B.Com (Hons.) Semester IV

Subject: Business Mathematics (Practical)

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Linear Programming through Excel Solver

Before moving on to excel solver, we need to have detailed question. Therefore, we start with the following problem:

A firm makes two types of furniture's, chairs and tables. Profits are ₹ 20 per chair and ₹ 30 per table. Both products are processed on three machines M1, M2 and M3. The time required for each product in hours and total time available in hours per week on each machine are as follows:

Machine	Chair	Table	Available Time
M1	3	3	36
M2	5	2	50
M3	2	6	60

How should the manufacturer schedule his production in order to maximize profit?

STEP 1: Formulate the problem:

Let x and y be the number of chairs and table to be produced per week respectively

Maximize Z= 20x +30y

Subject to constraints:

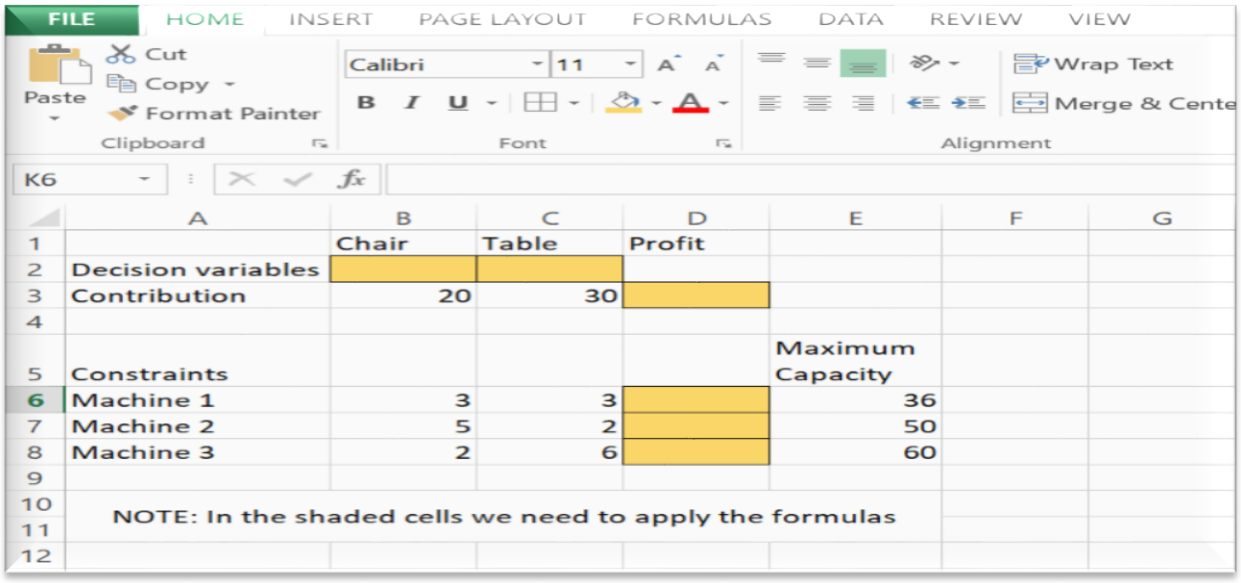
3x+3y <= 36

5x+2y <= 50

2x+ 6y <= 60

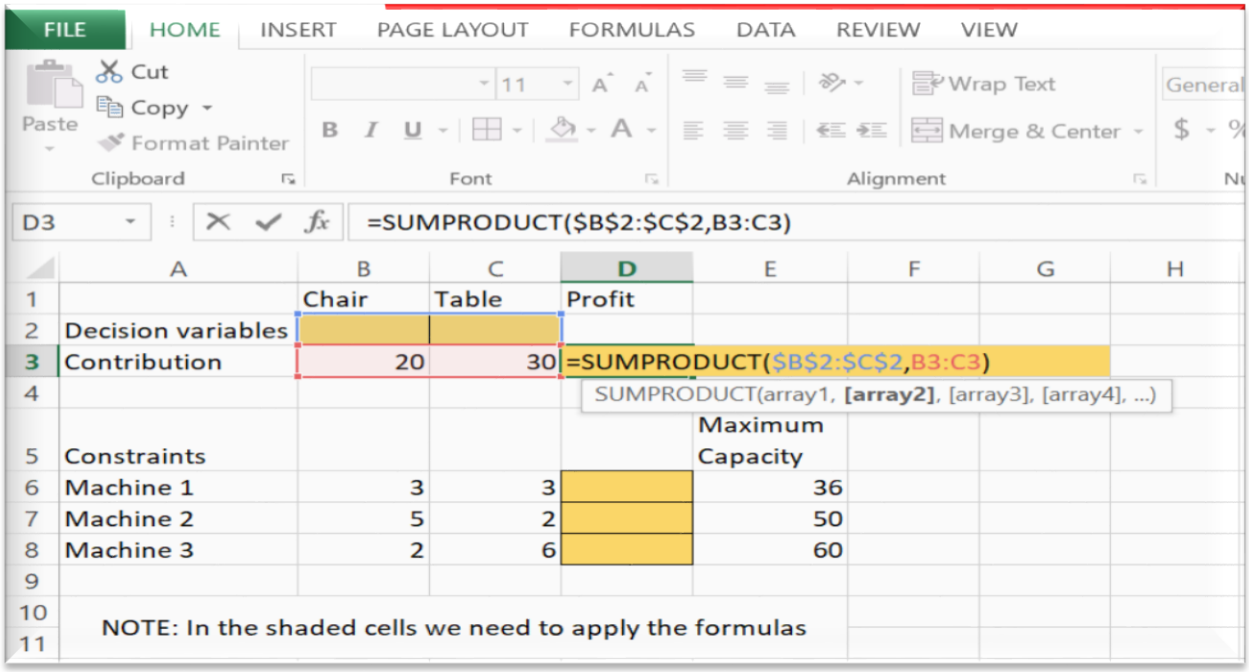
x, y >= 0 (Non-negativity constraint)

STEP 2: Now enter all this information to excel spreadsheet in the below format.



	A	B	C	D	E	F	G
1		Chair	Table	Profit			
2	Decision variables						
3	Contribution	20	30				
4							
5	Constraints				Maximum Capacity		
6	Machine 1	3	3		36		
7	Machine 2	5	2		50		
8	Machine 3	2	6		60		
9							
10	NOTE: In the shaded cells we need to apply the formulas						
11							
12							

STEP 3: NEXT, enter the formula in the cell D3 and D6 to D8.

