

**Operations Research
Class Test 1**

Max Time: 60 min

Marks: 10

(1) Automobile traffic from three highways, H1, H2, and H3, must stop and wait for a green light before exiting to a toll road. The tolls are \$3, \$4, and \$5 for cars exiting from H1, H2, and H3, respectively. The traffic flow rates from H1, H2, and H3 are 500, 600, and 400 cars per hour. The traffic light cycle should not exceed 132 seconds, and the green light on any highway must be at least 25 seconds. The yellow light is on for 10 seconds. The toll gate can handle a maximum of 510 cars per hour. Assuming no cars move on yellow, formulate a linear programming problem to find the optimal green time interval for the three highways that will maximize toll gate revenue per traffic cycle. [4]

(2) Maximize $Z = x_1 + 3x_2$ [3]
 Subject to
 $x_1 + x_2 \leq 2$ (resource 1)
 $-x_1 + x_2 \leq 4$ (resource 2)
 x_1 unrestricted and $x_2 \geq 0$

- (a) Determine all the basic solutions of the problem, and classify them as feasible and infeasible.
- (b) Solve the problem graphically to find the optimal solution of the problem.

(3) Consider the following LP [3]

Maximize $Z = 2x_1 + 4x_2 + 4x_3 - 3x_4$

Subject to

$x_1 + x_2 + x_3 = 4$

$x_1 + 4x_2 + x_4 = 8$

$x_1, x_2, x_3, x_4 \geq 0$

(a) If the problem is solved using Big-M method, write the initial simplex table, and identify the entering and leaving variables.

(b) If x_3 and x_4 are the initial basic variables, apply simplex algorithm to find the optimal solution of the problem.

