HW #2

1)

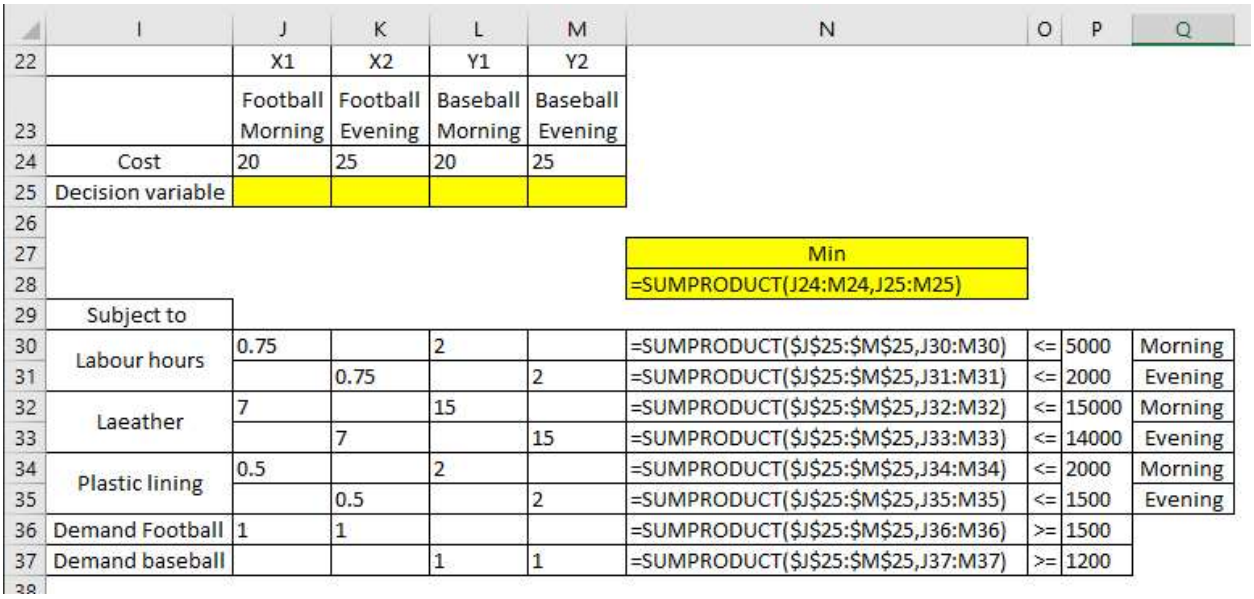
	A	B	C	D	E
1		Material 1 (lbs)	Material 2 (lbs)	Labour hours	
2	Product A	3	2	4	
3	Product B	1	4	2	
4	Product C	5	0	3.5	
5		Material 1	Material 2		
6	Material cost per pound	7	5		
7	Labour cost per hour	15			
8					
9		Selling price per unit	Total material cost	Total labour cost	Total profit
10	Product A	101	=SUMPRODUCT(B2:C2,$B$6:$C$6)	=$B$7*D2	=B10-(C10+D10)
11	Product B	67	=SUMPRODUCT(B3:C3,$B$6:$C$6)	=$B$7*D3	=B11-(C11+D11)
12	Product C	97.5	=SUMPRODUCT(B4:C4,$B$6:$C$6)	=$B$7*D4	=B12-(C12+D12)

	A	B	C	D	E
1		Material 1 (lbs)	Material 2 (lbs)	Labour hours	
2	Product A	3	2	4	
3	Product B	1	4	2	
4	Product C	5	0	3.5	
5		Material 1	Material 2		
6	Material cost per pound	$ 7	$ 5		
7	Labour cost per hour	$ 15			
8					
9		Selling price per unit	Total material cost	Total labour cost	Total profit
10	Product A	$ 101	$ 31	$ 60	$ 10
11	Product B	$ 67	$ 27	$ 30	$ 10
12	Product C	$ 97.50	$ 35	$ 52.50	$ 10

