Using Microsoft Excel for Decision Making

Pivot Tables:

Originally released in 1985, Microsoft Excel has become the most-used spreadsheet program in the world. Excel can perform formula-based calculations, mathematical functions, and data analytics, specifically via pivot tables. Because of its utility, Excel has become a staple in many organizations.

An important benefit of the pivot table is summarizing data in a quick and easy manner. The pivot table helps make a concise summary out of thousands of rows and columns of unorganized data. With the help of these tables you can summarize large amounts of information into a small space.

Analyzing data is much easier using pivot tables, where users will have the convenience of handling a large amount of data and analyzing the data faster. Pivot tables let you take a huge amount of data and work on it in such a manner that you need only to view a small number of data fields. This will is a big help in the easy analysis of a large data sets.

In addition, data analysis experience is made more interesting with pivot tables, as using pivot tables has become more interactive. The tables allow a user to drag and drop data with easiness and the data table becomes interactive.

Solver Add-in:

Solver uses a computer's fast processing power to subject any mathematical scenario to rapid data analysis for purposes of finding an optimal solution to complicated formulas. A key advantage of Solver is the ability to quickly process scenarios involving multiple unknown variables. This is often regarded as "linear algebra."

Whereas more conventional Excel formulas process straightforward calculations, Solver takes Excel's math engine much further and runs advanced problem-solving algorithms to discover results for multiple variables simultaneously. This is particularly useful when there are many unknowns, or many different sets of equations, each with its own set of unknown variables. Solver saves hours of manual algebra calculations in these circumstances.

Optimization is a key purpose of Solver as used in the corporate world. As with linear algebra, many product development cycles are influenced by multiple factors, each of which can significantly change profit margins or product quality. If the relationship between these factors and a company's desired goals can be expressed mathematically, Solver can quickly identify the value of these factors to meet those goals.

Deliverables:

- **A screen shot for each solution of the pivot table scenarios.**
- **A screen shot for each solution of the Solver scenarios.**
- **Place all screen shots into a MS Word document and save it as a PDF for uploading via the Tutorial Three upload link assignment.**

Pivot Table Exercise:

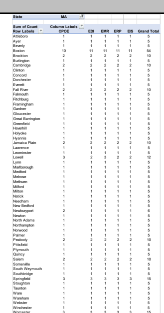
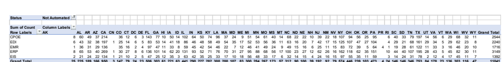
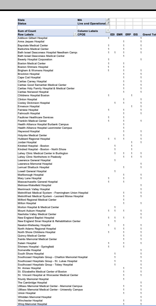
1) Use the HMIS_Tutorial_Three.xlsx workbook from the Week 04 Module. Note: Add a column (attribute) in the workbook named Count and place the value of 1 in each row of Count.

2) Create the following pivot tables in separate worksheets from HMIS:

a. List the count of HMIS applications by city for hospitals in Massachusetts (MA).

b. List the count of HMIS applications in hospitals by state for the application status 'Not Automated.'

c. List the count of HMIS applications by hospital in Massachusetts for the application status 'Live and Operational.'

Pivot Table A	Pivot Table B	Pivot Table C
		
Note: Answers in detail are available in HMIS_Tutorial_Three_Solutions.xlsx. The three pivot table images above may be viewed at 400% for clarity.		

Solver Add-in Exercise:

1) Follow the directions in Classwork 4.3 to install the Solver Add-in (e.g., page 5).

2) Set up the **Z function** algorithm to either maximize (i.e., revenue or profit) or minimize (i.e., cost or expense) is the first step in any linear programming scenario.
{max or min **Z= $(A_1)(X_1) + (A_2)(X_2) + \ldots + (A_n)(X_n)$;** where A_n is a constant and X_n is an unknown variable}

3) The next step is identifying the resources and how the resources are depleted or *constrained*. { *max cups <= 500; max premium cups <= 350; max mocha cups <= 125*}

4) The Pony Expresso scenario (i.e., Classwork 4.3 page 5) would have the following **Z function** and *constraints*:

Maximize Revenue **Z = ($1.25)($X_1$) + ($2.00)(X_2) + ($2.25)($X_3$)**

Subject To Constraints:

$$X_1 + X_2 + X_3 <= 500$$
$$X_2 + X_3 <= 350$$
$$X_3 <= 125$$

5) Load the Solver worksheet with the **Z function** and *constraints,* then run Solver:

