	Operations Management

Given the demanding nature of the program, the institute is very interested in determining which variables are good signals when trying to determine a student's likelihood of success in the program. Further, there is an interest in knowing if there are significant differences based on choice of major.

[A] Pivot Table Analysis

Go to the Worksheet entitled: GPA data Pivot. Create a pivot table on a separate worksheet.

You are going to generate several Pivot tables. Each time you create a pivot table, hi-lite and copy it, then paste the values on a separate sheet labelled "Pivot Results".

Use "COPY-> PASTE SPECIAL -> Values" each time

Pivot 1: Average GPA by Major and Age group (note you will have to change the field settings from "Sum" to "Average"

Average of GPA core	Colun						
Row Labels	BMGT	FMGT	HRMG	INTT	MKTG	OPMT	Grand Total
17-19 yrs	62.0	60.5		47.2	69.2	55.9	63.4
20-24 yrs	63.0	66.7	67.8	55.9	67.6	65.9	65.9
25-29 yrs	63.3	71.8	78.6	65.1	70.2	66.7	69.9
30 + yrs	74.4	73.3	76.9	67.9	73.7	62.5	72.4
Grand Total	**64.7**	**68.2**	**77.2**	**60.9**	**68.8**	**65.4**	**67.6**

Pivot 2: Average GPA by Major and gender/age

Average of GPA core	Column Labels						
Row Labels	BMGT	FMGT	HRMG	INTT	MKTG	OPMT	Grand Total
Female	**64.0**	**67.8**	**79.1**	**64.1**	**69.1**	**63.2**	**68.0**
17-19 yrs	63.6	52.5		52.5	71.9	55.9	62.2
20-24 yrs	59.8	66.2	77.2	57.0	68.1	66.3	65.8
25-29 yrs	65.7	74.4	81.1	68.9	69.6	61.9	71.2
30 + yrs	75.7	72.8	76.7	79.2	74.2	62.0	73.9
Male	**65.4**	**68.6**	**73.2**	**59.1**	**68.4**	**66.3**	**67.2**
17-19 yrs	60.0	67.4		41.9	64.1		64.8
20-24 yrs	65.8	67.2	63.2	55.2	66.9	65.8	66.0
25-29 yrs	60.3	69.7	74.3	62.4	70.8	68.6	68.7
30 + yrs	72.8	74.0	78.1	64.5	73.3	62.8	70.8
Grand Total	**64.7**	**68.2**	**77.2**	**60.9**	**68.8**	**65.4**	**67.6**

Chi Squared Test.

The overall Age breakdown for all the first year students is:

17-19 yrs	6%
20-24 yrs	54%
25-29 yrs	29%
30 + yrs	11%
	100%

This would imply that the expected age grouping for each major is as listed in the following table.

Expected:							
	BMGT	FMGT	HRMG	INTT	MKTG	OPMT	Grand Total
17-19 yrs	12.0	27.5	2.6	4.7	30.6	4.6	82
20-24 yrs	102.1	234.3	22.0	40.3	260.1	39.2	698
25-29 yrs	55.3	126.9	11.9	21.8	140.8	21.2	378
30 + yrs	20.6	47.3	4.5	8.1	52.5	7.9	141
Grand Total	190	436	41	75	484	73	1299