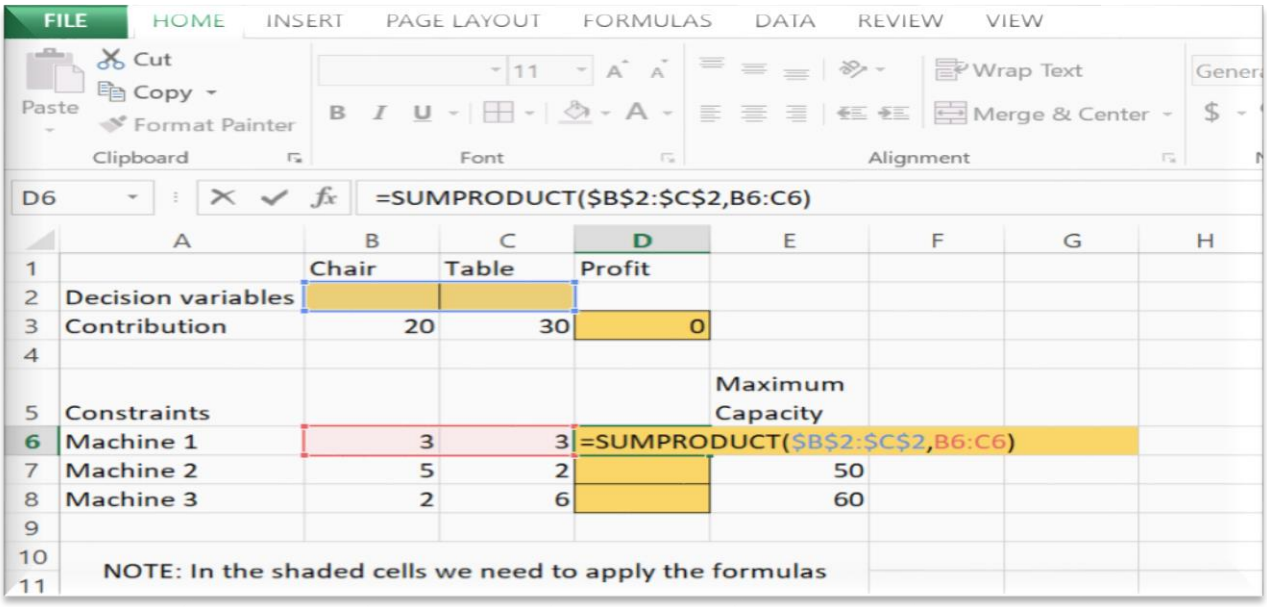


	A	B	C	D	E	F	G	H
1		Chair	Table	Profit				
2	Decision variables							
3	Contribution	20	30	=SUMPRODUCT($B$2:$C$2,B3:C3)				
4								
5	Constraints				Maximum Capacity			
6	Machine 1	3	3		36			
7	Machine 2	5	2		50			
8	Machine 3	2	6		60			
9								
10	NOTE: In the shaded cells we need to apply the formulas							
11								

SUMPRODUCT(array1, **[array2]**, [array3], [array4], ...)

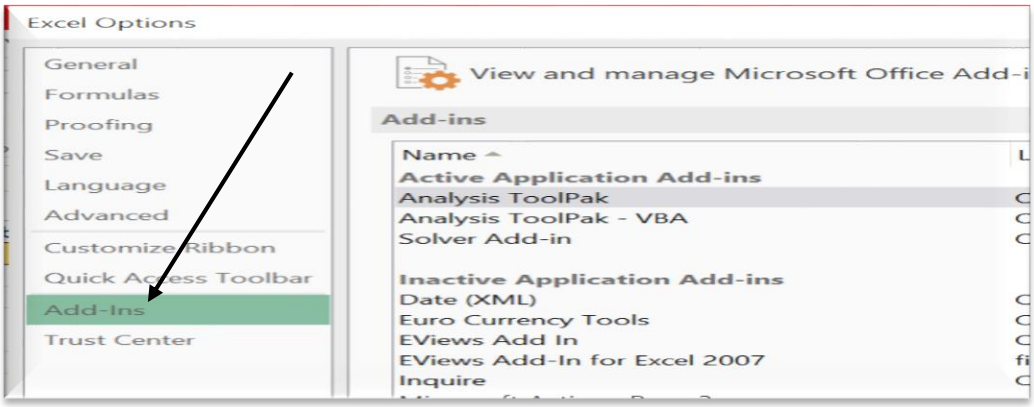
Enter the formula in D3 to calculate total profit using SUMPRODUCT formula (i.e. multiplying profit per unit into quantity of specific furniture and then adding it)

Similarly enter the formula in D6 to D8 using SUMPRODUCT formula to calculate capacity utilised of each machine

