1 Formulate LP model for this problem?

Max Z 3x1+3x2+5x3

Subj: 1.2x1 + 1.7x2 + 1.2x3 <= 1000

0.8x1 + 0 + 2.3x3 <= 1200

2x1 + 3x2 + 4.5x3 <= 2000

x1,x2,x3 >= 0

2 Solve the problem by SOLVER

			x1	x2	x3			
			3	3	5			
			700	0	133.3333	2766.667		
	c1		1.2	1.7	1.2	1000	<=	1000
	c2		0.8	0	2.3	866.6667	<=	1200
	c3		2	3	4.5	2000	<=	2000

3. What is the optimal production mix? What contribution can the firm anticipate by producing this mix?

The optimal production mix:

Chair = 700, Bench = 0, Table = 133.333, Max Sales = 2766.667

700	0	133.3333	2766.667	

4..What is the value of one unit more of tube-bending time? of welding time? of metal tubing?

The value of one unit more of: Tube-bending time is 1.1666

Welding time is 0

Metal tubing is 0.8

	Shadow Price	C
0	1.166666667	
7	0	
0	0.8	

5.. A local distributor has offered to sell Outdoors, Inc. some additional metal tubing for $0.60/lb. Should Outdoors buy it? If yes, how much would the firm's contribution increase if they bought 500 lbs. and used it in an optimal fashion?
Yes we can increase the upto 555.555 that is our allowable increase

onstraints

Cell	Name	Final Value	S Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
G6	c1	1000	1.166666667	1000	200	466.6666667
G7	c2	866.6666667	0	1200	1E+30	333.3333333
G8	c3	2000	0.8	2000	555.5555556	333.3333333

6. If Outdoors, Inc. feels that it must produce at least 100 benches to round out its product line, what effect will that have on its contribution?
x2=benches
Then we have to add one more constraint which says: X2 >= 100
Max increase for the benches is
So if we make 100 more benches then the loss which the company will be bearing is 100 * 0.68333333 = 68.333
Total profit – loss = 2766.67 – 68.333 = 2698.337
7. The R&D department has been redesigning the bench to make it more profitable. The new design will require 1.1 hours of tube-bending time, 2.0 hours of welding time, and 2.0 lbs. of metal tubing. If it can sell one unit of this bench with a unit contribution of $3, what effect will it have on overall contribution?
Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
G6	c1	1000	1.166666667	1000	200	466.6666667
G7	c2	866.6666667	0	1200	1E+30	333.3333333
G8	c3	2000	0.8	2000	555.5555556	333.3333333

Tube bending: 1.1 * 1.6667
Welding: 2.0 * 0
Metal Tubing: 2 * 0.8
Total = 2.88333
Now, the reduced cost for x2 is -1.383333 Therefore, the contribution is: 2.88333 – 1.38333 = 1.5 per unit of x2

8 . Marketing has suggested a new patio awning that would require 1.8 hours of tube-bending time, 0.5 hours of welding time, and 1.3 lbs. of metal tubing. What contribution must this new product have to make it attractive to produce this season? New Patio awning require 1.8 hours of tube-bending time,
0.5 hours of welding time,
1.3 lbs. of metal tubing. The contribution this new product has to make should be more than the amount and resources we are spending on it. Contribution of new product > 1.8*1.166666667 + 0* 0.5 + 0.8*1.3
Contribution > 3.140000001

9. Outdoors, Inc. has a chance to sell some of its capacity in tube bending at cost + $1.50/hour. If it sells 200 hours at that price, how will this affect contribution?

On selling the time of tube bending, we generate a profit of: 1.50 * 200 = $300
However, when we reduce the time of tube bending available to the company itself, we will affect the profit generated by manufacturing too. That loss will be 1.166667 * 200 = $233.3333
However, in total revenue, we will see a profit of 300 – 233.3333 = 66.6667

10 If the contribution on chairs were to decrease to $2.50, what would be the optimal production mix and what contribution would this production plan give?

The original contribution was $3. The decrease is $0.5 which is within the range for allowable decrease. Therefore, the optimal production mix would remain the same.
New contribution: 2.5 * 700 = $1750