(A Product) A product can be produced on four different machines. Each machine has a fixed setup cost, variable production cost per unit processed, and a production capacity, given in the file P06_53.xlsx. A total of 2000 units of the product must be produced. Determine how to minimize the total cost.

	Machine 1	Machine 2	Machine 3	Machine 4
Fixed cost	$1,000	$920	$800	$700
Variable cost	$20	$24	$16	$28
Capacity	900	1000	1200	1600

P06_53.xlsx

Discussion: -

It is like the manufacturer problem 40[RA] where the manufacturer should take a decision on production of different items. In this problem, we need to take a decision on the type of machines which we are using to produce the product. Our objective is to minimize the cost. To calculate the cost, we need to decide on the units produced from each type of machine.

Mathematical Model: -

Parameters (Inputs):

$i \in 1,2,3,4$ (i: $Index\ for\ machines$)
F_i : $Fixed\ cost\ to\ use\ machine\ i$
V_i : $Per\ unit\ Variable\ cost\ that\ were\ produced\ using\ machine\ i$
C_i : $Capacity\ of\ machine\ i$
D : $Demand\ for\ the\ product; D = 2000$

Decision Variables:

x_i : $Decision\ on\ whether\ producing\ product\ i\ or\ not$
y_i : $Units\ of\ item\ i\ produced$

Objective:

$$Minimize\ total\ \ cost = \sum_{i=1}^{4}(x_i * F_i) + \sum_{i=1}^{4}(y_i * V_i)$$

Constraints:

$$\sum_{i=1}^{4} y_i \geq D \ ; \qquad (1)\ Demand\ Constraint$$

$x_i \epsilon \{0,1\}$ (2) *Binary Constraint*

$y_i \leq x_i * C_i \quad ; For\ i \in \{1,2,3,4\}$ (3) *Machine capacity constraint*

Excel Implementation: Please find the attached spreadsheet for solution.

42[RA].xlsx

	Machine 1	Machine 2	Machine 3	Machine 4				
Fixed cost	$1,000	$920	$800	$700				Inputs
Variable cost	$20	$24	$16	$28				Decision variables
Capacity	900	1000	1200	1600				Calculated Variables
								Constraints
								Objective
Decision	1	0	1	0				
Units produced	800	0	1200	0	2000	>=	2000	
	<=	<=	<=	<=				
Capacity	900	0	1200	0				

Fixed Cost	1800
Variable Cost	35200
Total Cost	37000