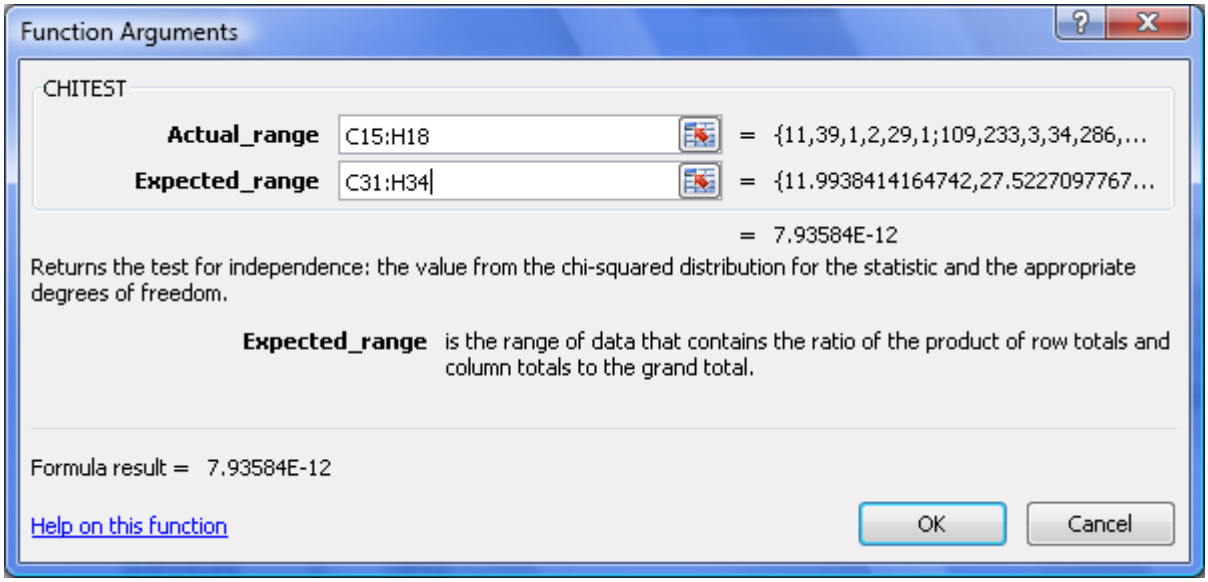
The expected age grouping in the table assumes that choice of Major is Independent of age group.

Count of Major	Column Labels						
Row Labels	BMGT	FMGT	HRMG	INTT	MKTG	OPMT	Grand Total
17-19 yrs	11.0	39.0	1.0	2.0	29.0	1.0	83.0
20-24 yrs	109.0	233.0	3.0	34.0	286.0	33.0	698.0
25-29 yrs	42.0	123.0	24.0	26.0	138.0	25.0	378.0
30 + yrs	28.0	41.0	13.0	13.0	31.0	14.0	140.0
Grand Total	**190.0**	**436.0**	**41.0**	**75.0**	**484.0**	**73.0**	**1,299.0**

Create a pivot table with Age and Major and count of major, to get the actual age groups by Major.

Do a "Chi Squared" test to see if it is true that choice of Major is independent of age. This table is in the in the excel file on the spreadsheet labelled **Chi Test**.

The function you need to use is CHITEST



Concluding Pivots

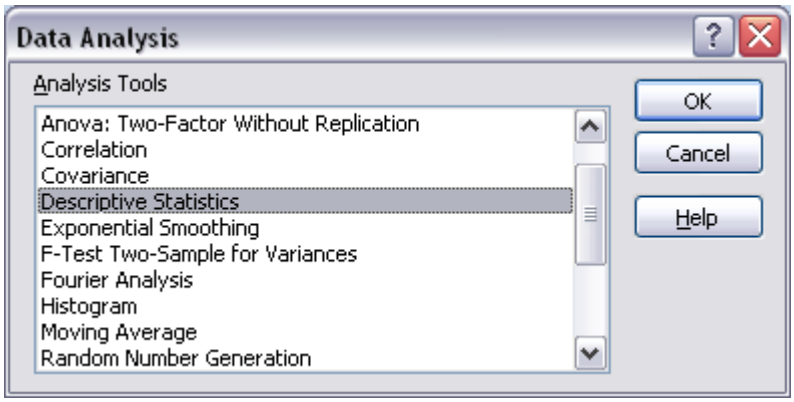
Finally, Generate 3 more Pivot tables using different items from the data (your choice). Save each one on the answer page. Add a short statement commenting on any interesting observations you found in each.

