

Uva Wellassa University
Faculty of Management



Degree of Bachelor of Business Management in Entrepreneurship and Management
SECOND YEAR FIRST SEMESTER EXAMINATION –MAY/JULY 2017

ENM 261-2/ ENM 262-2 Operations Research

Instructions to candidates:

No. of pages : Six (06)
No. of questions : Five (05) Essay
Time allocation : Two (02) Hours
Marks allocated : 100 Marks
Answer **only four (04)** questions.

Index Number:

01.

i) Linear programming is a mathematical technique, which involves the allocation of limited resources in an optimal manner, on the basis of a given criterion of optimality. Linear programming deals with the optimization of a linear objective function subject to a set of linear equalities and/or inequalities known as constrains. Briefly explain the importance of the knowledge of linear programming technique in business decision making. (05 Marks)

ii) Stargrade Producers PLC manufactures & sells three different kinds of products P_1 , P_2 & P_3 in the export market. The budgeted sales of the three products for the next quarter are 150 units, 200 units and 350 units of P_1 , P_2 and P_3 respectively. All three products use the same raw material and labour resource. The raw material and labour requirement of each product and the total amount of availability of such resources for the next quarter are shown in the following table.

Resource	P1	P2	P3	Total Availability
Raw Material (Kg)	5	8	6	4,000
Labour (Hours)	5	5	8	3,000



The production of each product is undergoing in four departments; department A, Department B, Department C and Department D. Following table shows the

production time required for each product in each department to complete the production.

Product	Department A	Department B	Department C	Department D
P1	2	1	1	3
P2	0.5	0.5	2	0.5
P3	0.5	2	1.5	1.5

Each department operates 8 working hours per day for 25 days per month. The contribution per unit of P₁, P₂ and P₃ are Rs.2,500, Rs.2000 and Rs.3,500 respectively.

As per the terms of the contract Stargrade Producers PLC must produce at least 50 units of P₁ and 75 units of P₃.

You are required to;

- a) formulate this production problem as linear programming model to determine the optimal production plan. (10 Marks)
- b) setup the initial simplex tabulea (05 Marks)
- c) state whether the simplex table given in part (b) above provides the optimal answer to the problem. (05 Marks)

(Total Marks - 25)

02.

- i) What is meant by 'unbalanced transportation problem'? (03 Marks)
- ii) State how you would convert an unbalanced transportation problem into a balanced transportation problem (04 Marks)
- iii) What is meant by "degeneracy" in transportation problems (03 Marks)

- iv) You are given the following transportation problem. The table shows the quantity demanded by each destination and the quantity supplied by each origins and the respective cost of transporting one unit from each origin to each destinations.

		Destination				Supply
		D ₁	D ₂	D ₃	D ₄	
Source	O ₁	5	3	9	3	1200
	O ₂	6	5	4	8	1400
	O ₃	10	10	20	7	700
	Demand	400	1000	1100	800	

You are required to;

determine the number of units to be transport from each supply origin to the demand destinations in order to minimize the transportation cost. *(Use the North West Corner Rule for determining the initial basic solution and test the optimality using the stepping stone method)*

(15 Marks)

(Total Marks -25)

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

Activity	Expected time (Days)	Immediate predecessor	Cost (Rs)
A	3	--	50,000
B	4	A	25,000
C	3	B	28,000
D	10	B	13,500
E	8	B	18,500
F	5	D	50,000



G	6	F,E	40,000
H	8	C,G	40,000
I	5	H	25,000
J	6	H	15,000
K	4	I	10,000
L	2	J	15,000
M	5	K,L	10,000

The overhead cost per day will be Rs.500.00

You are required to;

- i) Draw the project network diagram (08 Marks)
 - ii) Calculate the earliest starting time, earliest finishing time, latest starting time and the latest finishing time of each activity (08 Marks)
 - iii) Calculate the total float of each activity (04 Marks)
 - iv) Determine the critical path and normal project duration (02 Marks)
 - v) Calculate the total cost of completing this project (03 Marks)
- (Total Marks-25)

04.

- i) When building a single server waiting line model it is assumed that the customers are patient; no balking, reneging or jockeying and come from a population that can be considered infinite. What is meant by;
 - a) Balking (03 Marks)
 - b) Reneging and (03 Marks)
 - c) Jockeying (03 Marks)
- ii) The main computer lab at Uva Wellassa University has a help desk to assist students working on computer software assignments. On average 8 students per hour arrive at the help desk. The help desk server can help on average 10 students per hour. The students' arrivals can be best described using poisson distribution and the service rate

can be described by an exponential distribution. The students patiently form a single queue in front of the help desk to wait for help and they are served based on first come-first served basis.

You are required to Calculate;

- a) the proportion of time that the help desk is busy serving the students (02 Marks)
- b) the proportion of time that the system will be found idling (02 Marks)
- c) average number of students in the system (02 Marks)
- d) average number of students waiting in the queue (02 Marks)
- e) average time a student spent waiting in the system (02 Marks)
- f) average time a student spent waiting in the queue (02 Marks)
- g) what is the probability of having at least 4 students in the queue. (04 Marks)

(Total Marks -25)

05. Inventory control is one of the important aspects to be considered by any business organizations.

- i) State the reasons for maintaining inventories (03 Marks)
- ii) List the four (04) categories of costs associates with inventories (04 Marks)
- iii) Briefly describe the factors to be considered in inventory analysis (06 Marks)
- iv) A company required 50,000 units to cater its annual demand. The purchase price per unit is Rs.50 and the company spends Rs.150 for placing each order. The carrying cost is 3% of purchase price. You are required to
 - a) calculate the economic order quantity (02 Marks)
 - b) determine the optimal number of orders to be placed per annum (01 Marks)
 - c) ascertain the total ordering and carrying cost (excluding purchase price)

(02 Marks)

- v) The following information is relevant to demand and the lead time of a company purchasing and selling a household equipment.



Demand per working day	Probability
5,000 units	0.3
6,000 units	0.7
Lead Time	
15 working days	0.4
20 working days	0.6

If the current stock levels are maintained at the reorder level of 100,000 units what is the probability of having stock outs? (07 Marks)

(Total Marks -25)