Digital Assignment 1

optimisation Techniques

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1) Limitations of Operational Research:

i) Dependence of Quantitive Data:

Heavily relies on numerical data & mathematical model. If data is inaccurate, outdated, or unavailable, the result can be misleading

ii) Complexity of models:

The mathematical models used in OR can be very complex and difficult to understand for people without specialized training.

iii) Cost & Time intensive:

Developing & implementing OR models can be costly & time consuming.

iv) Simplifying Assumption:

OR models often make assumptions to simplify real-life problems, These assumption may not always hold true, reducing the effectiveness of the model.

v) Dynamic Environment:

Business environments are constantly changing. OR models may not quickly adapt these changes, leading to decisions that are no longer optimal.

2) Different Techniques of Operations Research:

1) Linear programming:

This technique is used to optimize an objective function subject to certain constaints. It is widely used in production planning, resource allocation & TP.

2) Integer Programming:

Similar to LP, but solutions are restricted to whole numbers. This is useful for problems where factorial values are not practical.

3) Dynamic programming:

Used for multistage decision ~~pbo~~ problems where the solution involves breaking down the problems into smaller sub-problems.

4) Queuing Theory:

This technique studies the behaviour of waiting lines. It is used to optimize service efficiency in banks, hospitals, call centers, etc. by minimizing wait times & improving customer service.

5) Game Theory:

This technique is used in competitive situations where the outcome depends on the actions of multiple decision-makers. It helps in making strategic decisions in business negotiation, pricing or marketing

3) Assuming,

x no of day center 1 run

y " " " center 2 "

$\therefore$ minimize $Z = 40x + 50y$

s.t: $140x + 100y \geq 1540$ ——— (i)

$60x + 180y \geq 1440$ ——— (ii)

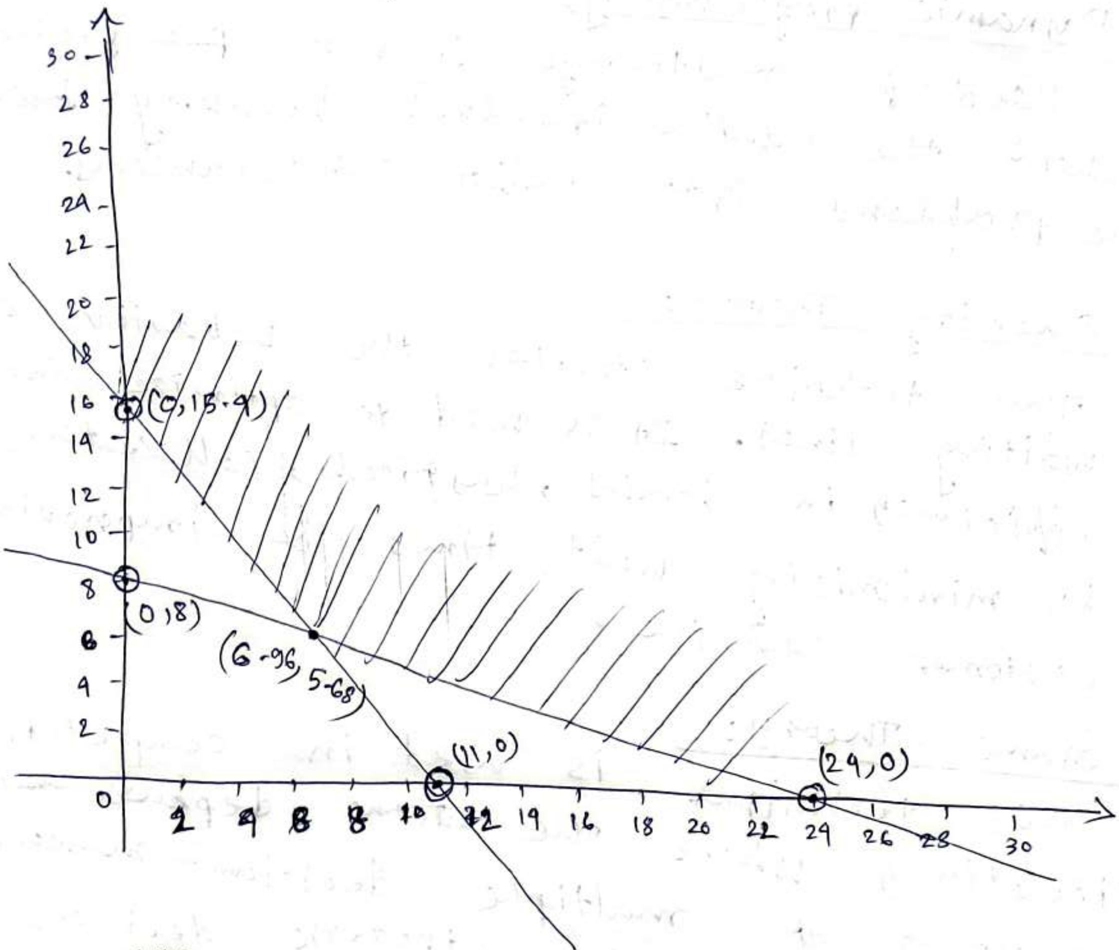
$x, y \geq 0$

(i)

