Operation Research Mini Project

A catering company is to make lunch for a business meeting. It will serve ham sandwiches, light ham sandwiches, and vegetarian sandwiches. A ham sandwich has 1 serving of vegetables, 4 slices of ham, 1 slice of cheese, and 2 slices of bread. A light ham sandwich has 2 serving of vegetables, 2 slices of ham, 1 slice of cheese and 2 slices of bread. A vegetarian sandwich has 3 servings of vegetables, 2 slices of cheese, and 2 slices of bread. A total of 10 bags of ham are available, each of which has 40 slices; 18 loaves of bread are available, each with 14 slices; 200 servings of vegetables are available, and 15 bags of cheese, each with 60 slices, are available. Given the resources, how many of each sandwich can be produced if the goal is to maximize the number of sandwiches?

Solution:

Let,

x = No. of ham sandwiches

y = No. of light ham sandwiches

z = No. of vegetarian sandwiches

Max Z = x+y+z

No. of slices of ham = 400

No. of slices of bread = 252

No. of slices of cheese = 900

No. of servings of vegetables = 200

Constraints are,

4x+2y<=400

2x+2y+2z<=252

x+2y+3z<=200

x+2y+2z<=900

Let S1, S2, S3, S4 be slack variables,

4x+2y+0z+S1+0S2+0S3+0S4=400

2x+2y+2z+0S1+S2+0S3+0S4=252

x+2y+3z+0S1+0S2+S3+0S4=200

x+2y+2z+0S1+0S2+0S3+S4=900

Iteration-1		Cj	1	1	1	0	0	0	0	
B	**CB**	**XB**	x	y	z	**S1**	**S2**	**S3**	**S4**	**MinRatio XBx1**
S1	0	400	**(4)**	2	0	1	0	0	0	4004=100→
S2	0	252	2	2	2	0	1	0	0	2522=126
S3	0	200	1	2	3	0	0	1	0	2001=200
S4	0	900	1	2	2	0	0	0	1	9001=900
Z=0		**Zj**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
		Zj-Cj	-1↑	-1	-1	0	0	0	0	

The pivot element is 4.

Iteration-2		Cj	1	1	1	0	0	0	0	
B	**CB**	**XB**	x	y	z	**S1**	**S2**	**S3**	**S4**	**MinRatio XBx3**
x1	1	100	1	0.5	0	0.25	0	0	0	---
S2	0	52	0	1	**(2)**	-0.5	1	0	0	522=26→
S3	0	100	0	1.5	3	-0.25	0	1	0	1003=33.3333
S4	0	800	0	1.5	2	-0.25	0	0	1	8002=400
Z=100		**Zj**	**1**	**0.5**	**0**	**0.25**	**0**	**0**	**0**	

		Zj-Cj	0	-0.5	-1↑	0.25	0	0	0	

The pivot element is 2.

Iteration-3		Cj	1	1	1	0	0	0	0	
B	**CB**	**XB**	**x**	**y**	**z**	**S1**	**S2**	**S3**	**S4**	**MinRatio**
x1	1	100	1	0.5	0	0.25	0	0	0	
x3	1	26	0	0.5	1	-0.25	0.5	0	0	
S3	0	22	0	0	0	0.5	-1.5	1	0	
S4	0	748	0	0.5	0	0.25	-1	0	1	
Z=126		**Zj**	**1**	**1**	**1**	**0**	**0.5**	**0**	**0**	
		Zj-Cj	0	0	0	0	0.5	0	0	

Since all Zj-Cj≥0

Hence, optimal solution is arrived with value of variables as :
x=100,y=0,z=26

Max Z=126

We find that 100 ham sandwiches, 26 vegetarian sandwiches, and 0 light ham sandwiches should be made to maximize the total number of sandwiches made.