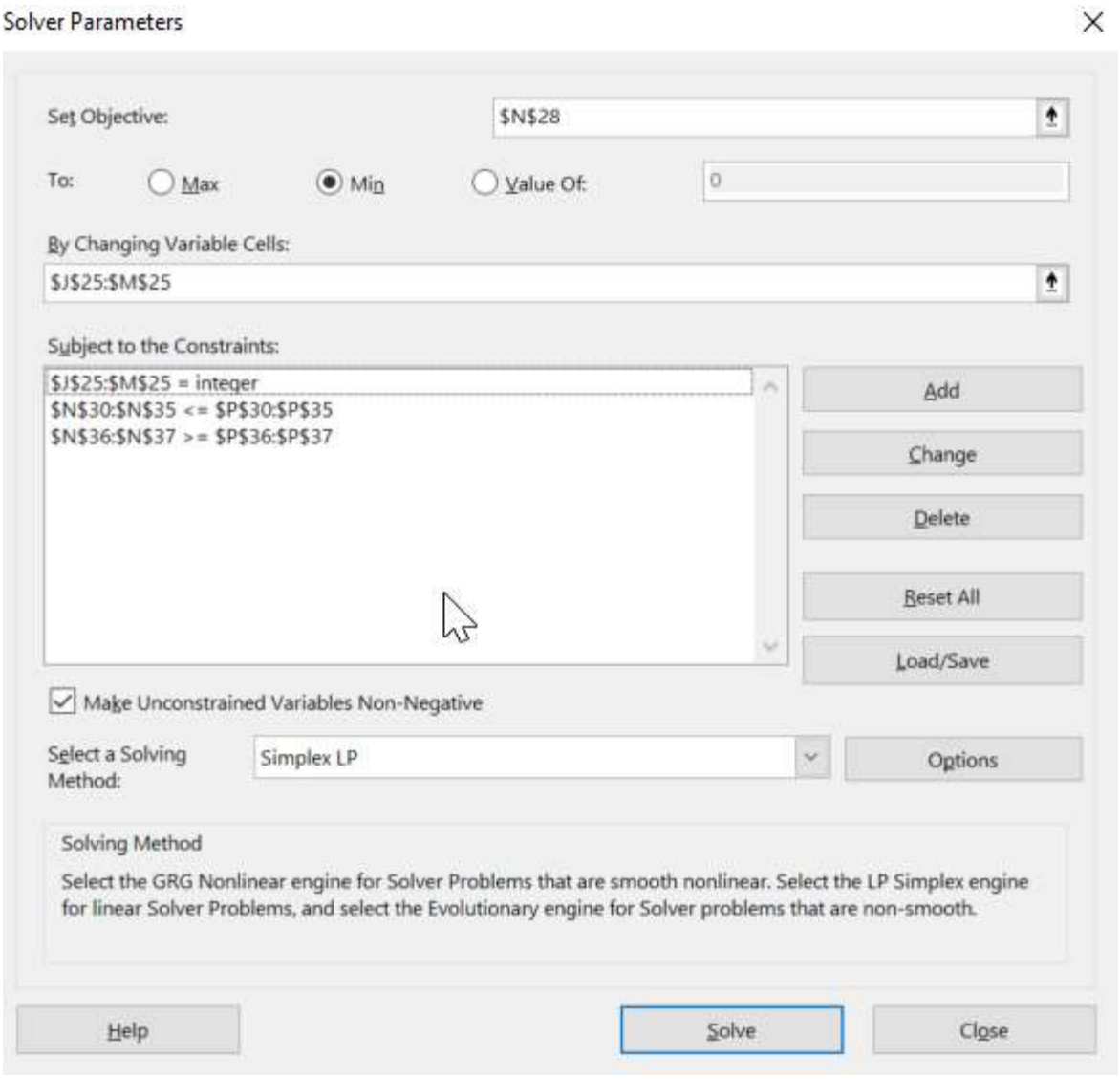
	A	B	C	D	E	F	G	H
1		Product A	Product B	Product C				
2	Profit	10	10	10				
3	Decision variable	0.00	98.25	1.00				
4	subject to							
5		3	1	5	103.25	<=	300	material 1 availability
6		2	4	0	393	<=	400	material 2 availability
7		4	2	3.5	200	<=	200	labour hours
8		0	0	10	10	>=	10	at least 10 units of C demand
9								
10				Maximized Profit	$992.50			

Thus, to maximize the profit, the manager should produce 98.25 B's and 1 C

2)



