



**NATIONAL OPEN UNIVERSITY OF NIGERIA**  
**PLOT 91 CADASTRAL ZONE, NNAMDI AZIKWE EXPRESSWAY, JABI, ABUJA**  
**FACULTY OF SCIENCES**  
**DEPARTMENT OF COMPUTER SCIENCE**  
**2022\_1 EXAMINATIONS.**

**COURSE CODE: CIT425**

**COURSE CREDIT: 3**

**COURSE TITLE: OPERATIONS RESEARCH**

**ALLOWED: 2<sup>1</sup>/<sub>2</sub> HOURS**

**INSTRUCTION: ANSWER QUESTION ONE (1) AND ANY OTHER (4) QUESTIONS**

- 1a. State the purpose of Operational Research, **2marks**
- 1b. What are the Limitations of Operations Research **4marks**
- 1c. Explain the three components that make up LP model **3marks**
- 1d. what are the Properties of Linear Programming Model **4marks**
- 1e. Briefly explain the following concepts: i.) Stage, ii) state, iii) forward and backward recursive approach **4marks**
- 1f. Differentiate between balanced and unbalanced transportation problems, and state what may lead to the unbalanced condition and how it may be handled. **5marks**
- 2a. In which business areas may Operations Research be applied? **4 marks**
- b. Nigeria Coal Corporation (NCC) operates three mines in Enugu. The ore from each mine is separated into two grades before it is shipped. The daily production capacities of the mines, as well as their daily operating costs, are as follows:

	HG-Ore	LG-Ore	Daily Op Cost
Onyeama	4	6	20,000
Iva	6	6	22,000
Aria	1	6	18,000

NCC wants to deliver 50 tons of H-grade ore and 60 tons of L-grade ore by the end of the week. NCC pays employees' full day's pay for each day or fraction of a day the mine is open. Compute the number of days each mine should operated during in a week if NCC is to fulfil its commitment at minimum total cost. **8marks**

- 3a. Differentiate between these Models: i.) Static and Dynamic, ii.) Analytic and Simulation **4marks**
- b. Peace Company transports refrigerator units from factories in Lagos and Onitsha to distribution centres in Abuja and Kano. Given the transport costs as in the table below, derive the linear programming model **8marks**

source	destination	Transport cost
Lagos	Abuja	N30
	Kano	N40
Onitsha	Abuja	N60
	Kano	N50

The supply and demand, in number of units, is shown below:

Supply	Demand
Lagos, 200	Abuja, 300
Onitsha, 600	Kano, 400

- 4a. Write the steps taken to solve a linear programming (LP) problem graphically? **4marks**  
b. Use the graphical method to find feasible and optimum solutions to the following problem **8marks**

Maximize:  $z = 5x_1 + 4x_2$

Subject to:

$$6x_1 + 4x_2 \leq 24$$

$$x_1 + 2x_2 \leq 6$$

$$-x_1 + x_2 \leq 1$$

$$x_2 \leq 2$$

$$x_1, x_2 \geq 0 \quad (\text{none negative values for the variables})$$

- 5a. Given the LP problem below: **7 ½ marks**

Maximize:  $z = 5x_1 + 4x_2$

Subject to:

$$6x_1 + 4x_2 \leq 24$$

$$x_1 + 2x_2 \leq 6$$

$$-x_1 + x_2 \leq 1$$

$$x_2 \leq 2$$

$$x_1, x_2 \geq 0 \quad (\text{none negative values for the variables})$$

- i.) Use appropriate slacks to restate(write) the simplex form of the problem **2½ marks**  
ii.) Set up the starting simplex table **2½ marks**  
iii.) Without any computations write out the Basic and Nonbasic variables, and the solutions from the table from **2½ marks**

- 5b. Write the steps followed to formulate the model of any optimization problem? **4½ marks**

- 6a. Summarize the steps in formulation and solution of Dynamic Programming problems **5marks**

- 6b. Write the algorithms for Vogel's approximation method **7marks**