NATIONAL OPEN UNIVERSITY OF NIGERIA

Plot 91, University Village Cadastral Zone, Nnamdi Azikiwe Express Way, Jabi-Abuja.

FACULTY OF COMPUTING
DEPARTMENT OF COMPUTER SCIENCE
2024_2 EXAMINATION

Course Code: CIT756
Course Title: OPERATIONS RESEARCH
Credit Unit: 2 units
Instruction: Answer question **ONE** and any other two (2) questions **Time:** 2hrs

1a. Discuss the term Operations Research. **[5 marks]**

b. Enumerate the stages in Operations Research **[5 marks]**

c. State the role of Operations Research in business **[5 marks]**

d. A manufacturing company has divided its total target market into three zones. The Company's marketing department has been collecting data regarding the deployment of salesmen and the sales made in each zones. They have realized that the sales are directly dependent upon the number of salesmen in each zone. The data collected by the company is given in the table below. For various reasons, the company has decided to retain only 9 salesmen during the next year. Determine the allocation of these salesmen to these three different zones, so that the total sales cab net is maximized. **[15 marks]**

No. of Salesmen	Profits in Thousands of Naira		
	Zone 1	Zone 2	Zone 3
0	35	40	45
1	40	50	50
2	45	65	60
3	60	75	70
4	70	85	80
5	80	95	90
6	90	100	100
7	105	105	110
8	100	100	120
9	90	105	100

2a. State the Primal dual property and outline the steps involved **[5 Marks]**

b. A calculator company produces a scientific calculator and a graphing calculator. Long-term projections indicate an expected demand of at least 100 scientific and 80 graphing calculators each day. Because of limitations on production capacity, no more than 200 scientific and 170 graphing calculators can be made daily. To satisfy a shipping contract, a total of at least 200 calculators must be shipped each day.If each scientific calculator sold results in a N2 loss, but each graphing calculator produces a N5 profit, how many of each type should be made daily to maximize net profits? **[15 marks]**

3. Big Bros. Inc. is an investment company doing an analysis of the pension fund for a certain company. A maximum of #10 million is available to invest in two places. No more than #8 million can be invested in stocks yielding 12% and at least #2 million can be invested in long-term bonds yielding 8%. The stock-to-bond investment ratio cannot be more than 1to 3. How should Big Bros. advise their client so that the pension fund will receive the maximum yearly return on investment?
Formulate the required LP model. **[20 marks]**

4a. State and explain the principle of Optimality **[5 marks]**

b. An army unit required 200 men, 20 junior commission officer (JCO's) and 10 officers. Men are recruited at the age of 18 and JCO's and officers are selected out of these. If they continue in service, they retire at the age of 40. At present there are 800 Igbo and every year 20 of them retires. How many Igbo should be recruited every year and at what age promotions should take place? **[15 marks]**

5. A company presently operates three manufacturing plants that distribute a product to four warehouses. Currently, the capacity of the plants and the demands of the warehouses are stable. These are listed with the unit shipping costs in the following table below
Find the optimal distribution plan for the company? **[20 marks]**

PLANTS	WAREHOUSES				MONTHLY CAPACITY
	A	B	C	D	
X	3	16	9	2	40
Y	1	9	3	8	20
Z	4	5	2	5	50
Monthly Demands	25	25	42	8	110 / 100