

Homework (2) solution:

Task 1:

(a) cost of storing one ton of polystyrene A1: $3 * 200 + 400 * \frac{1}{2} * 300 = 1150 \text{ €}$

Cost of storing one ton of polystyrene A2: $2 * 200 + 2 * 400 + 2 * 300 = 1800 \text{ €}$

(b) the profit made by manufacturing, storing and selling one ton of polystyrene A1: $1950 - 1150 - 600 = 200 \text{ €}$

The profit made by manufacturing, storing and selling one ton of polystyrene A2: $2440 - 1800 - 400 = 240 \text{ €}$

(c) Consider: x_1 : the number of tons produced of polystyrene A1

x_2 : the number of tons produced of polystyrene A2

The objective function: $\text{MAX } (Z) = 200 x_1 + 240 x_2$

Task 2:

$$\text{Max } Z = 200 x_1 + 240 x_2 + 0 e_1 + 0 e_2 + 0 e_3 + 0 e_4 + 0 e_5$$

(a) The production constraints:

$$3 x_1 + 2 x_2 \leq 360$$

$$1 x_1 + 2 x_2 \leq 160$$

$$\frac{1}{2} x_1 + 2 x_2 \leq 120$$

$$x_1 \leq 120$$

$$x_2 \leq 50$$

$$3 x_1 + 2 x_2 + e_1 = 360$$

$$x_1 + 2 x_2 + e_2 = 160$$

$$\frac{1}{2} x_1 + 2 x_2 + e_3 = 120$$

$$x_1 + e_4 = 120$$

$$x_2 + e_5 = 50$$

(b)

$$\text{and } x_1, x_2, e_1, e_2, e_3, e_4, e_5 \geq 0$$

			200	240	0	0	0	0	0	0	MinRatio
C	V	Q	x1	x2	e1	e2	e3	e4	e5		Q/x2
0	e1	360	3	2	1	0	0	0	0	0	360/2=180
0	e2	160	1	2	0	1	0	0	0	0	160/2=80
0	e3	120	1/2	2	0	0	1	0	0	0	120/2=60
0	e4	120	1	0	0	0	0	1	0	0	---
0	e5	50	0	(1)	0	0	0	0	1	0	50/1=50 →
Z=0			0	0	0	0	0	0	0	0	
Cj-Zj			200	240 ↑	0	0	0	0	0	0	

			200	240	0	0	0	0	0	0	MinRatio
C	V	Q	x1	x2	e1	e2	e3	e4	e5		Q/x1
0	e1	260	3	0	1	0	0	0	0	-2	260/3=86.6667
0	e2	60	1	0	0	1	0	0	0	-2	60/1=60
0	e3	20	(1/2)	0	0	0	1	0	0	-2	20/(1/2)=40 →
0	e4	120	1	0	0	0	0	1	0	0	120/1=120
240	x2	50	0	1	0	0	0	0	0	1	---
Z=12000			0	240	0	0	0	0	240		
Cj-Zj			200 ↑	0	0	0	0	0	0	-240	

			200	240	0	0	0	0	0	MinRatio
C	V	Q	x1	x2	e1	e2	e3	e4	e5	Q/e5
0	e1	140	0	0	1	0	-6	0	10	140/10=14
0	e2	20	0	0	0	1	-2	0	(2)	20/2=10→
200	x1	40	1	0	0	0	2	0	-4	---
0	e4	80	0	0	0	0	-2	1	4	80/4=20
240	x2	50	0	1	0	0	0	0	1	50/1=50
Z=20000			200	240	0	0	400	0	-560	
Cj-Zj			0	0	0	0	-400	0	560↑	

			200	240	0	0	0	0	0	MinRatio
C	V	Q	x1	x2	e1	e2	e3	e4	e5	Q/e3
0	e1	40	0	0	1	-5	(4)	0	0	40/4=10→
0	e5	10	0	0	0	1/2	-1	0	1	---
200	x1	80	1	0	0	2	-2	0	0	---
0	e4	40	0	0	0	-2	2	1	0	40/2=20
240	x2	40	0	1	0	-1/2	1	0	0	40/1=40
Z=25600			200	240	0	280	-160	0	0	
Cj-Zj			0	0	0	-280	160↑	0	0	

			200	240	0	0	0	0	0
C	V	Q	x1	x2	e1	e2	e3	e4	e5
0	S3	10	0	0	1/4	-5/4	1	0	0
0	S5	20	0	0	1/4	-3/4	0	0	1
200	x1	100	1	0	1/2	-1/2	0	0	0
0	S4	20	0	0	-1/2	1/2	0	1	0
240	x2	30	0	1	-1/4	3/4	0	0	0
Z=27200			200	240	40	80	0	0	0
Cj-Zj			0	0	-40	-80	0	0	0

Since all $C_j - Z_j \leq 0$

Hence, optimal solution is arrived with value of variables as:

$$x_1 = 100, x_2 = 30$$

$$\text{Max } Z = 27200$$