TECHNICAL UNIVERSITY OF MOMBASA

UNIVERSITY EXAMINATIONS DECEMBER 2016

EXAMINATION FOR THE DEGREE OF
BACHELOR OF COMMERCE YR4 SEM1

BMS 4401: MODEL BUILDING IN MATHEMATICAL PROGRAMMING

DATE: DECEMBER 2016 **DURATION:** 2 HOURS

ANSWER QUESTION ONE AND ANY OTHER TWO

QUESTION ONE

a) Distinguish between the following types of mathematical models ;
   i. Standard and custom made models (3 marks)
   ii. Optimizing and Descriptive models (3 marks)
   iii. Probabilisticand deterministic models (3 marks)

b) An engineering factory can produce five types of product (PROD 1, PROD 2, . . . , PROD 5) by using two production processes: grinding and drilling. After deducting raw material costs, each unit of each product yields the following contributions to profit:

PROD 1	PROD 2	PROD 3	PROD 4	PROD 5
£550	£600	£350	£400	£200

Each unit requires a certain time on each process. These are given below (in hours). A dash indicates when a process is not needed.

	PROD 1	PROD 2	PROD 3	PROD 4	PROD 5
Grinding	12	20	–	25	15
Drilling	10	8	16	–	–

In addition, the final assembly of each unit of each product uses 20 hours of an employee's time. The factory has three grinding machines and two drilling machines and works a six-day week with two shifts of 8 hours on each day. Eight workers are employed in assembly, each working one shift a day.

Required: Formulate an LP to maximize the total profit contribution (10 marks)

c) Explain the following terms as used in Network models

i. Normal duration (2marks)

ii. Crash limits (2 marks)

iii. Normal cost (2marks)

d) Briefly explain the syntax rules that guide development of an AMPL model (5 marks)

QUESTION TWO

a) Briefly describe the main steps involved in formulation of a linear programing problem (10 marks)

b) Write a mathematical structure of a linear programing problem (5 marks)

c) "Model building is said to be a scientific process involving interactions between real world and conceptual word''. Use a relevant diagram to explain this statement (5 marks)

QUESTION THREE

a) A food is manufactured by refining raw oils and blending them together. The raw oils come in two categories:

Vegetable oils	VEG 1
	VEG 2
Non-vegetable oils	OIL 1
	OIL 2
	OIL 3

Vegetable oils and non-vegetable oils require different production lines for refining. In any month, it is not possible to refine more than 200 tons of vegetable oil and more than 250 tons of non-vegetable oils. There is no loss of weight in the refining process and the cost of refining may be ignored.

There is a technological restriction of hardness in the final product. In the units in which hardness is measured, this must lie between 3 and 6. It is assumed that hardness blends linearly. The costs (per ton) and hardness of the raw oils are

	VEG 1	VEG 2	OIL 1	OIL 2	OIL 3
Cost	£110	£120	£130	£110	£115
Hardness	8.8	6.1	2.0	4.2	5.0

The final product sells for £150 per ton.

Required: Formulate an LP in order to maximize the net profit (10 marks)

b) Explain any twolimitations of linear programing models (4 marks)

c) Explain the three components of a linear programing model (6 marks)

QUESTION FOUR

Use the table below to answer the questions that follow

Activity	Duration in days	Activity	Duration in days
1-2	3	3-6	7
1-3	8	6-7(Dummy)	0
2-4 (dummy)	0	6-8(Dummy)	0
2-7	1	7-9	5
3-4(dummy)	0	8-9	6
3-8	2	9-10	8
4-5	4	10-11	9

Required;

a) Draw a network from the activity (8 marks)
b) Find the critical path (7 marks)
c) Find the duration of the project (5 marks)

QUESTION FIVE

Uwingu ltd. has two products cloud and wind. To produce one unit of cloud, 2 units of material X and 4 units of material Y are required. To produce one unit of wind, 3 units of material x and 2 units of material Y are required. As the raw material of material Y are in short supply so not more than 16 units of material X can be used. At least 16 units of material y must be used in order to meet the committed sales of the cloud and wind. Cost per unit of material X and Y are sh. 2.50 and .25 respectively. The selling price per unit of cloud and wind are sh.12 and sh. 16 respectively

Required:

a) Formulate the mathematical model (8 marks)
b) Solve the model graphically for maximum contribution (12 marks