NATIONAL OPEN UNIVERSITY OF NIGERIA

UNIVERSITY VILLAGE, 91 CADASTRAL ZONE, NNAMDI AZIKWE EXPRESSWAY, JABI, ABUJA
FACULTY OF SCIENCE
2021_1 EXAMINATION

COURSE CODE: CIT756
COURSE TITLE: Operations Research
CREDIT: 2 Units
TIME ALLOWED: 2 Hours
INSTRUCTION: Answer Question ONE (1) and any other Three (3) Questions

1 (a) Identify the key functions witnessed in each of the following eras toward the development of Operation Research [*5 marks]*

(i) First industrial revolution (ii) Second World War (iii) Post Second World War

1(b) List Five (5) business areas where Operation Research is applied. *[5 marks]*

1 (c) Identify Seven (7) steps involved in finding solution to integer programming problems using the cutting-plane algorithm. *[7 marks]*

1(d) Outline the implication of the North-west corner method of transportation problem and state its algorithm *[5 marks]*

1(e) The minimum, normal and maximum usage of an inventory are 500, 800,and 1000 respectively. The lead time varying between 3 to 9 weeks both an average of 6 and the normal ordering quantity (EOQ) is 5,000. Find:

(i) .Re-order level. *[1 mark]*

(ii).Minimum level *[1.5 marks]*

(iii). Maximum level *[1.5 marks]*

2(a) State the main similarities between an analogic model and an iconic model *[3 marks]*

2(b) XYZ Ltd produces four products P1, P2, P3and P4. Each one of these products has to be processed on three machines X, Y, Z. The capacity of the machines and the time required to manufacture one of each type of products are shown in the table below:

Product	Processing Time of Production		
	Machine X	Machine Y	Machine Z
P1	2	4	3

P2	3	2	2
P3	4	1	2
P4	3	1	1
Capacity (hrs)	800	600	420

The profit contribution/unit of products P1, P2, P3and P4are Rs, 8, 8, 6, 4, and 2 respectively. Formulate a LP model for the above and show the initial simplex Table *[12 marks]*

3(a) Write an algorithm showing the stages of operation research [7 marks]

3 (b) A 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	Carbohydrate	Protein	Fats
A	10g	2g	3g
B	5g	5g	4g

If food Acost 29k per ounce and food B cost 15k per ounce, how many ounces of each food should be purchased for each patient per day in order to meet the minimum requirements at the lowest cost? Formulate a linear programming model for this.*[8 marks]*

4(a) State the 4 steps involved in reading the solution values for the primal from the optimal solution table of the dual *[4marks]*

(b) Explain the steps Involved in Calculation of Replacement Policy when Money Value Changes [5 marks]

(c) Analyse the merits of integer programming [6 marks]

5(a) A Multinational Company (MNC) is planning to invest in four different projects in Business Process Outsourcing (BPO) industry in an important town in the North. The details of the investment of MNC (in thousands of naira) are provided below:

Project	Present Value of Expected Return	Capital requirements for 3 years		
		1	2	3
A	800	600	500	550
B	550	900	400	-
C	400	300	200	400
D	250	400	150	100
Funds available for investment	1500	1200	700	500

It is also known that projects A and B are mutually exclusive. However, Project D can only be accepted if project C is acceptable due to technology constraints. Which project should the MNC accept to maximise their present value of expected returns? *[5 marks]*

5(b) Differentiate [with an example] between Linear programming and Integer programming

[4 marks]

5(c) List the steps involved in Dynamic programming