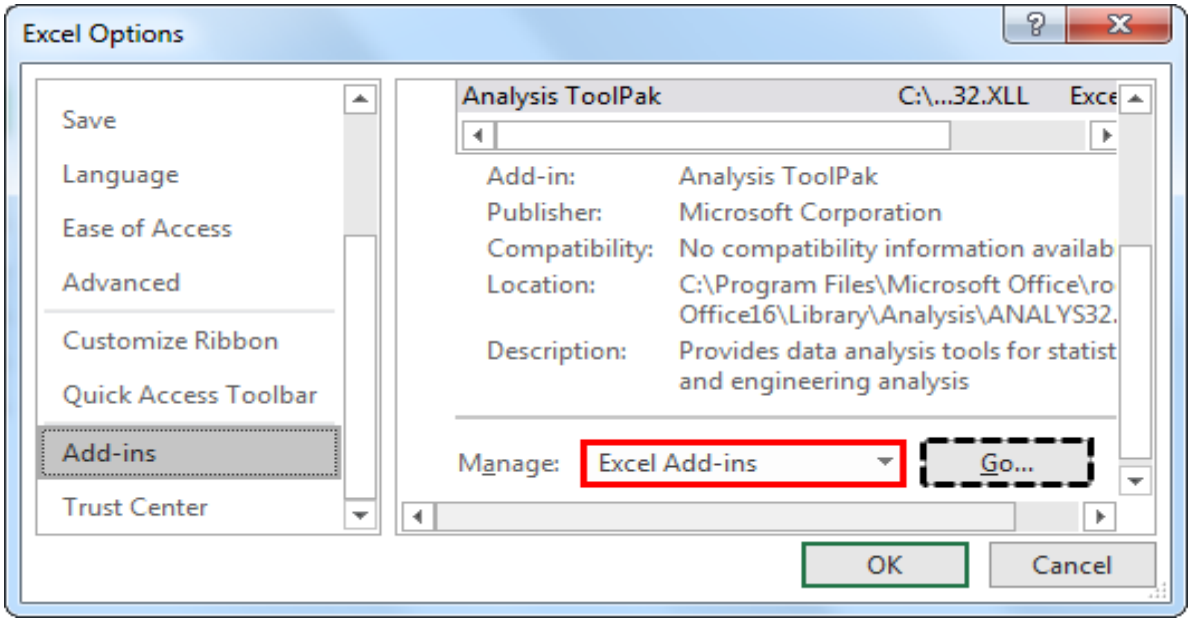


STEP 4: To load the solver add-in, execute the following steps.

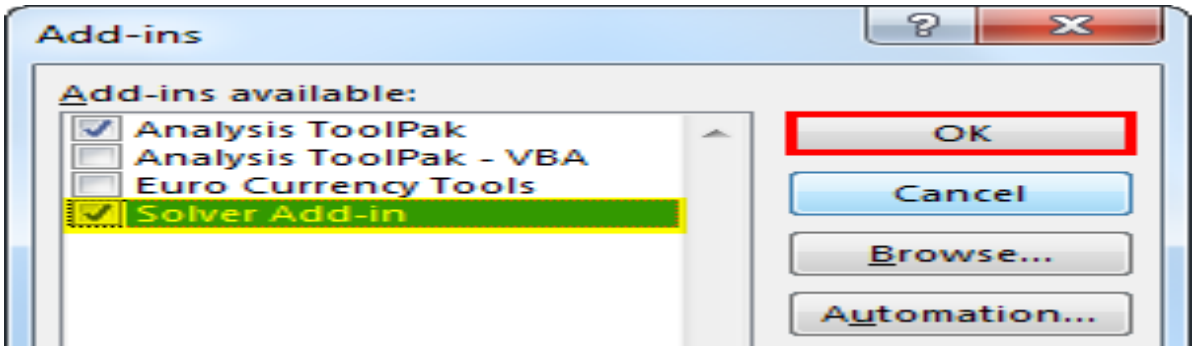
a. Go to the File tab then, under File tab click on “Options”.
b. Go to Add-ins under Excel Options.



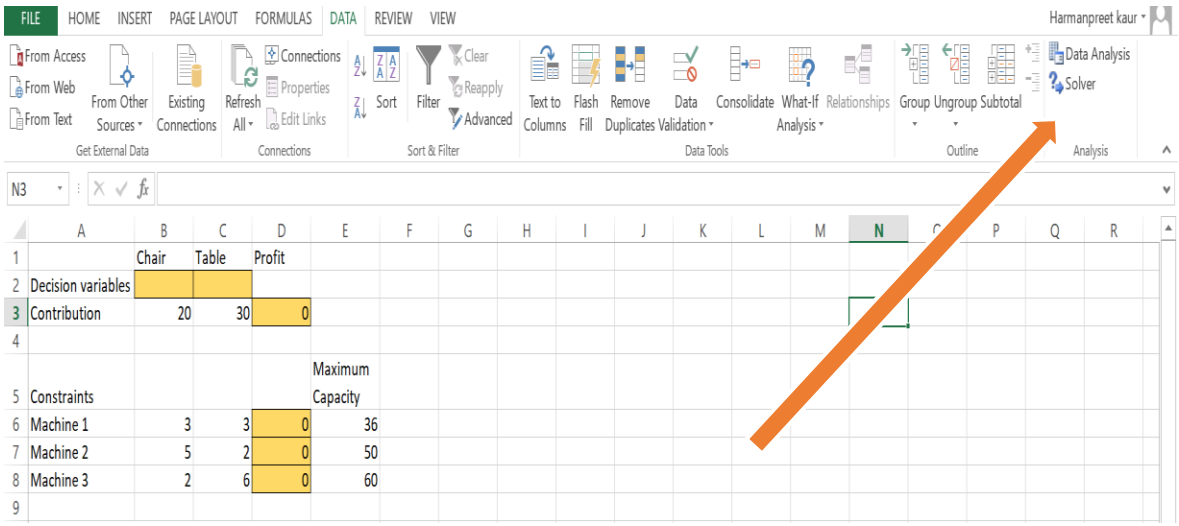
c. Under this select “Excel Add-ins” and click on Go.



d. Under below pop up choose “Solver Add-in” and click on “Ok” to enable it.