x	11	0
y	0	15.4

(ii)

x	24	0
y	0	8



$8400x + 6000y = 92400$

$8400x + 25200y = 201600$

$-\quad\quad -\quad\quad -$

$19200y = 109200$

$y = 5.68$

$\therefore x = \dfrac{1440 - 180 \times 5.68}{60} = 6.96$

$(0, 15.4) \rightarrow Z = \cancel{500}\ 770$

$(24, 0) \rightarrow Z = 960$

$(6.96, 5.68) \rightarrow Z = 562.4$

$\therefore$ optimal solution, $x = 6.96$
$y = 5.68$

4) Max $Z = 3x + 2y + 0s_1 + 0s_2 + 0s_3$

s.t: $2x + y \leq 18$ $\quad x, y \geq 0$
$2x + 3y \leq 42$
$3x + y \leq 24$

$2x + y + s_1 + 0s_2 + 0s_3 = 18$
$2x + 3y + 0s_1 + s_2 + 0s_3 = 42$
$3x + y + 0s_1 + 0s_2 + s_3 = 24$

	C_j		3	2	0	0	0	
C_B	x_b	b	x	y	s_1	s_2	s_3	min ratio
0	s_1	18	2	1	1	0	0	9
0	s_2	42	2	3	0	1	0	21
0	s_3	24	$\boxed{3}$	1	0	0	1	8
	Z_j	0	0	0	0	0	0	
	$Z_j - C_j$		-3	-2	0	0	0	

$(42, 2, 3, 0, 1, 0) - 2(8, 1, 1/3, 0, 0, 1/3)$

$\Rightarrow 26, 0, 7/3, 0, 1, -2/3$

$(18, 2, 1, 1, 0, 0) - 2(8, 1, 1/3, 0, 0, 1/3)$

$\Rightarrow 2, 0, 1/3, 1, 0, -2/3$

		C_j	3	2	0	0	0	
C_B	x_B	B	x	y	S_1	S_2	S_3	min ratio
0	S_1	2	0	$\boxed{1/3}$	1	0	$-2/3$	6
0	S_2	26	0	$7/3$	0	1	$-2/3$	11
3	x	8	1	$1/3$	0	0	$1/3$	24
	Z_j	24	3	1	0	0	1	
	$Z_j - C_j$	X	0	-1	0	0	1	

$(26, 0, 7/3, 0, 1, -2/3) - 7/3\,(6, 0, 1, 3, 0, -2)$

$\rightarrow 12, 0, 0, -7, 1, 5/3$

$(8, 1, 1/3, 0, 0, 1/3) - 1/3\,(6, 0, 1, 3, 0, -2)$

$\rightarrow (6, 1, 0, -1, 0, 1)$

		C_j	3	2	0	0	0	
C_B	x_B	B	x	y	S_1	S_2	S_3	min ratio
2	y	6	0	1	3	0	-2	—
0	S_2	12	0	0	-7	1	$\boxed{4}$ $\cancel{5/3}$	$\cancel{12}\,4 \times 3/5 = 2.4$
3	x	6	1	0	-1	0	1	$6/1 = 6$
	Z_j	30	3	2	3	0	-1	
	$Z_j - C_j$	X	0	0	3	0	-1	

		C_j	3	2	0	0	0	
C_B	x_B	B	x	y	S_1	S_2	S_3	min ratio
2	y	12	0	1	$-1/2$	$1/2$	0	
0	S_3	3	0	0	$-7/4$	$1/4$	1	
3	x	3	1	0	$3/4$	$-1/4$	0	
	Z_j	33	3	2	$5/4$	$1/4$	0	
	$Z_j - C_j$	X	0	0	$5/4$	$1/4$	0	

$(6, 0, 1, 3, 0, -2) + 2(3, 0, 0, -7/4, 1/4, 1)$

$\rightarrow (12, 0, 1, -1/2, \frac{1}{2}, 0)$

$(6, 1, 0, -1, 0, 1) - (3, 0, 0, -7/4, 1/4, 1)$

$\rightarrow (3, 1, 0, 3/4, -1/4, 0)$

$\therefore$ $\boxed{\text{max } Z = 33}$ it is the optimal solution.

5) Min $Z = 12x_1 + 16x_2$

s.t: $x_1 + 2x_2 \leq 40$ $\quad x_1 \geq 0$

$x_1 + x_2 \leq 30$ $\quad x_2 \geq 0$

$\therefore$ Max $Z = -12x_1 - 16x_2 + 0S_1 + 0S_2$

s.t: $x_1 + 2x_2 + S_1 + 0S_2 = 40$

$x_1 + x_2 + 0S_1 + S_2 = 30$

		C_J	-12	-16	0	0	min
C_B	x_B	B	x_1	x_2	S_1	S_2	ratio
0	S_1	40	1	2	1	0	
0	S_2	30	1	1	0	1	
	Z_J	0	0	0	0	0	
	$Z_J - C_J$	X	+12	+16	0	0	

$Z_J - C_J \geq 0$ $\quad \therefore$ max $Z = 0$

$\therefore x_1 \ \& \ x_2 = 0$

$\therefore$ The solution is unbounded basic feasible solution.