NATIONAL OPEN UNIVERSITY OF NIGERIA,

PLOT 91, CADASTRAL ZONE, UNIVERSITY VILLAGE, JABI – ABUJA

FACULTY OF SCIENCES

2021_1 EXAMINATION

COURSE CODE: CIT 425
COURSE TITLE: OPERATIONS RESEARCH
CREDIT: 3 UNITS
TIME ALLOWED: 2 HOURS 30 MINUTES
INSTRUCTION: ANSWER QUESTION ONE (1) AND ANY OTHER FOUR (4)

QUESTION ONE (22 MARKS) COMPULSORY

1a. Define Operations research hence itemize any four (4) basic facts about Operations Research you know (6 marks)
1b. Describe the term Modelling as an Operations Research Concept (5 marks)
1c. Explain what is meant by a linear program (6 marks)
1d. Explain using appropriate illustrations how to construct a model (5 marks)

2a. A manufacturer produces 4 different products: *X*1, *X*2, *X*3, and *X*4. There are 3 inputs to this production process which are:

(i) labour in person-weeks
(ii) kilograms of raw material A
(iii) boxes of raw material B

Each product has different input requirements. In determining each week's production schedule, the manufacturer cannot use more than the available amounts of labor and the two raw materials.

Inputs	X_1	X_2	X_3	X_4	Input Availabilities
Person-Weeks	1	2	1	2	20
Kilograms of Material A	6	5	3	2	100
Boxes of Material B	3	4	9	12	75
Production Levels	x_1	x_2	x_3	x_4	
Price per Unit	6	4	7	5	

If the goal is to maximize the total revenue, formulate this as a mathematical optimization problem showing the cost function and the constraints. (8 marks)
2b. Itemize any four (4) business areas where Linear Programming finds application (4 marks)

3a. State the four (4) basic properties of linear programming models (4 marks)
3b. Outline the steps involved in finding the solutions to an Integer programming problem using the Cutting-Plane algorithm (6 marks)
3c. Describe Transportation Problem in optimization (2 marks)

4. Solve completely the following Linear Programming Problem (12 marks)

$$\begin{aligned} \text{minimize} \quad & -2x1 - 4x2 - x3 - x5 + x6 \\ \text{subject to} \quad & x1 + 3x2 + x5 - x6 + x7 = 4 \\ & 2x1 + 3x2 + x8 = 6 \\ & x2 + 4x3 + x5 - x6 + x9 = 3 \\ & x1, x2, x3, x5, x6, x7, x8, x9 \geq 0 \end{aligned}$$

5. Use simplex method to solve the following Linear Programming Problem (12 marks)

$$\begin{aligned} \text{maximize} \quad & 2x1 + 4x2 + x3 + x4 \\ \text{subject to} \quad & x1 + 3x2 + x4 \leq 4 \\ & 2x1 + 3x2 \leq 6 \\ & x2 + 4x3 + x4 \leq 3 \\ & x1, x2, x3 \geq 0 \\ & x4 : \text{unrestricted} \end{aligned}$$

6a. Use a suitable diagram to represent the general form of a transportation problem for "m" sources and "n" destination as a generalized network model (4 marks)
6b. What is the difference between a Probabilistic and Deterministic mathematical model? (4 marks)
6c. Describe the two (2) available methods used for solving integer programming problems (4 marks)