[B] Raw Data Analysis

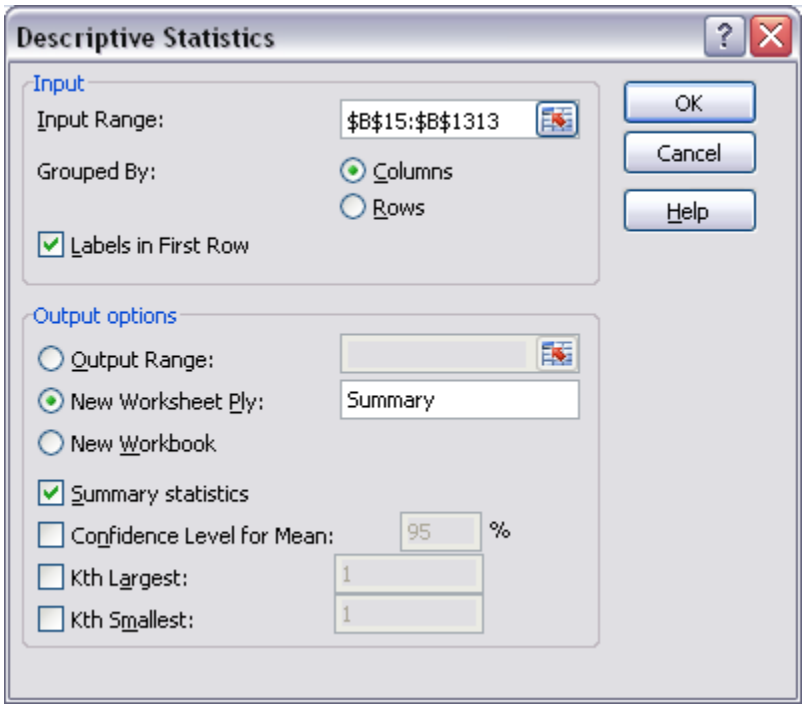
Go to worksheet **GPA data Raw**.

Select descriptive statistics from the Data analysis tool

Data Tab -> Data Analysis -> Descriptive Statistics)



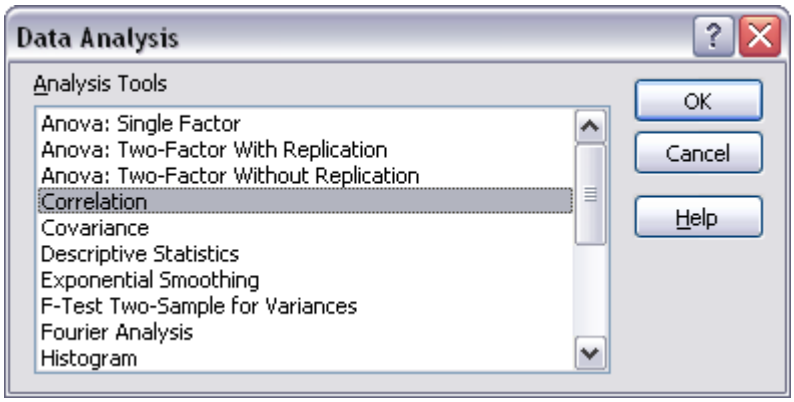
Make sure to select "Summary statistics". You want to select the date for GPA_core



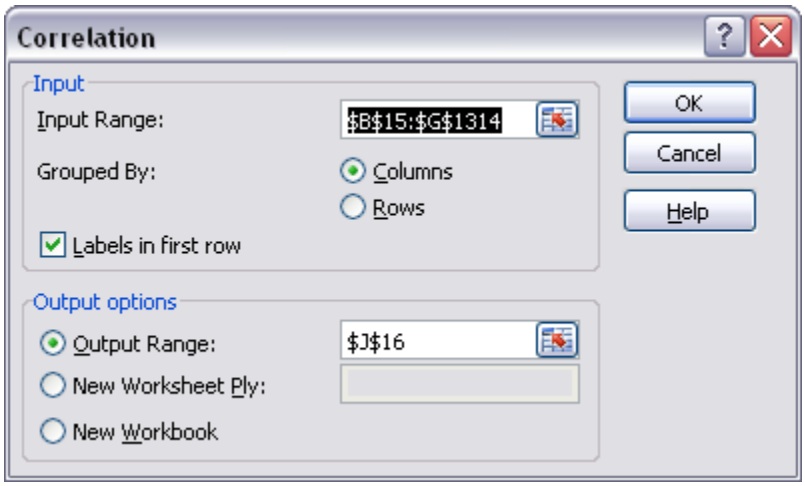
Place output on a separate worksheet called "Summary"

Now we want to look at the correlation.

(Data Tab -> Data Analysis -> Correlation)



Select your ranges. Note that the "Labels in first row" is selected.



