Page No.
Date

Operational Research (mini project)

Q] A Small city of 15,000 people requires on average of 3 lakhs of gallons of water daily. The city is supplied with water purified at a central water works, where water is purified by filtration, chlorination and addition of two chemicals Softening chemical X and health chemical Y. water works plan to purchase ~~three~~ two popular brands of products, product A and product B, which contain these two elements. One Unit of product A gives 8 kg of X and 3 kg of Y. One Unit of product B gives 4 kg of X and 9 kg of Y. To maintain the water at minimum level of Softness and meet a minimum in health protection, it is decided that 150 kg & 100 kg of two chemicals that make up each product must be added daily. At a cost of Rs. 8/- and Rs. 10/- per unit respectively for A and B, what is the optimum Quantity of each product that should be used to meet Consumer Standard?

→ Min Z = $8x + 10y$

$3x + 9y \geq 100$

$8x + 4y \geq 150$

Max Z = $-8x - 10y$

Page No.
Date

$$\max z = -8x - 10y + 0p + 0q - MA_1 - MA_2$$

$$3x + 9y - 1p + 0q + 1A_1 + 0A_2 = 100$$

$$8x + 4y + 0p - 1q + 0A_1 + 1A_2 = 150$$

Basic variable	CB	Cj / XB	-8 / x	-10 / y	0 / p	0 / q	-M / A_1	-M / A_2	min Ratio
A_1	-M	100	3	9*	-1	0	1	0	11.11
A_2	-M	150	8	4	0	-1	0	1	37.5
		Δj	-11M-8	-13M+10	M	M	0	0	

Basic variable	CB	Cj / XB	-8 / x	-10 / y	0 / p	0 / q	-M / A_2	min Ratio
y	-10	100/9	1/3	1	-1/9	0	0	100/3
A_2	-M	950/9	20/3	0	-4/9	-1	1	95/6
		Δj	$\frac{-20M-34}{3}$	0	$\frac{4M+10}{9}$	M	0	

$R_1 \rightarrow \frac{R_1}{9}$ $\qquad$ $R_2 \rightarrow R_2 - 4R_1$

Basic variable	CB	Cj / XB	-8 / x	-10 / y	0 / p	0 / q	min Ratio
y	-10	35/6	0	1	-2/15	-1/3	
x	-8	95/6	1	0	-1/15	-3/20	
		Δj	0	0	28/15	23/15	

$$x = \frac{95}{6}, \quad y = \frac{35}{6}$$

$$\text{Min } z = 8x + 10y$$

$$= 80\left(\frac{95}{76}\right) + 10\left(\frac{35}{6}\right)$$

$$= \frac{760}{6} + \frac{350}{6}$$

$$= \frac{1110}{6}$$

$$= 185 \text{ //}$$