Assignment 2 - Linear Programming Models

Solution 1:

Resource	Resource Usage per Unit of Activity		Amount of Resource Available
	Collegiate	Mini	
Nylon (in ft)	3	2	5000
Time (in hrs)	0.75	0.67	35*40 = 1400
Profit per unit($)	32	24	
Max Sales	1000	1200	

a. Clearly define the decision variables

The no. of collegiate and the no of mini bags that should be produced in a week.

b. What is the objective function?

Objective Function, Maximise Z = 32X + 24Y, X = no. of collegiate bags, Y = no. of Mini bags

c. What are the constraints?

Resources are the constraints.
$3X + 2Y \leq 5000$
$0.75X + 0.67Y \leq 1400$
$X \leq 1000$
$Y \leq 1200$

d. Write down the full mathematical formulation for this LP problem.

$Z = 32X + 24Y$
Subject To
$3X + 2Y \leq 5000$
$0.75X + 0.67Y \leq 1400$
$X \leq 1000$
$Y \leq 1200$
And
$X \geq 0$,
$Y \geq 0$

Solution 2

Resource	Resource Usage per Unit of Activity			Amount of Resource Available Capacity	Resource Available Storage
	Large	Medium	Small		
Plant 1	X_{LP1}	X_{MP1}	X_{SP1}	750	13000
Plant 2	X_{LP2}	X_{MP2}	X_{SP2}	900	12000
Plant 3	X_{LP3}	X_{MP3}	X_{SP3}	450	5000
Profit per unit($)	420	360	300		
Max Sales	900	1200	750		

a. Define the decision variables

How many products of each size Large, Medium, and Small should be produced by each plant to utilize excess capacity and maximize profit.

b. Formulate a linear programming model for this problem.

Maximize P, $Z = 420 X_{LP1} + 360X_{MP1} + 300X_{SP1} + 420X_{LP2} + 360X_{MP2} + 300X_{SP2} + 420X_{LP3} + 360X_{MP3} + 300X_{SP3}$

Subject To: $X_{LP1} + X_{MP1} + X_{SP1} \leq 750$ //Capacity
$X_{LP2} + X_{MP2} + X_{SP2} \leq 900$
$X_{LP3} + X_{MP3} + X_{SP3} \leq 450$
$20X_{LP1} + 15X_{MP1} + 12X_{SP1} \leq 13000$ //Storage
$20X_{LP2} + 15X_{MP2} + 12X_{SP2} \leq 12000$
$20X_{LP3} + 15X_{MP3} + 12X_{SP3} \leq 5000$
$X_{LP1} + X_{LP2} + X_{LP3} \leq 900$ //Sales
$X_{MP1} + X_{MP2} + X_{MP3} \leq 1200$
$X_{SP1} + X_{SP2} + X_{SP3} \leq 750$
$X_{LP1}, X_{LP2}, X_{LP3}, X_{MP1}, X_{MP2}, X_{MP3}, X_{SP1}, X_{SP2}, X_{SP3} \geq 0$