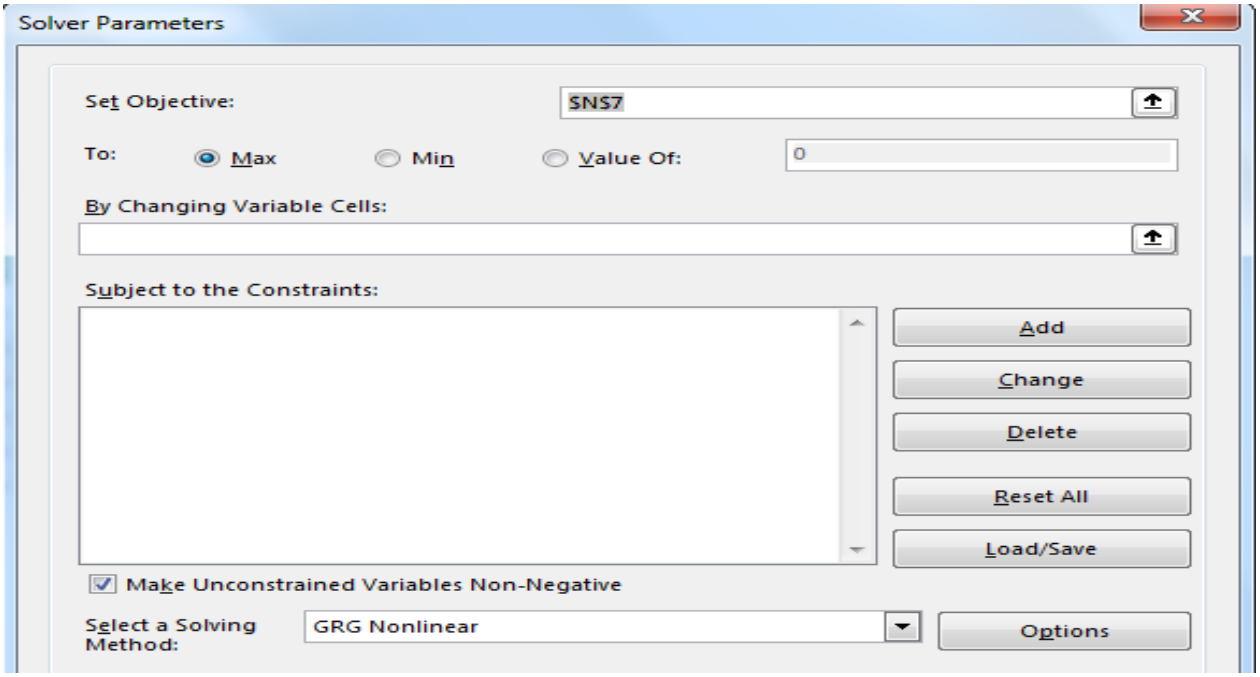


e. Now we can see “Solver Add-in” under the DATA tab.

