Uva Wellassa University
Faculty of Management
Degree of Bachelor of Business Management in Entrepreneurship and Management
SECOND YEAR FIRST SEMESTER EXAMINATION –JULY/AUGUST 2016
ENM 261-2 Operations Research

Instructions to candidates:
No. of pages : Four (04)
No. of questions : Five (05) Essay
Time allocation : Two (02) Hours
Marks allocated : 100 Marks
Answer only four (04) questions.
Question paper is not to be removed from the examination hall.

Index Number:

01. Pahan Traders produces two (02) types of food products, Product A and Product B using three (03) distinct processes; mixing, producing and packing. The estimated times required in hours for each product in each process are summarized below.

	Product A	**Product B**
Mixing	5	4
Producing	10	3
Packing	2	2

The production manager has estimated that the total time available for the next quarter will be 3,400 hours of mixing, 4,500 hours of producing and 2,000 hours of packing for both products. Further, at least 100 units of product B should be manufactured in a quarter to satisfy the established customers' requirements. Apart from this all the stocks produced can be sold.

The contribution to profit and the fixed overheads per unit is Rs.375 for product A and Rs.750 for product B.

You are required to;

i) Construct the linear programming model for this situation to determine the optimal production plan (07 Marks)

ii) Determine the optimal production plan using the graphical method of solving a linear programming problem (15 Marks)

iii) Calculate the expected contribution for the next quarter (03 Marks)

(Total Marks - 25)

02. Melwa Company is a concrete manufacturer who has three plants located in three different places. The company is supposed to transport concrete for X, Y and Z destinations where three projects are undergoing. The table below shows the quantity demanded by each destination and the quantity supplied by each production plant and the respective cost of transporting (in dollers) one ton of concrete from each plant to each destination.

	X	Y	Z	Supply
Plant A	12	16	20	150
Plant B	14	22	22	175
Plant C	8	10	24	275
Demand	200	100	300	

The company wishes to find out the number of tones to be transported from each plant to each destination in order to minimize the total transportation cost.

You are required to;

i) Derive the objective function. (04 Marks)

ii) State the supply and demand constraints. (06 Marks)

iii) Determine the initial basic solution using North West Corner (NWC) Rule (05 Marks)

iv) Find out the optimal solution by using Modified Distribution (MODI) method. (10 Marks)

(Total Marks - 25)

03.

i) A software development center is planning to develop five (5) application programs. There are six (06) expert programmers who could develop these programs. The Chief Executive Officer of the Software Development Center has collected information on computer time required (in minutes) by each programmer to develop each of program as shown by the following matrix.

		Program				
		S1	**S2**	**S3**	**S4**	**S5**
Experts	**P1**	170	150	130	250	150
	P2	180	156	132	264	156
	P3	150	132	114	228	138
	P4	160	144	120	240	144
	P5	152	128	112	224	136
	P6	145	135	120	140	145

You are required to find how these experts should be assigned to the programs to minimize the total computer time utilization. (15 Marks)

ii) Nawoda Enterprise has four (04) sales representatives to cover four (04) sales districts. The districts have different sales potentials and the sales representatives have different marketing capabilities. The following estimates of monthly sales (in 1000 rupees) of each representative in each district have been provided to you, considering the capabilities of the sales representatives and the nature of the demand of the different districts.

		District			
		A	**B**	**C**	**D**
Sales Representative	**I**	285	260	265	195
	II	320	230	190	150
	III	340	230	180	140
	IV	270	190	90	150

The marketing manager of Nawoda Enterprise is seeking your advice on assigning the sales representatives to the districts in order to maximize the monthly sales revenue. Advise the marketing manager providing the optimal assignment of sales representatives. (10 Marks)

(Total Marks - 25)

04.

i) List the basic assumptions of Economic Order Quantity (EOQ) model. (05 Marks)

ii) A company buys PVC pipes from a manufacturer and distributes to retailers. The company is considering reducing its inventory cost by applying economic order quantity technique in purchasing PVC pipes. The quarterly demand for PVC pipes is 50,000 units, the ordering cost is Rs.1,000 per order, and the carrying cost per annum is 10% on purchase price. The purchase price of each PVC pipe is Rs.1,000.

a. Calculate the Economic Order Quantity (EOQ) (04 Marks)

b. Determine the optimum number of orders to be placed in a year (03 Marks)

c. Calculate the time duration between two consecutive orders (03 Marks)

d. Assume that there is a lead time of 3 business days between the time the company places an order and the time the order is received. If there are 250 business days in a year what is Reorder Point (ROP)? (04 Marks)

iii) Calton manufacturing PLC produces canned fish tins in batches. The firm's estimated demand for the year is 100,000 units. The company operates 200 business

days each year. Hence, the daily demand rate is 500 units. It costs Rs.600 to setup the manufacturing process and the carrying cost is Rs.50 per unit per annum. When the production process has been set up, 600 canned fish tins can be manufactured daily. It costs Rs.50 to produce one canned fish tin. Calculate the Economic Batch Quantity. (06 Marks)

(Total Marks -25)

05. The following table shows a list of activities to be performed in a construction project along with the expected time duration and the immediate predecessor for each activity.

Activity	Expected time (Days)	Immediate predecessor
A	3	--
B	4	A
C	3	B
D	10	B
E	8	B
F	5	D
G	6	F,E
H	8	C,G
I	5	H
J	6	H
K	4	I
L	2	J
M	5	K,L

You are required to;

i) Draw the project network diagram (08 Marks)

ii) Calculate the earliest starting time, the earliest finishing time, the latest starting time and the latest finishing time of each activity (08 Marks)

iii) Calculate the slack time of each activity (04 Marks)

iv) Determine the critical path and normal project duration (05 Marks)

(Total Marks -25)