

Department of Mathematics
MTL 103 (Optimization Methods and Applications)
Minor Exam 1

Time: 1 hour
Max. Marks: 20

Date: 07/02/18

Note: The exam is closed-book, and all the questions are compulsory.

✓ Q.1 A farm is engaged in breeding pigs. The pigs are fed on various products grown on the farm. In view of the need to ensure certain nutrient constituents (say X, Y, Z), it is necessary to buy two additional products, say A and B . One unit of product A contains 36 units of X , 3 units of Y and 20 units of Z . One unit of product B contains 6 units of X , 12 units of Y and 10 units of Z . The minimum requirement of X, Y and Z is 108 units, 36 units and 100 units respectively. Product A costs Rs. 20 per unit and product B costs Rs. 40 per unit. Formulate the above problem as a linear programming problem to minimize the total cost, and solve the problem using graphical method.

(6 marks)

✓ Q.2 (a) Obtain all basic feasible solutions to the following polyhedron

$$\begin{aligned}x_1 + 2x_2 + x_3 &= 4 \\ 2x_1 + x_2 + 5x_3 &= 5 \\ x_1, x_2, x_3 &\geq 0\end{aligned}$$

✓ (b) Consider a polyhedron

$$\begin{aligned}x_1 + x_2 &\leq 1 \\ -x_2 + x_3 &\leq 0 \\ x_1, x_2, x_3 &\geq 0.\end{aligned}$$

(2.5 marks)

Show that $(1, 0, 0)$ is a degenerate basic feasible solution of the polyhedron. Is degeneracy of $(1, 0, 0)$ depends on the representation of the polyhedron?

(2.5 marks)

✓ Q.3 Find the set of all optimal solutions of the following linear programming problem

$$\begin{aligned}\max \quad & 2x_1 + 4x_2 \\ \text{s.t.} \quad & x_1 + 2x_2 \leq 5 \\ & x_1 + x_2 \leq 4 \\ & x_1 \geq 0, x_2 \geq 0.\end{aligned}$$

(4 marks)