



B.C.A. (Semester - V) (Revised) Examination, October 2013
NON-COMPUTER SCIENCE (Elective)
Operations Research

Duration : 2 Hours

Max. Marks : 50

- Instructions :** 1) All questions are **compulsory**, however **internal choice** is provided from Q. 2 to Q. 5.
2) **Use of calculators is permitted.**
3) **Graph paper will be provided when asked.**

1. A) Find the dual to the following LPP :

$$\text{Max. } Z = 30x + 20y$$

$$\text{Subject to, } 2x + 3y \leq 45$$

$$4x + 5y \leq 85$$

$$x, y \geq 0.$$

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B) What do you mean by queue priorities or queue disciplines ? List out any three of the various queue priorities.

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C) What is replacement ?

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D) A company management and the labour union are negotiating a new three-year settlement. Each of these has four strategies : I - Hard and Aggressive bargaining ; II - Reasoning and Logical approach ; III - Legalistic strategy ; and IV - Conciliatory Approach. The costs to the company are given for each pair of strategy choice :

		Company Strategies			
		I	II	III	IV
Union Strategies	I	20	15	12	35
	II	25	14	8	10
	III	40	2	10	5
	IV	-5	4	11	0

What strategy will the two sides adopt ? Determine the value of the game.

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P.T.O.



2. A) Solve the following LPP by simplex method :

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$$\text{Max. } Z = 3x + 5y + 4w$$

$$\text{Subject to, } 2x + 3y \leq 8$$

$$2y + 5w \leq 10$$

$$3x + 2y + 4w \leq 15$$

$$x, y, w \geq 0.$$

- B) Use graphical method to solve the following LP problem :

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$$\text{Max. } z = 3x + y$$

$$\text{Subject to, } x + 2y \leq 20$$

$$2x + y \leq 10$$

$$x \leq 5$$

$$y \leq 7$$

$$x, y \geq 0.$$

OR

- II. i) Apply Duality concept for the following minimisation problem and solve the dual :

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$$\text{Min. } z = 40x + 24y$$

$$\text{Subject to, } 20x + 50y \geq 4800$$

$$80x + 50y \geq 7200$$

$$x, y \geq 0.$$

- ii) One unit of product A contributes Rs. 7 and requires 3 units of raw materials and 2 hrs. of labour. One unit of product b contributes Rs. 5 and requires two units of raw material and one hour of labour. Availability of raw material at present is 48 units and that of labour is 40 hours. Formulate this as a linear programming problem and solve it.

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3. A) Describe the Inventory Model with Uniform Demand. 5
B) Obtain the optimal strategy for both persons and the value of the game for the zero-sum two-person game whose pay-off matrix is given below : 5

		Player B	
		B1	B2
Player A	A1	1	-3
	A2	3	5
	A3	-1	6
	A4	4	1
	A5	2	2
	A6	-5	0

OR

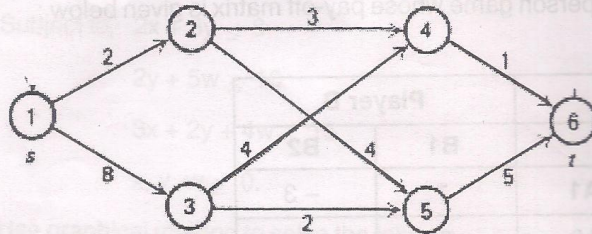
- III. i) XYZ company buys in lots of 500 boxes which is a 3 month supply. The cost per box is Rs. 125 and the ordering cost is Rs. 150. The inventory cost is estimated at 20% of unit value.
- a) What is the total annual cost of the existing inventory policy ?
b) How much money could be saved by employing the economic order quantity ? 5
- ii) Use the notion of Dominance to simplify the rectangular game with the following pay-off and solve it graphically. 5

		Player B			
		I	II	III	IV
Player A	1	18	4	6	4
	2	6	2	13	7
	3	11	5	17	3
	4	7	6	12	2



4. A) Find the shortest route between node 1 and node 6 in the network given below :

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B) Solve the following transportation problem for optimal solution :

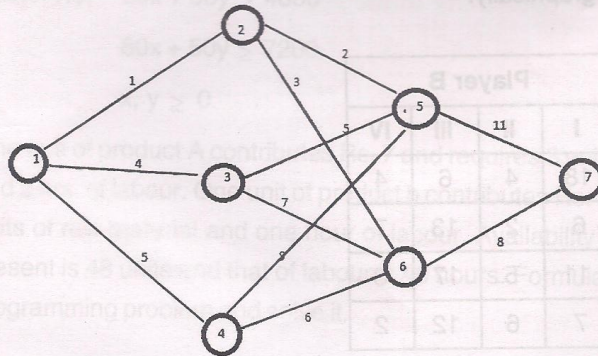
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	P	Q	R	S	T	Supply
A	5	8	6	6	3	8
B	4	7	7	6	5	5
C	8	4	6	6	4	9
Demand	4	4	5	4	8	

OR

IV. i) Use Dynamic Programming to find the shortest path between the two end nodes in the following network diagram :

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- ii) An airline company has drawn up a new flight schedule involving 5 flights. To assist in allocating 5 pilots to the flights, it has asked them to state their preference score by giving each flight a number out of 10. The higher the number, the greater is the preference. Certain of these flights are unsuitable to some pilots owing to domestic reasons. These have been marked with X.

Pilot	Flight Number				
	I	II	III	IV	V
A	8	2	X	5	4
B	10	9	2	8	4
C	5	4	9	6	X
D	3	6	2	8	7
E	5	6	10	4	3

What should be the allocation of the pilots in order to meet as many preferences as possible ?

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5. A) A foreman has to schedule 6 jobs, each of which must be processed on two machines A and B in order AB. Processing time for the jobs in hours are given below :

Jobs	1	2	3	4	5	6
Machine A	2	6	1	7	9	2
Machine B	4	3	4	3	5	5

Decide the sequence in which the jobs must be processed in order to minimize the time elapsed from the start of the first job to the finish of the last job.

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- B) In the modification of a plant layout of a factory, four new machines M, N, O, P are to be installed in a machine shop. There are five vacant places A, B, C, D and E available. Because of the limited space, machine N cannot be placed at C and O cannot be placed at A. The cost of locating machine i to place j (in '000 Rs.) is shown below :

Machines	Places				
	A	B	C	D	E
M	9	11	15	10	11
N	12	9	-	10	9
O	-	11	14	11	7
P	14	8	12	7	8

Find the optimal assignment schedule.

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OR

- V. i) There are five jobs, each of which must go through the machines A, B and C in the order BAC. Each machine can process only one job at a time. Processing time (in hours) is given below :

Jobs	Machine A	Machine B	Machine C
J	5	8	4
K	6	10	9
L	2	6	8
M	3	7	6
N	4	11	5

Determine the sequence for the jobs as to minimise total time required to complete them, and the total time elapsed.

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ii) The distribution of commodity from warehouses A, B, C and D is planned to three sources. P, Q and R the level of surpluses and requirements at various sources are given in the following matrix with related cost of transportation as cells of the matrix :

	P	Q	R	Surpluses
A	2	7	4	5
B	3	3	1	8
C	5	4	7	7
D	1	6	2	14
Requirements	7	9	18	-

Work out the optimal cost of distribution.