**MURANG'A UNIVERSITY COLLEGE**

*A constituent college of Jomo Kenyatta University of Agriculture and Technology*

***University Examination 2015/2016***

**END OF SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY YEAR 3 SEMESTER 1**

**BIT 2212: BUSINESS SYSTEM MODELLING**

**DATE: 9TH DECEMBER 2015** **TIME: 2 HOURS**

**Instructions:** Answer question **One** and **Two** other questions

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**Question One (30 Marks)**

a) (i) Explain briefly the term 'Operations Research'. (2 Marks)

(ii) Name two broad areas of application of Operations Research in management'.

(2 Marks)

(iii) Operations Research is sometimes referred to as 'Management Science'. Explain.

(2 Marks)

b) A company makes two types of paint: exterior and interior. The profit(per tonne) is $5000 and $4000 for exterior and interior paint respectively. To produce the paint, two raw materials have to be used as follows:

Material M1:6 tonnes per tonne of exterior paint and 4 tonnes per tonne of interior paint.

Material M2:1 tonne per tonne of exterior paint and 2 tonnes per tonne of interior paint.

The daily availability of the raw materials M1 and M2 is limited to 24 tonnes and 6 tonnes respectively. Formulate the linear programming problem to maximize the company's daily profit.

(5 Marks)

c) Use a graphical method to determine the optimal solution to the following problem:

Maximize: $z = 3x_1 + 5x_2$

Subject to: $x_1 \leq 4$

$$x_2 \leq 6$$

$$3x_1 + 2x_2 \leq 18$$

$$x_1 \geq 0, x_2 \geq 0$$ (6 Marks)

d) Describe the steps involved in decision making. (4 Marks)

e) Briefly explain the different decision rules usually adopted in context of decision making under uncertainty. (4 Marks)

f) Explain what is meant by the term 'queue discipline' and describe some forms of common queue disciplines giving examples for illustration.

(5Marks)

**Question Two (20 Marks)**

a) Highlight the various conditions that a managerial problem must meet in order to be modeled into a LP model. (6 Marks)

b) A furniture manufacturing company plans to make two products – chairs and tables – from its available resources, which consists of 400 board feet of Mahogany timber and 450 man – hours of labour. The company knows that to make a chair requires 5 board feet and 10 man – hours and yields a profit of Rs.45 while each table uses 20 board feet and 15 man – hours and has a profit of Rs.80. Formulate the problem to maximize the profit and use the Simplex method to determine how many chairs and tables the Company can make keeping within its resource constraints. Give the optimal profit.

(14 Marks)

**Question Three (20 Marks)**

a) A computer maintenance contract is to be signed by your company office. At an average, three computers per month go off road due to various defects. The cost of a computer being unavailable is Rs 8000 per month. Two companies have bid for the contract. Alfa computers has quoted at Rs 3000 per month whereas Beta Bytes has quoted at Rs 5000 per month for the contract. Enquiries reveal that Alfa computers has an average repair capability of 5 computers per month and Beta Bytes can repair 6 computers per month at an average. Carry out suitable calculation to determine who should be given the contract. (8 Marks)

b) A construction company wants cement at three of its project sites P1, P2 and P3. It procures cement from four plants C1, C2, C3 and C4. Transportation costs per tonne, capacities and requirements are as follows:

| | P1 | P2 | P3 | Capacity(tones) |
|---|---|---|---|---|
| C1 | 2 | 7 | 4 | 50 |
| C2 | 3 | 3 | 1 | 80 |
| C3 | 5 | 4 | 7 | 70 |
| C4 | 1 | 6 | 2 | 140 |
| Requirement | 70 | 90 | 180 | 340 |

Determine optimal allocation of requirements. (12 Marks)

**Question Four (20 Marks)**

a) Explain the various environments under which decisions can be made. (7 Marks)

b) A merchant buys strawberries for Rs 20 per case and sells them for Rs 50 per case. As strawberries are highly perishable, any unsold quantity must be thrown away at the end of the day. The past 100 days sales are given below:

| Daily sales(cases) | 10 | 11 | 12 | 13 |
|---|---|---|---|---|
| Number of days | 15 | 20 | 40 | 25 |

Calculate how many cases the merchant should stock at the beginning of the day.

(8 Marks)

c) Mohan is a confectioner. He buys plastic boxes in bulk and uses them to pack his chocolates. His annual requirement of boxes is 1200 and each box costs him Rs 30. He has estimated that his ordering costs are Rs 10 per order and his carrying costs are 20 per cent.

How many boxes should he order at a time so as to minimize his expenses? (5 Marks)

**Question Five (20 Marks)**

A project has the following time schedule:

| Activity | Time in months | Activity | Time in months |
|---|---|---|---|
| 1 – 2 | 2 | 4 – 6 | 3 |
| 1 – 3 | 2 | 5 – 8 | 1 |
| 1 – 4 | 1 | 6 – 9 | 5 |
| 2 – 5 | 4 | 7 – 8 | 4 |
| 3 – 6 | 8 | 8 – 9 | 3 |
| 3 – 7 | 5 | | |

a) (i) Draw a network for the project (5 Marks)

(ii) Compute the critical path and its duration. (2 Marks)

(iii) Compute the total float for each activity. ( 5 Marks)

b) Find the minimum number of cranes the project must have for its activities 2 – 5 , 3 – 7, and 8 – 9 without delaying the project. (8 Marks)