



# NATIONAL OPEN UNIVERSITY OF NIGERIA

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

## FACULTY OF SCIENCES

### DEPARTMENT OF COMPUTER SCIENCE

#### 2022\_1 EXAMINATION

**Course Code:** CIT756

**Course Title:** OPERATIONS RESEARCH

**Credit Unit:** 3 units

**Instruction:** Answer Question one and other three (3) questions **Time:** 3hrs

1. a. Define Operations Research [**5 marks**]
- b. List the stages in Operations Research [**5 marks**]
- c. An investment consultant has four projects with different investments and present value of expected returns. Funds available for investment during the three proposals are also available. The detailed information regarding the project is as follows.

Project	Investment during year			PV of expected return
	1	2	3	
P <sub>1</sub>	1,000,000	600,000	500,000	800,000
P <sub>2</sub>	500,000	200,000	400,000	700,000
P <sub>3</sub>	300,000	250,000	350,000	400,000
P <sub>4</sub>	400,000	300,000	260,000	300,000
Funds for investment	1,800,000	1,000,000	800,000	

Formulate an integer programming model for the consultant to make a decision as to which project should be accepted in order to maximise present value of expected return. [**15 marks**]

2. A special diet for a patient in the hospital must have at least 8000 units of vitamins, 100 units of minerals and 2800 units of calories. Two types of foods X and Y are available in the market at the cost of #8 and #6 respectively. One unit of X contains 40 units of vitamins, 2 units of minerals and 80 units of calories. One unit of food B contains 200 units of vitamins, 4 units of minerals and 80 units of calories. What combination of foods X and Y can be used so that the minimum requirement of vitamins, minerals and calories is maintained and the cost incurred by the hospital is minimised? **[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 1 to 3. How should Big Bros. advise their client so that the pension fund will receive the maximum yearly return on investment? You are required to formulate the required LP model **[15 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 can be 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

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 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. **[15 marks]**

6. 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
<b>Total</b>	<b>120</b>
Wheat	
Seed	40
Fertilizer	80
Planting/care/harvesting	90
<b>Total</b>	<b>210</b>

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? **[15 marks]**