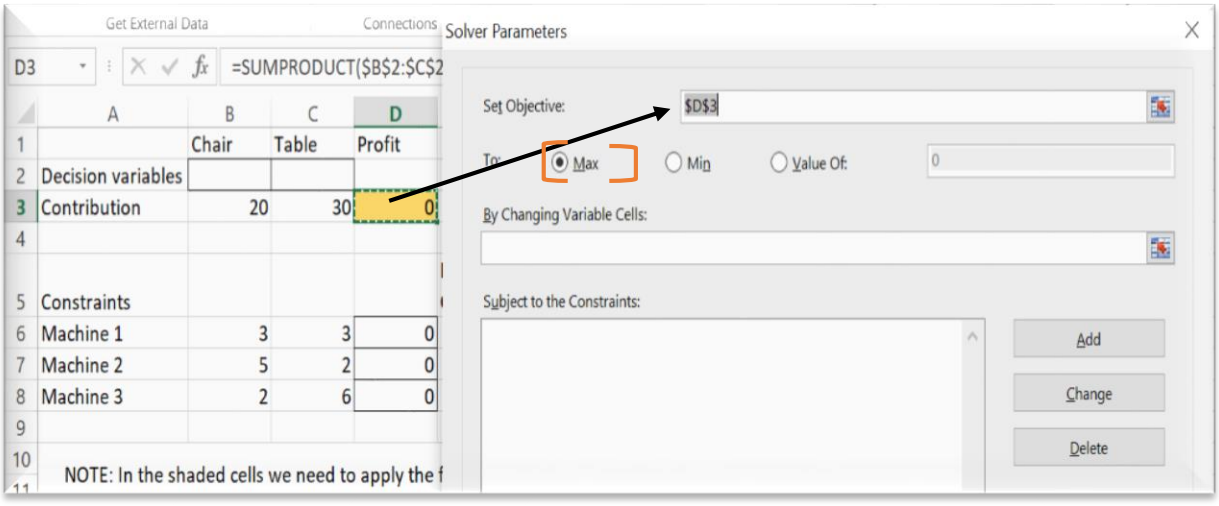


STEP 5: Solve Linear Programming through Excel Solver

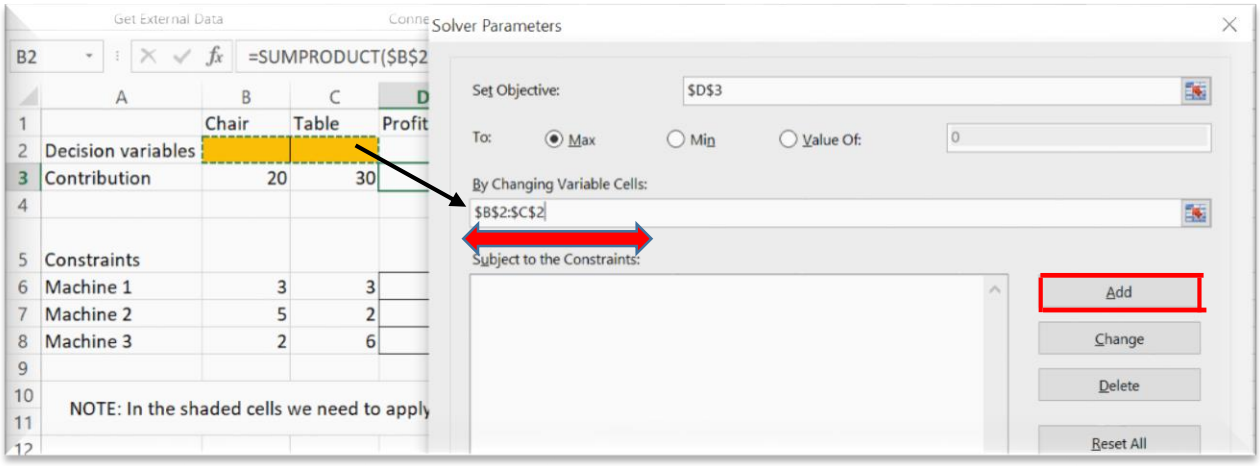
To apply solver go to the DATA tab and click on "Solver" we will see below window.



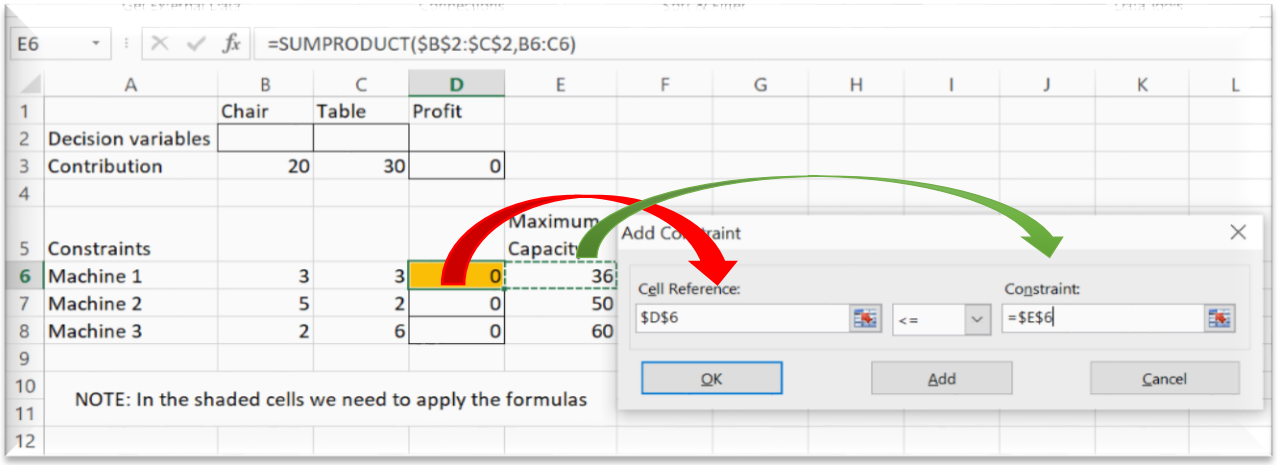
- In the above window, our first option is "Set Objective".
  Our objective is to identify the "Total Profit", so our Total Profit cell is D3, so select the cell D3 for this "Set Objective" and set it to "Max".



