Department of Statistics & Operations Research
College of Science
King Saud University
Advances in Operations Research
Mid Examination
Semester 461 (9/10/2024) / Course Coordinator: Prof. Sameh Askar

Time: 2 hours
Semester: First
Date: 06/04/1446
Course: Math 507

[Exam's total mark=30] / Exam content: Parametric, Goal and Fractional Programming

Answer only three questions from the following questions (Two pages)

Q1: Study the variation in the optimum solution with the parameter α where $-\infty < \alpha < \infty$ for the following L.P.P.,

$$\begin{aligned} \underset{x_1,x_2}{\text{Max}}\, Z &= (4-10\alpha)x_1 + (8-4\alpha)x_2 \\ \text{s.t.} \quad & x_1 + x_2 \le 4, \\ & 2x_1 + x_2 \le 3-\alpha \\ & x_1, x_2 \ge 0. \end{aligned}$$

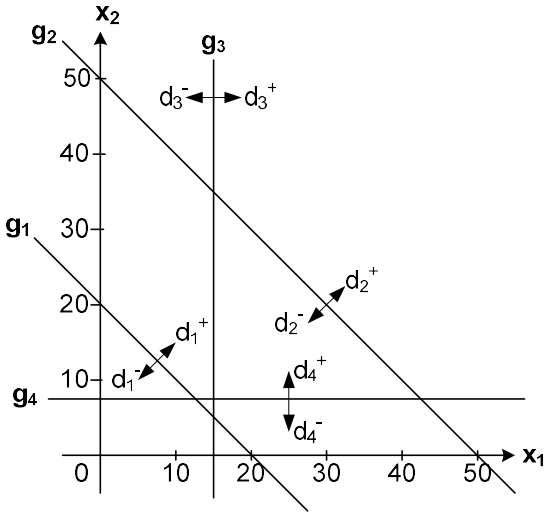
Where, at $\alpha = 0$ the optimum solution is given in the following table,

	c_j	4	8	0	0	
c_B	BV	x_1	x_2	x_3	x_4	b
0	x_3	-1	0	1	-1	1
8	x_2	2	1	0	1	3
Z_j		16	8	0	8	$Z = 24$
$\bar{c}_j = c_j - Z_j$		-12	0	0	-8	

Where, x_3 and x_4 are slack variables.

Q2: Solve the following linear goal programming using graphical method. Use the graph below to get the optimum solution.

$$\begin{aligned} \text{Min}\, Z = & \left(d_3^+ + d_4^+, d_1^+, d_2^-, d_3^- + \frac{8}{5}d_4^-\right) \\ s.t. \quad & g_1: x_1 + x_2 + d_1^- - d_1^+ = 20, \\ & g_2: x_1 + x_2 + d_2^- - d_2^+ = 50, \\ & g_3: x_1 + d_3^- - d_3^+ = 15, \\ & g_4: x_2 + d_4^- - d_4^+ = 20, \\ & x_1, x_2, d_1^+, d_1^-, d_2^+, d_2^-, d_3^+, d_3^-, d_4^+, d_4^- \ge 0 \end{aligned}$$



Where, the four goals (g_1, g_2, g_3 and g_4) are written in order of priority.

Q3: Use the modified simplex method by Lee to solve the following goal programming problem,

$$\begin{aligned} \text{Min } Z &= P_1 d_1^- + P_2(2d_2^- + d_3^-) + P_3 d_1^+ \\ s.t. \quad & P_1: x_1 + x_2 + d_1^- - d_1^+ = 400, \\ & P_2: x_1 + d_2^- = 240, \\ & P_3: x_2 + d_3^- = 300, \\ & x_1, x_2, d_1^+, d_1^-, d_2^-, d_3^- \geq 0 \end{aligned}$$

Q4: Use the standard simplex method to solve the following linear fractional programming problem,

$$\begin{aligned} \text{Min } Z(x_1, x_2) &= \frac{-2x_1 + x_2 + 2}{x_1 + 3x_2 + 4}, \\ s.t. \quad & -x_1 + x_2 \leq 4, \\ & 2x_1 + x_2 \leq 14, \\ & x_2 \leq 6, \\ & x_1, x_2 \geq 0 \end{aligned}$$

End of Exam-Good Luck