



NATIONAL OPEN UNIVERSITY OF NIGERIA
University Village, Plot 91, Cadastral Zone, Nnamdi Azikwe Express Way, Jabi-Abuja

FACULTY OF SCIENCES
DEPARTMENT OF MATHEMATICS
2025_2 EXAMINATIONS

Course Code: MTH309

Course Title: Optimization Theory

Time Allowed: 3 Hours

Total: 70 Marks

Instructions: ATTEMPT QUESTION ONE (1) AND ANY OTHER THREE (3) QUESTIONS

1. A manufacturer produces two types of models M_1 and M_2 . Each model of the type M_1 requires 4 hours of grinding and 2 hours of polishing; whereas each model of the type M_2 requires 2 hours of grinding and 5 hours of polishing. The manufacturer has 2 grinders and 3 polishers. Each grinder works 40 hours a week and each polisher work for 60 hours a week. Profit on M_1 model is \$3.00 and on model M_2 is \$4.00. Whatever is produced in a week is sold in the market. How should the manufacturer allocate his production capacity to the two types of models, so that he may make the maximum profit in a week?

(22 marks)

2. Solve the following linear programming problem (LLP) by graphical method

$$\text{Minimize } z = 20x_1 + 10x_2$$

$$\text{Subject to } x_1 + 2x_2 \leq 40$$

$$3x_1 + x_2 \geq 30$$

$$4x_1 + 3x_2 \geq 60$$

$$x_1, x_2 \geq 0$$

(16 marks)

3. Maximize $4x_1 + 3x_2$

$$x_1 - 6x_2 + x_3 = 5$$

$$3x_1 + x_4 = 11$$

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

(16 marks)

4. Obtain the initial basic feasible solution of the transportation problem whose cost and rim requirement table is given below.

Origin/Destination	D_1	D_2	D_3	Supply
O_1	2	7	4	5
O_2	3	3	1	8
O_3	5	4	7	7
O_4	1	6	2	14
Demand	7	9	18	34

(16 marks)

5. Find the optimal integer solution to the LLP

$$\text{Max } z = x_1 + x_2$$

$$\text{Subject to: } 3x_1 + 2x_2 \leq 5$$

$$x_2 \leq 2$$

$$x_1, x_2 \geq 0 \text{ and are integers.}$$

(16 marks)