- Next option is "By changing variables", in this problem, our variables are "Chairs" and "Tables". To select a range of cell B2:C2.

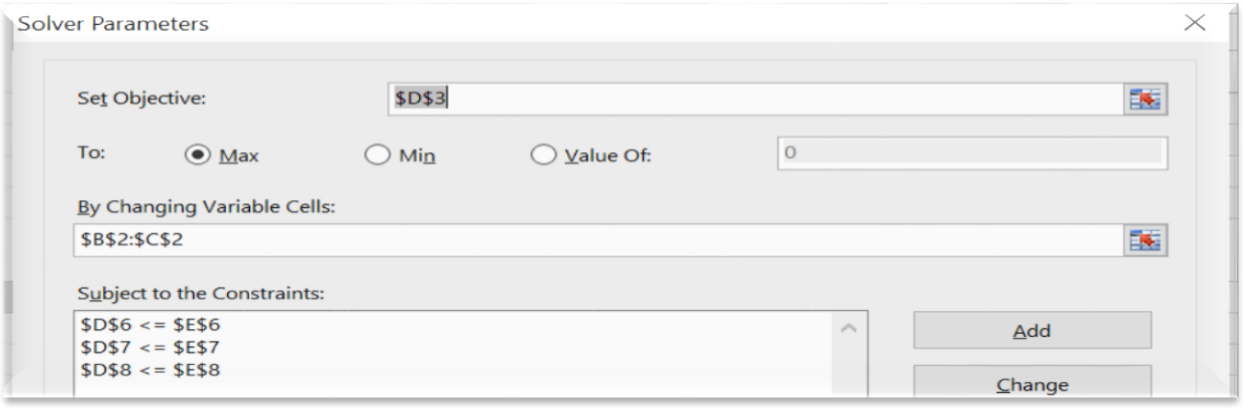


- Now, the next option "subject to the constraints", Once you click on "Add" we will see below add constraint window.

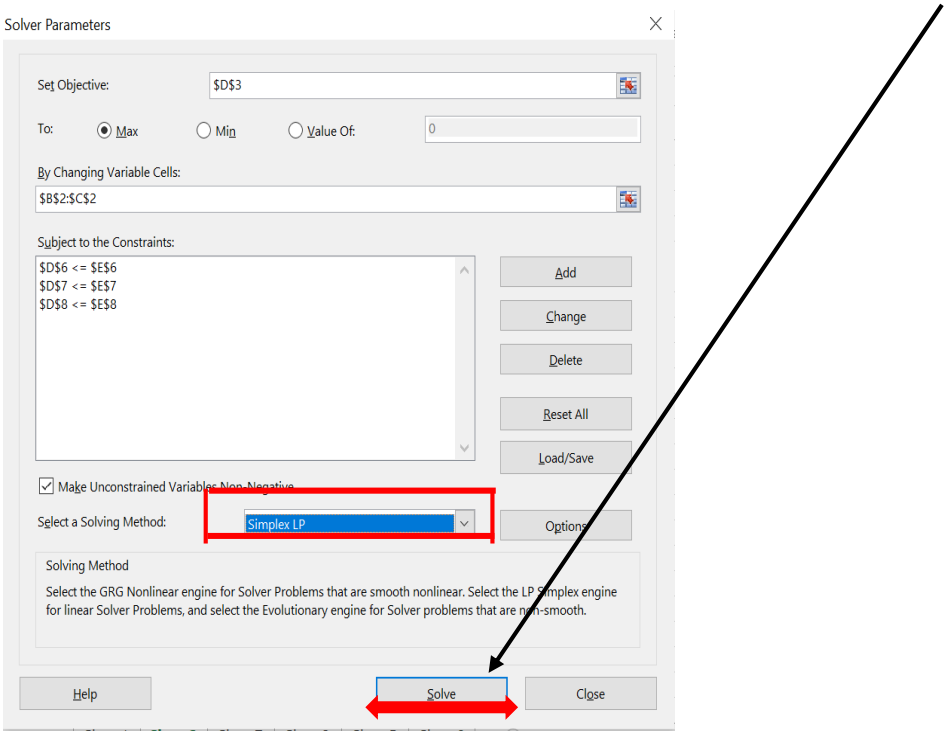


- Click on "Add" to stay back in the same window. Now in the second constraint select the value as D7 and select "<=" and under constraint select G7 cell.
  Similarly, for the third constraint select the value as D8 and select "<=" and under constraint select G8 cell.

