TECHNICAL UNIVERSITY OF MOMBASA

UNIVERSITY EXAMINATIONS 2015/2016

EXAMINATION FOR THE DEGREE OF BACHELOR OF COMMERCE

BMS 4405: OPERATIONS RESEARCH II

END OF SEMESTER EXAMINATIONS

SERIES: SEPTEMBER 2016

DATE: SEPTEMBER 2016 B **DURATION:** 2 HOURS

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY OTHER TWO

QUESTION ONE

(a.) Explain the

(i.) M-method **(4 marks)**

(ii.) Two-phase method **(4 marks)**

of solving the **LP** problem

(b.) Give a summary of the steps used in the Two-phase method **(6 marks)**

(c.) (i.) Use the two-phase method to solve the **LP** problem:

$$\text{Minimize } z = 4x_1 + x_2$$

Subject to

$$
\begin{aligned}
&3x_1 + x_2 = 3\\
&4x_1 + 3x_2 \geq 6\\
&x_1 + 2x_2 \leq 4\\
&x_1, x_2 \geq 0
\end{aligned}
$$

Find the basic feasible solution **(10 marks)**

(ii.) Find the optimal solution **(6 marks)**

QUESTION TWO

(a.) The states of a Markov Chain can be classified based on the transition probability p_{ij} of **P.** Explain the following statements:

(i.) A state j is absorbing **(2 marks)**

(ii.) A state j is transient **(2 marks)**

(iii.) A state j is recurrent **(2 marks)**

(iv.) A state j is periodic **(2 marks)**

(b.) (i.) Define the steady-state probability in an Ergodic Markov Chain **(2 marks)**

(ii.) Explain the term "mean first return time" **(2 marks)**

(c.)(i.) Determine the steady-state probability distribution, given the transition matrix

$$
P = \begin{pmatrix} 0.3 & 0.6 & 0.1 \\ 0.1 & 0.6 & 0.3 \\ 0.05 & 0.4 & 0.55 \end{pmatrix}
$$

(4 marks)

(ii.) Compute the mean first return time **(4 marks)**

QUESTION THREE

(a.) Give the three basic elements of the Dynamic Programming Model **(3 marks)**

(b.) Describe the Knapsack/Fly-Away kit/Cargo-Loading Model **(6 marks)**

(c.) A 4-ton vessel can be loaded with one or more of three items. The following table gives the unit weight, w_i, in tons and the unit revenue in thousands of dollars, r_i, for item *i*.

Item i	w_i	r_i
1	2	31
2	3	47
3	1	14

Determine the number of units of each item that will maximize the total return **(11 marks)**

QUESTION FOUR

(a.) Describe the shortest-route problem **(2 marks)**

(b.) Describe the Dijkstra's Algorithm for determining the shortest routes between the source node and every other node in the network **(8 marks)**

(c.) The network in Figure 1-1gives the permissible routes and their lengths in kilometres between city 1 and four other cities (nodes 2 to 5).

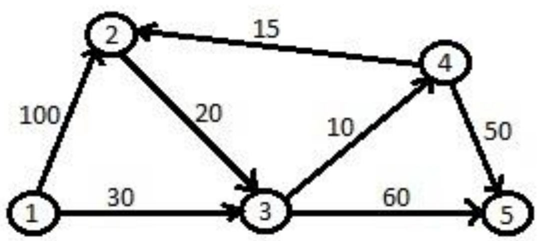

Fig 1-1: Network for Dijkstra's shortest-route algorithm

Determine the shortest routes between city 1 and each of the remaining four cities

(10 marks)

QUESTION FIVE

(a.) Describe the general constrained nonlinear programming problem **(4 marks)**

(b.) Describe the separable programming as a method to solve non-linear problems **(4 marks)**

(c.) Use separable programming to solve the problem

Maximize $z = x_1 + x_2^4$

subject to

$$3x_1 + 2x_2^2 \le 9$$
$$x_1, x_2 \ge 0$$

(12 marks)