UNIVERSITY EXAMINATIONS 2016/2017

EXAMINATION FOR THE DEGREE OF BACHELOR OF BUSINESS ADMINISTRATION AND BACHELOR OF COMMERCE

BMS 4307: OPERATIONS RESEARCH I

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) i.) Give the steps in the process of solving any LP problem. **(4 marks)**

ii.) Give a definition of Linear Programming. **(3 marks)**

iii.) Give a brief explanation about what is a minimization problem in LP. **(3 marks)**

(b.) A chemical manufacturer processes two chemicals, Akron and Nezon, in varying proportions to produce three products A, B and C. He wishes to produce at least 150 units of A, 200 units of B and 60 units of C. Each ton of Akron yields 3 of A, 5 of B and 3 of C. Each ton of Nezon yields 5 of A, 5 of B and 1 of C.

Akron cost $40 per ton and Nezon $50 per ton:

Required:

i.) Formulate the problem as a linear programming model. **(6 marks)**

ii.) Find the dual formulation of (i.) above. **(6 marks)**

iii.) Find the optimal production point at minimum cost. **(8 marks)**

QUESTION TWO

a.) i.) Give an explanation what Game Theory is. **(4 marks)**

ii.) Explain what is a pure saddle-point solution. **(4 marks)**

b.) Two players, A and B, play the coin-tossing game. Each player, unknown to the other, chooses a head (H) or a tail (T). Both players would reveal their choices simultaneously. If they match (HH or TT), player A receives $1 from B. Otherwise, A pays B $1.

(12 marks)

QUESTION THREE

a.) Define the simplex method of linear programming. **(4 marks)**

b.) A firm produces three products **X**, **Y** and **Z** with a contribution of $20, $18 and $16 respectively. Production data are as follows:

	Per Unit		
Products	**Machine Hours**	**Labour Hours**	**Materials (kgs)**
X	5	2	8
Y	3	5	10
Z	6	3	3
Availability	3,000 Hours	2,500 Hours	10,000 kgs

Required:

i.) Set up the initial Simplex Tableau including the necessary slack variables, and use it to find the optimal solution. **(12 marks)**

ii.) Interpret the final tableau of the simplex solution. **(4 marks)**

QUESTION FOUR

a.) The special structure of the transportation problem allows for securing a non-artificial starting basic solution using one of the three methods. Describe any two of these. **(8 marks)**

b.) Draw a representation of the transportation model with nodes and arcs. **(4 marks)**

b.) A transport company ships truckloads of grain from three silos to four mills. The supply (in truckloads) and the demands (also in truckloads) together with the unit transport costs per truckload on different routes, is shown below. The unit transportation costs, $\mathbf{C_{ij}}$, (shown in the northwest corner of each box) are in hundreds of dollars.

Required:

Find the minimum-cost shipping schedule between the silos and the mills.

Transportation Model

	Mills				
Silos	**1**	**2**	**3**	**4**	**Supply**
1	10 X_{11}	2 X_{12}	20 X_{13}	11 X_{14}	15
2	12 X_{21}	**7** X_{22}	9 X_{23}	20 X_{24}	25
3	4 X_{31}	14 X_{32}	16 X_{33}	18 X_{34}	10
Demand	5	15	15	15	

(8 marks)

QUESTION FIVE

a.) CPM (Critical Path Method) and PERT (Program Evaluation and Review Technique) are network-based methods designed to assist in the planning, scheduling and control of projects. Give a summary of the steps of these techniques and show diagrammatically. **(8 marks)**

b.) Determine the critical path for the project network in the figure below. All the durations are in days. Show forward and backward pass calculations for the project. **(12 marks)**