NATIONAL OPEN UNIVERSITY OF NIGERIA
14/16 AHMADU BELLO WAY, VICTORIA ISLAND, LAGOS
SCHOOL OF SCIENCE AND TECHNOLOGY
MARCH/APRIL 2014 EXAMINATION

COURSE CODE: CIT 756

COURSE TITLE: OPERATIONS RESEARCH

TIME ALLOWED: 3 HOURS

INSTRUCTION: *Answer any five questions.*

1 Using the Simplex method, Solve the linear programming.

Max $x_1 + x_2$

Subject to: $2X_1 + X_2 \leq 4$

$X_1 + 2X_2 \leq 3$

With: $X_1 \geq 0, X_{\geq} \geq 0$

2a. What do you understand by modeling and models? 5 marks

b. The sales manager of Turnover Limited maintains he could increase the sales turnover (in units) of any of the company's product by 50 percent if he was authorized to give a 10% price discount and place appropriate additional advertising matter. The Board wishes to know the maximum additional advertising expense they can incur in respect of any given product without the manager's proposal resulting in a smaller profit. 9 marks

3a. Discuss the Vogel's Approximation Method, clearly enumerating the algorithm involved in this method.
5marks

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 Onitsha, 600	Abuja, 300 Kano, 400

How should transportation issue be made from Lagos and Onitsha to minimize the transportation cost? (9 Marks)

4. 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. 14 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

5 The sales manager of Turnover Limited maintains he could increase the sales turnover (in units) of any of the company's product by 50 percent if he was authorized to give a 10% price discount and place appropriate additional advertising matterThe Board wishes to know the

maximum additional advertising expense they can incur in respect of any given product without the manager's proposal resulting in a smaller profit14 marks

6. (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 (9 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

7. A farmer has 100 acres on which to plant two crops: corn or wheat. To produce these crops, there are certain expenses as shown in the table.

Item	Cost per Acre (¿)¿
Corn	
Seed	12
Fertilizer	58
Planting/care/ harvesting	50
Total	120
Wheat	
Seed	40

Fertilizer	80
Planting/care/ harvesting	90
Total	210

After the harvest, the farmer must store the crops awaiting proper market conditions. Each acre yields an average of 110 bushels of corn or 30 bushels of wheat. The limitations of resources are as follows:

Available capital: $¿15,000$.

Available storage facilities: $4,000$ bushels.

If net profit (the profit after all expenses have been subtracted) per bushel of corn is $¿1.30$ and for wheat is $¿2.00$, how should the farmer plant the 100 acres to maximize the profits?

14 marks