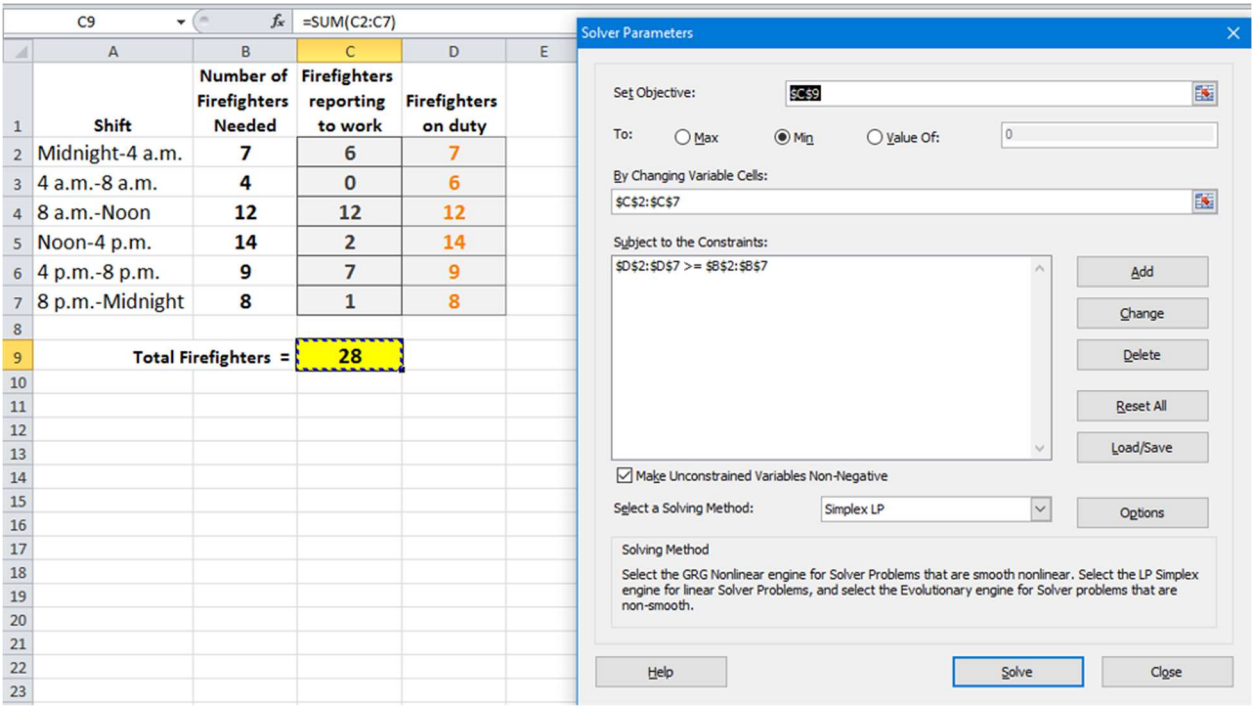
	I	J	K	L	M	N	O	P	Q
22		X1	X2	Y1	Y2				
23		Football Morning	Football Evening	Baseball Morning	Baseball Evening				
24	Cost	20	25	20	25				
25	Decision variable								
26									
27						Min			
28						=SUMPRODUCT(J24:M24,J25:M25)			
29	Subject to								
30	Labour hours	0.75		2		=SUMPRODUCT($J$25:$M$25,J30:M30)	<=	5000	Morning
31			0.75		2	=SUMPRODUCT($J$25:$M$25,J31:M31)	<=	2000	Evening
32	Laeather	7		15		=SUMPRODUCT($J$25:$M$25,J32:M32)	<=	15000	Morning
33			7		15	=SUMPRODUCT($J$25:$M$25,J33:M33)	<=	14000	Evening
34	Plastic lining	0.5		2		=SUMPRODUCT($J$25:$M$25,J34:M34)	<=	2000	Morning
35			0.5		2	=SUMPRODUCT($J$25:$M$25,J35:M35)	<=	1500	Evening
36	Demand Football	1	1			=SUMPRODUCT($J$25:$M$25,J36:M36)	>=	1500	
37	Demand baseball			1	1	=SUMPRODUCT($J$25:$M$25,J37:M37)	>=	1200	
38									


Solver Parameters
Set Objective:
$N$28
To:
Max
Min
Value Of:
0
By Changing Variable Cells:
$J$25:$M$25
Subject to the Constraints:
$J$25:$M$25 = integer
$N$30:$N$35 <= $P$30:$P$35
$N$36:$N$37 >= $P$36:$P$37
Add
Change
Delete
Reset All
Load/Save
Make Unconstrained Variables Non-Negative
Select a Solving Method:
Simplex LP
Options
Solving Method
Select the GRG Nonlinear engine for Solver Problems that are smooth nonlinear. Select the LP Simplex engine for linear Solver Problems, and select the Evolutionary engine for Solver problems that are non-smooth.
Help
Solve
Close

	I	J	K	L	M	N	O	P	Q
22		X1	X2	Y1	Y2				
23		Football Morning	Football Evening	Baseball Morning	Baseball Evening				
24	Cost	20	25	20	25				
25	Decision variable	805	695	624	576				
26									
27						Min			
28						60355			
29	Subject to								
30	Labour hours	0.75		2		1851.75	<=	5000	Morning
31			0.75		2	1673.25	<=	2000	Evening
32	Laeather	7		15		14995	<=	15000	Morning
33			7		15	13505	<=	14000	Evening
34	Plastic lining	0.5		2		1650.5	<=	2000	Morning
35			0.5		2	1499.5	<=	1500	Evening
36	Demand Football	1	1			1500	>=	1500	
37	Demand baseball			1	1	1200	>=	1200	
38									