Pony Expresso

Price of regular coffee	$ 1.25	Total Revenue	$ 918.75	x1 = # of cups of regular coffee per day	
Cups needed to sell	150			x2 = # of cups of premium latte per day	
Subtotal	$ 187.50	Regular cups	150	x3 = # of cups of premium mocha per day	
		Premium cups	350		
Price of premium latte	$ 2.00	Total cups	500	Max Z = 1.25(x1) + 2.00(x2) + 2.25(x3)	
Cups needed to sell	225				
Subtotal	$ 450.00	Constraints		Subject To Constraints:	
		Max cups	500	Cups of coffee per day <= 500	x1 + x2 + x3 <= 500
Price of premium mocha	$ 2.25	Max premium	350	Cups of premium coffee per day <= 350	x2 + x3 <= 350
Cups needed to sell	125	Max mocha	125	Cups of mocha per day <= 125	x3 <= 125
Subtotal	$ 281.25				
				x1 >= 0, x2 >= 0, and x3 >= 0	

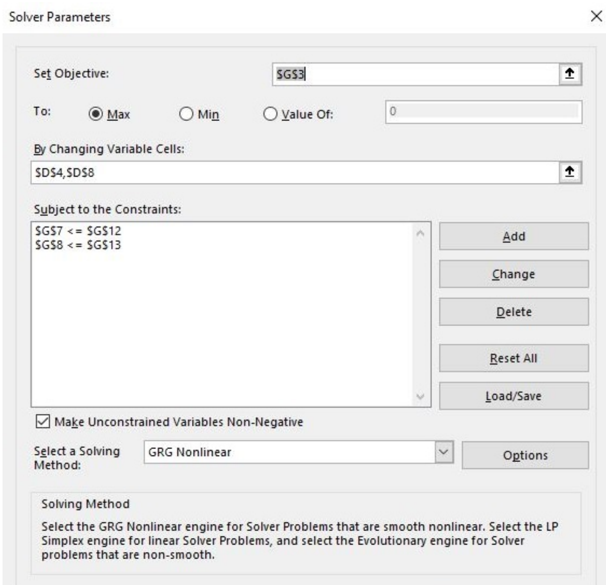
6) Set up the **Z function**, *constraints*, and the Solver worksheet for the following scenarios.

7) **Bicycle Scenario**: (**maximize the profit Z function using two variables X_1 and X_2**)

A bicycle company produces two types of mountain bikes, the deluxe and the professional. **The deluxe has a profit margin of $10, while the professional has a profit margin of $15**. *Each deluxe frame takes 2 pounds of aluminum alloy and 3 pounds of steel alloy, while each professional frame takes 4 pounds of aluminum alloy and 2 pounds of steel alloy. The bicycle company has vendor contracts to supply 100 pounds of aluminum alloy per week and 80 pounds of steel alloy per week*. Given these *constraints*, what production level of deluxe and professional bicycles would yield a maximum profit?

Bicycle Frames

Profit on deluxe frames	$ 10.00	Total Profit	$ 412.50	x1 = # of deluxe frames per week	
Deluxe frames to produce	15			x2 = # of professional frames per week	
Subtotal	$ 150.00	Deluxe Frames	15		
		Professional Frames	17.5		
Profit on professional frames	$ 15.00	Total Alum Alloy	100	Max Z = 10x1 + 15x2	
Professional frames to produce	17.5	Total Steel	80	S.T.	
Subtotal	$ 262.50			Aluminum Alloy per week <= 100	2x1 + 4x2 <= 100
				Steel per week <= 80	3x1 + 2x2 <= 80
		Constraints		Deluxe takes 2 lbs AA & 3 lbs steel	
		Max Alum Alloy per week	100	Professional takes 4lbs AA & 2lbs steel	
		Max Steel per week	80		
				x1 >= 0 and x2 >= 0	



