CHUKA UNIVERSITY

UNIVERSITY EXAMINATIONS

SECOND YEAR EXAMINATION FOR THE AWARD OF MASTER OF BUSINESS ADMINISTRATION (OPERATION MANAGEMENT)

MSOM 822: OPERATIONS RESEARCH

STREAMS: MBA (Y2S1) **TIME: 3 HOURS**

DAY/DATE: WEDNESDAY 07/04/2021 **2.30 P.M. – 5.30 P.M.**

INSTRUCTIONS: Answer question ONE and any other THREE questions

Q1. (a) Discuss any five benefits of using the linear programming technique to solve business problems [10 marks]

(b) Discuss any five characteristics of a dual problem in linear programming [10 marks]

(c) Explain any five decision variables in the analysis of queuing problems [10 marks]

(d) Write the dual problem of the following linear programming problem

Minimize $Z=5x_1-6x_2+4x_3$

Subject to the following constraints

$3x_1+4x_2+6x_3\geq 9$

$x_1+3x_2+2x_3\geq 5$

$7x_1+2x_2+x_3\leq 10$

$x_1+2x_2+4x_3\geq 4$

$2x_1+5x_5-3x_3\geq 0$

$x_1 \quad x_1 \quad x_3 \quad \geq 0$ [10 marks]

2. (a) Explain the steps in solving linear programming problems using the simplex method [4 marks]

(b) A firm produces three types of pumps A, B and C. Each of them passes through three processes turning, drilling and assembly as shown below:

	Processing time (hrs) per pump			
Type of pump	Turning	Drilling	Assembly	Profit per Pump (000)
A	2	4	1	3
C	4	2	1	4
C	3	1	2	5
Total time available in hours	80	48	40	12

Required:

(i) Formulate the problem as a linear programming problem [4 marks]

(ii) Determine the output of each pump to maximize profit using the simplex method [12 marks]

3. (a) Discuss any five areas of application of the Markov process [5 marks]

(b) A company produces three products that compete in the same market. The market research department has estimated the state transition matrix for the products to be

$$\begin{pmatrix} 0.1 & 0.2 & 0.1 \\ 0.4 & 0.5 & 0.1 \\ 0.3 & 0.1 & 0.6 \end{pmatrix}$$

Initially the three products share the available market as follows

Product A – 50%

Product B – 20%

Product C – 30%

It is assumed that the conditions of a first order Markov process will apply

Required:

(i) The market shares of the products in the first two periods [6 marks]

(ii) The market shares of the product as equilibrium [9 marks]

4. (a) Discuss the assumptions of a single phase single channel queuing system [8 marks]

(b) Workers of a factory come to a tool store to enquire about the special tools that they require for a particular job. The average time between the arrivals is 60 seconds and the arrivals are assumed to be in poison distribution. The average service time is 40 seconds. Using the assumptions of a single phase single channel queuing model, calculate

(i) The percentage of time the facility is idle [3 marks]

(ii) The average queue length [3 marks]

(iii) The average number of worker in the system [2 marks]

(iv) The mean waiting time of an arrival [2 marks]

(v) The average waiting time in the system [2 marks]

5. (a) Explain any reasons why managers may resort to using the simulation process in decision making [8 marks]

(b) Discuss the process of Monte Carlo simulation [7 marks]

(c) Give any five limitations of using simulation in decision making [5 marks]

6. (a) Discuss any five benefits in using network analysis to manage projects [5 marks]

(b) Give any three assumptions in crashing of projects [3 marks]

(c) A project consists of the following activities

	Normal		**Crash**	
Activity	**Time**	**Cost**	**Time**	**Cost**
1-2	3	300	2	400
2-3	3	30	3	30
2-4	7	420	5	580
2-5	9	720	7	810
3-5	5	250	4	300
4-5	0	0	0	0
5-6	6	320	4	410
6-7	4	400	3	470

6-8	13	780	10	900
7-8	10	1000	9	1200

Required:

(i) Draw a network diagram for the project [4 marks]

(ii) Determine the normal project duration and cost [2 marks]

(iii) Crash the relevant activities systematically and determine the optimum time and cost [6 marks]