Football Morning	Football Evening	Baseball Morning	Baseball Evening
805	695	624	576

3)



4)

	A	B	C	D	E	F	G	H
1	**Rotary pump**		**SEP**	**OCT**	**NOV**	**DEC**		**Legends**
2	Standard		650	875	790	1100		Constraints
3	Heavy duty		900	350	1200	1300		Decision Variables
4	MPS - Standard		651	879	785	1900		Objective Function
5	MPS - Heavy Duty		1744	1262	1244	350		
6	Onhand Inventory - Standard	0	=C4+B6-C2	=D4+C6-D2	=E4+D6-E2	=F4+E6-F2		
7	Onhand Inventory - Heavy Duty	0	=C5+B7-C3	=D5+C7-D3	=E5+D7-E3	=F5+E7-F3		
8	Total Inventory		=SUM(C6:C7)	=SUM(D6:D7)	=SUM(E6:E7)	=SUM(F6:F7)		
9	Minimum Inventory - Standard	≥	0	0	0	800		
10	Minimum Inventory - heavy Duty	≥	0	0	0	850		
11	Max Inventory	≤	1800	1800	1800	1800		
12	Production cost per unit - Standard		125	=C12*1.05	=D12*1.05	=E12*1.05		
13	Production cost per unit - Heavy Duty		135	=C13*1.05	=D13*1.05	=E13*1.05		
14	Total production cost - Standard		=SUMPRODUCT(C12:F12,C4:F4)					
15	Total production cost - Heavy Duty		=SUMPRODUCT(C13:F13,C5:F5)					=SUM(C14:F15)
16	Holding cost(= Avg. Inv of a month * carrying cost)		=(((B8+C4+C5)+C8)/2)*5	=(((C8+D4+D5)+D8)/2)*5	=(((D8+E4+E5)+E8)/2)*5	=(((E8+F4+F5)+F8)/2)*5		=SUM(C16:F16)
17	Total Cost (production and inventory)							=SUM(H15:H16)
18	labour hours - Standard		=0.45*C4	=0.45*D4	=0.45*E4	=0.45*F4		
19	labour hours - Heavy Duty		=0.52*C5	=0.52*D5	=0.52*E5	=0.52*F5		
20	Total Labour hrs		=SUM(C18:C19)	=SUM(D18:D19)	=SUM(E18:E19)	=SUM(F18:F19)		
21	Minimum labour hrs.	≥	1000	1000	1000	1000		
22	Maximum labour hrs.	≤	1200	1200	1200	1100		

	A	B	C	D	E	F	H
1	**Rotary pump**		**SEP**	**OCT**	**NOV**	**DEC**	**Legends**
2	Standard		650	875	790	1,100	Constraints
3	Heavy duty		900	350	1,200	1,300	Decision Variables
4	MPS - Standard		651	879	785	1900	Objective Function
5	MPS - Heavy Duty		1744	1262	1244	350	
6	Onhand Inventory - Standard	0	1	5	0	800	
7	Onhand Inventory - Heavy Duty	0	844	1756	1800	850	
8	Total Inventory		845	1761	1800	1650	
9	Minimum Inventory - Standard	≥	0	0	0	800	
10	Minimum Inventory - heavy Duty	≥	0	0	0	850	
11	Max Inventory	≤	1800	1800	1800	1800	
12	Production cost per unit - Standard		125	131.25	137.8125	144.70313	
13	Production cost per unit - Heavy Duty		135	141.75	148.8375	156.27938	
14	Total production cost - Standard		579862.5				
15	Total production cost - Heavy Duty		654180.1313				1234042.631
16	Holding cost(= Avg. Inv of a month * carrying cost)		8100	11867.5	13975	14250	48192.5
17	Total Cost (production and inventory)						1282235.131
18	labour hours - Standard		292.95	395.55	353.25	855	
19	labour hours - Heavy Duty		906.88	656.24	646.88	182	
20	Total Labour hrs		1199.83	1051.79	1000.13	1037	
21	Minimum labour hrs.	≥	1000	1000	1000	1000	
22	Maximum labour hrs.	≤	1200	1200	1200	1100	

5)

a) 3 small and 44 large

B) 3*600+3*750+44*1000= 48050

C) 100000-48200=51800

D) optimal number of office sizes would remain the same as the increase of 200 is within allowable limits. Objective function value would increase by 3*200= 600. Thus the value of objective function is 48800.

E) the additional footage will have no effect as we have already exhausted the number of offices allowed with footage to spare.

F) since the allowable increase in rent for small and allowable decrease in the rent of large are greater than the changes as mentioned in the question there will be no change in allocation. The value of objective function would change by 50*3 -200*44=-8650.new value would be 48050-8650=39400