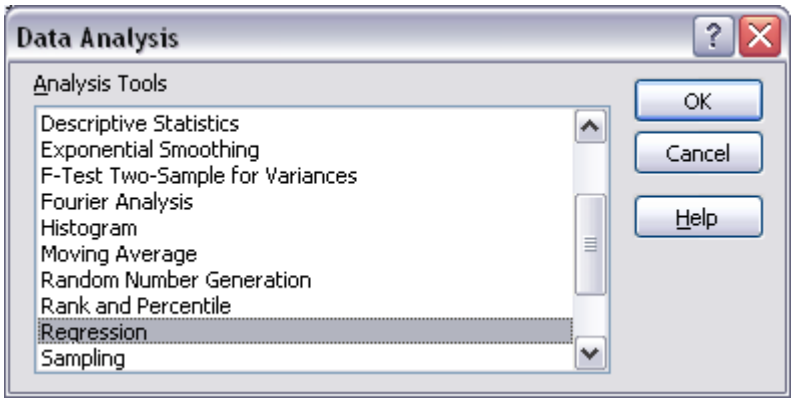
Your output should look like

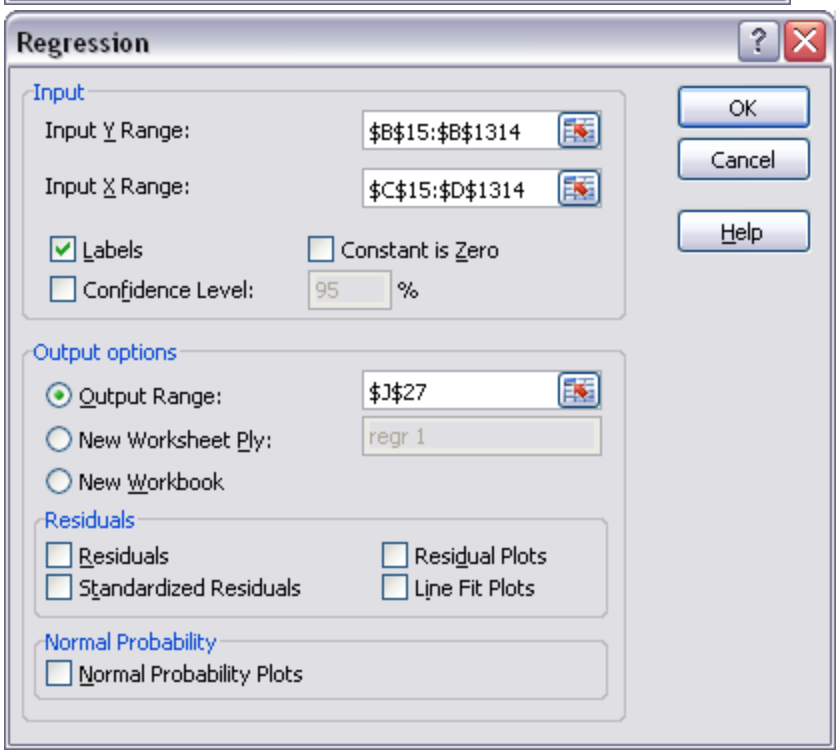
	GPA core	*Math 11*	*English 12*	*Prev_Ed*	*Gender*	*Agegroup*
GPA core	1					
Math 11	0.236382	1				
English 12	0.27278	0.145067	1			
Prev_Ed	-0.04287	-0.02959	-0.03288	1		
Gender	-0.02763	-0.0773	-0.09184	-0.01024	1	
Agegroup	0.19184	0.093506	0.070749	-0.03071	0.012733	1

Finally, we want to run a very simple regression:

[GPA_core] = a+b1[math 11] + b2[English 12]

(Data Tab -> Data Analysis -> Regression)





Your regression output should be placed below your correlation table.

Final Question:

From the Pivot Table and the Statistics, what conclusions can you draw about the variables that influence GPA? Keep your answer short, but cite data values (where necessary) that support your conclusion. In particular, what do the coefficients on Math 11 and English 12 tell you? What about the t stats and p values? You can look at outside sources to help you answer this question. Just be sure to cite what you used.