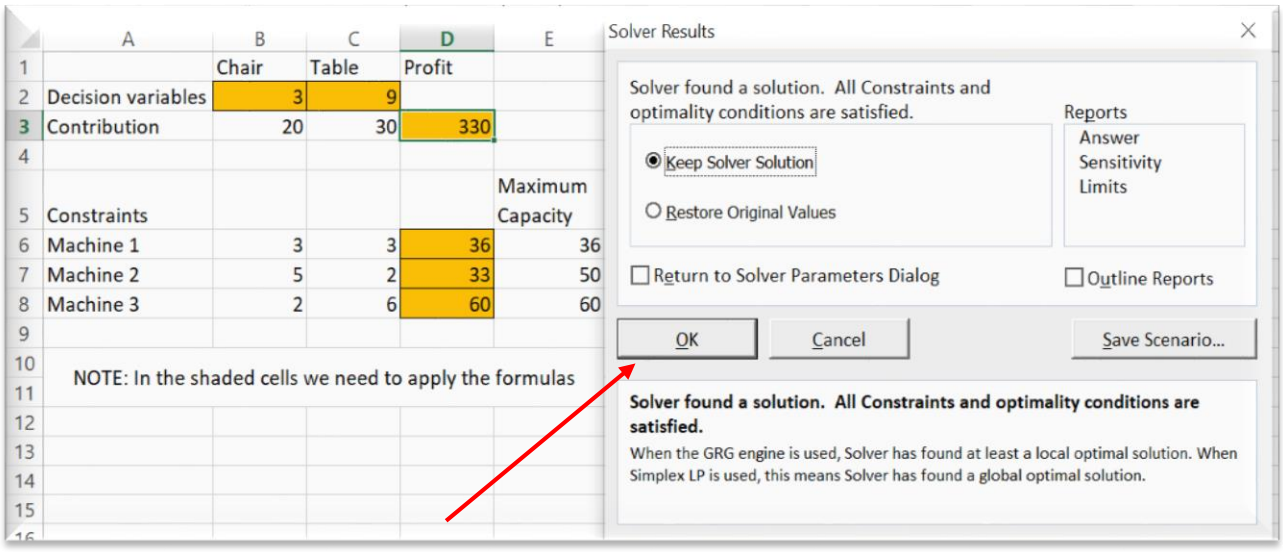
- After adding all constraints, Click on "Ok" to come out of Add Constraint window. Constraints are added like below. Now our all parameters are ready.



- Now tick check box for non-negative constraints and select "Simplex LP" as solving method from the drop down. Finally, Click on Solve.



- Finally, the answers will appear on the screen as you can see in the shaded cells below.



	A	B	C	D	E
1		Chair	Table	Profit	
2	Decision variables	3	9		
3	Contribution	20	30	330	
4					
5	Constraints				Maximum Capacity
6	Machine 1	3	3	36	36
7	Machine 2	5	2	33	50
8	Machine 3	2	6	60	60
9					
10	NOTE: In the shaded cells we need to apply the formulas				
11					
12					
13					
14					
15					

Click Ok, to save the solution.

STEP 5: Write the final solution.

As per the given solution, firm can have maximum profit of ₹ 330 by producing 3 chairs and 9 tables per week.

Question for Practice:

A diet is to contain at least 20 ounces of protein and 15 ounces of carbohydrate. There are three foods A, B, and C available in the market, costing Rs. 2, Re. 1, and Rs. 3 per unit respectively. Each unit of A contains 2 ounces of protein and 4 ounces of carbohydrate. . Each unit of B contains 3 ounces of protein and 2 ounces of carbohydrate; each unit of C contains 4 ounces of protein and 2 ounces of carbohydrate. Formulate the LPP so as to minimize the cost of diet and solve using Excel Solver.