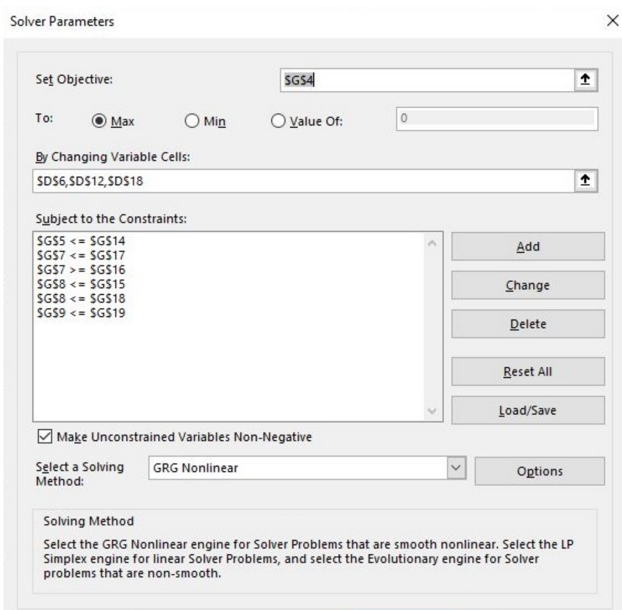
Answers in detail are available in HMIS_Tutorial_Three_Solutions.xlsx.

8) **Advertising Mix Scenario**: (**maximize the advertising reach Z function using three variables X_1 , X_2, and X_3**)

A Chamber of Commerce needs public service announcements to reach its constituents across a multi-county area. **TV advertising reaches 100,000 people per advertisement, radio advertising reaches 18,000 people per advertisement, and newspaper advertising reaches 40,000 people per advertisement** . *The Chamber's advertising budget is limited to $18,200. TV advertisements cost $2,000 each, radio advertisements cost $3,000 each, and newspaper advertisements cost $600 each. The total number of radio advertisements are limited to at most 50% of the total advertisements (e.g., TV, radio, and newspaper), while TV advertisements must be at least 10% of the total advertisements*. Advertising spots are limited to 10 for TV, 20 for radio, and 10 for newspaper media. Given these *constraints*, what number of TV, radio, and/or newspaper advertisements would reach the most people (i.e., constituents)?

Advertising Mix

Price of TV advertising	$ 2,000.00	Total Audience	1,010,000.00	x1 = # of advertisements through TV
Audience of TV advertising	100,000	Total Advertising Cost	$ 18,200.00	x2 = # of advertisements through radio
TV advertising spots	6.1			x3 = # of advertisements through newspaper
Subtotal TV Cost	$ 12,200.00	TV spots	6.1	
Subtotal TV Audience	610,000	Radio spots	0	
		Newspaper spots	10	
Price of radio advertising	$ 3,000.00	Total advertising spots	16.1	Max Z = 100000(x1) + 18000(x2) + 40000(x3)
Audience of Radio advertising	18,000			
Radio advertising spots	0	Constraints		S.T.
Subtotal Radio Cost	$ -			
Subtotal Radio Audience	-	Max advertising budget	$ 18,200.00	2000x1 + 3000x2 + 600x3 <= 18200
		Max radio spots is half of total ad spots	8.05	x2 <= 0.5 (x1 + x2 + x3)
Price of Newspaper advertising	$ 600.00	Min TV spots is 10% of total ad spots	1.61	x1 >= 0.1 * (x1 + x2 + x3)
Audience of Newspaper advertising	40,000	Max TV spots	10	x1 <= 10
Newspaper advertising spots	10	Max Radio spots	20	x2 <= 20
Subtotal Newspaper Cost	$ 6,000.00	Max Newspaper spots	30	x3 <= 30
Subtotal Newspaper Audience	400,000.00			
				x1 >= 0, x2 >= 0, and x3 >= 0



