National Open University of Nigeria
Plot 91, Cadastral Zone, Nnamdi Azikwe Express Way, Jabi – Abuja

Faculty of Sciences
October/November Examination 2016

Course Code: CIT 425
Course Title: Operation Research
Credit Unit: 3
Time Allowed: 2 Hours

Instruction: Answer Any 4 Questions

1. (a)Discuss the term; Operation Research. (4) Marks)
   (b) List and explain three approaches in the analysis and interpretation of business problem**.** **(**7marks **)**
   (c) Enumerate and explain the various steps involved in the scientific approach to an operation research problem. . (6.5 Marks)

2. (a) Briefly explain the following terms:
      i. Modeling
      ii. Models. (4 Marks)
   (b) List and explain at least four types of Models used in operation research. (6 Marks)
   (c) Outline and explain five classes of Mathematical Model. (7.5 Marks)

3. (a) Using a suitable table, summarize the common prototypes: their nature, model and the techniques for handling each of these prototypes. (7 Marks)

   (b) A convalescent hospital wishes to provide at a minimum cost, a diet that has a minimum of $200g$ of carbohydrates, $100g$ of protein and $120g$ of fats per day. These requirements can be met with two foods:

Food	Carbohydrates	Protein	Fats
A	$10g$	$2g$	$3g$
B	$5g$	$5g$	$4g$

If food A cost $29k$ per gram and food B cost $15k$ per gram, how many grams of each food should be purchased for each patient per day in order to meet the minimum requirements at the lowest cost?

Formulate the Linear Programming model. (10.5 Marks)

4. (a) State and explain the principle of Optimality (5 Marks)

(b) 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.
Find the optimal distribution plan for the company (12.5 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

5. (a) What is Linear Programming. Enumerate five assumptions in Linear Programming. (7 Marks)

(b) TRAX Ships a certain refrigerator unit from factories in Lagos and Onitsha to distribution centres in Abuja and Kano. Shipping costs are summarized in the table below:

Source	**Destination**	**Shipping 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

How should transportation issue be made from Lagos and Onitsha to minimize the transportation cost? (10.5 Marks)

6. (a) Explain Vogel's Approximation Method. Outline the algorithm involved in this method. (7marks)

(b) 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. (10.5 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