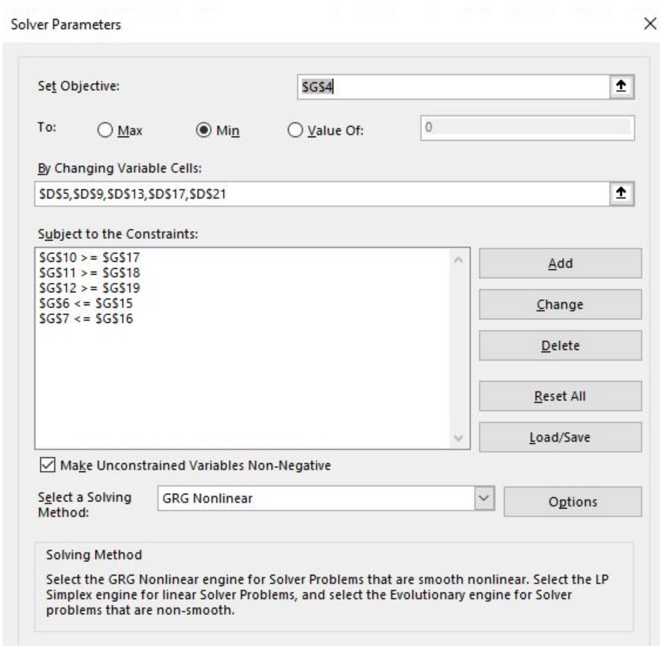
Answers in detail are available in HMIS_Tutorial_Three_Solutions.xlsx.

9) **Transportation Scenario**: (**minimize the transportation cost Z function using six variables X_1 , X_2, X_3, X_4 , X_5, and X_6**)

A niche retailer needs its goods produced at two locations (e.g., Louisville, KY and Kansas City, KS) shipped to three regional distribution centers (e.g., Region 1, 2, and 3). **Transportation costs per unit from Kansas City to Region 1 cost $2.10, Kansas City to Region 2 cost $2.25, and Kansas City to Region 3 cost $3.00. Transportation costs per unit from Lexington to Region 1 cost $2.00, Lexington to Region 2 cost $2.40, and Lexington to Region 3 cost $2.80** . *The production quotas for the Kansas City and Lexington locations equals 350 and 400 units per week, respectively. Region 1 demand requires shipments of 200 units per week, Region 2 demand requires shipments of 250 units per week, and Region 3 demand requires shipments of 300 units per week.* Given these *constraints*, what number units should be shipped each week from the Kansas City and Lexington locations to each of the three regional distribution centers to meet demand while minimizing transportation costs?

Transportation Costs

Cost per unit from Kansas City to Region 1	$ 2.10	Total Transportation Costs	$ 1,812.50	x1 = # of units to transport from Kansas City to Region 1	
Units to ship from Kansas City to Region 1	100			x2 = # of units to transport from Kansas City to Region 2	
Subtotal of Kansas City to Region 1 Transportation	$ 210.00	Kansas City Production	350	x3 = # of units to transport from Kansas City to Region 3	
		Louisville Production	400	x4 = # of units to transport from Louisville to Region 1	
Cost per unit from Kansas City to Region 2	$ 2.25	Total Production	750	x5 = # of units to transport from Louisville to Region 2	
Units to ship from Kansas City to Region 2	250			x6 = # of units to transport from Louisville to Region 3	
Subtotal of Kansas City to Region 2 Transportation	$ 562.50	Region 1 Shipments	200		
		Region 2 Shipments	250		
Cost per unit from Kansas City to Region 3	$ 3.00	Region 3 Shipments	300	Min Z = 2.10(x1) + 2.25(x2) + 3,00(x3) + 2.00(x4) + 2.40(x5) + 2.80(x6)	
Units to ship from Kansas City to Region 3	0				
Subtotal of Kansas City to Region 3 Transportation	$ -	Constraints		S.T.	
		Max Kansas City Production	500	Max Kansas City Productin <=500	x1 + x2 + x3 <=500
Cost per unit from Louisville to Region 1	$ 2.00	Max Louisville Production	400	Max Louisville Production <=400	x4 + x5 + x6 <= 400
Units to ship from Louisville to Region 1	100	Region 1 Demand	200	Min Region 1 shipments >= 200	
Subtotal of Louisville to Region 1 Transportation	$ 200.00	Region 2 Demand	250	Min Region 2 shipments >=250	
		Region 3 Demand	300	Min Region 3 shipments >=300	
Cost per unit from Louisville to Region 2	$ 2.40				
Units to ship from Louisville to Region 2	0			x1 >= 0, x2 >= 0, x3 >= 0, x4 >= 0, x5 >= 0, and x6 >= 0	
Subtotal of Louisville to Region 2 Transportation	$ -				
Cost per unit from Louisville to Region 3	$ 2.80				
Units to ship from Louisville to Region 3	300				
Subtotal of Louisville to Region 3 Transportation	$ 840.00				



Answers in detail are available in HMIS_Tutorial_Three_Solutions.xlsx.