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IV Semester B.C.A. Examination, May/June 2018
(CBCS) (F+R) (2015-16 and Onwards)
COMPUTER SCIENCE
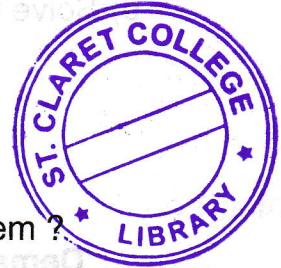### BCA – 405 : Operations Research

Time : 3 Hours　　　　　　　　　　　　　　　　Max. Marks : 100

Instruction : *Answer all the Sections.*

SECTION – A

I. Answer **any 10** of the following. **Each** question carries **2** marks.　　(10×2=20)

1. What is operations research ?
2. What is meant by optimal solution ?
3. Explain the steps involved in transportation problem.
4. Define artificial variable with example.
5. What are the different methods in solving assignment problem ?
6. How to calculate critical path ?
7. Explain Fulkerson's rule.
8. Define slack and surplus variable.
9. Explain the rule of determine saddle point.
10. Write any two applications of assignment problem.
11. Define : i) Total elapsed time　ii) Idle time.
12. Explain the rule of dominance.

SECTION – B

II. Answer **any four** of the following :　　　　　　　　　　(4×10=40)

13. a) List and explain the various phases of operations research.　　5

　　b) An agricultural research institute suggested the farmer to spread out atleast 4800 kgs of special phosphate fertilizer and not less than 7200 kg of a special nitrogen fertilizer to race the productivity of crops in his fields. There are two sources of obtaining these-mixtures A and mixtures B. Both of these are available in bags weighing 100 kg each and they cost Rs. 40 and Rs. 24 respectively. Mixture A contains phosphate and nitrogen equivalent of 20 kg and 80 kg respectively, while mixture B contains these ingradients equivalent to 50 kg each. Write this as an LPP and determine how many bags of each type the farmer should buy inorder to obtain the required fertilizer at minimum cost.　　5

14. a) Explain the steps of graphical method to obtain an optimal solution in a linear programming problem. **4**

b) Solve the following LPP by graphical method. **6**
Maximize $z = 10x_1 + 8x_2$
Subject to constraints
$2x_1 + 3x_2 \leq 30$
$x_1 - 2x_2 \geq -15$
$x_1, x_2 \geq 0$

15. a) Explain Hungarian method for solving assignment problem. **4**

b) Solve the transportation problem by using MODZ method. **6**

	I	II	III	IV	Supply
A	15	10	17	18	2
B	16	13	12	13	6
C	12	17	20	11	7
Demand	3	3	4	5	

16. a) Explain degeneracy in transportation problem. **4**

b) Use Vogel's approximation method to obtain an initial basic feasible solution of the given transportation problem. **6**

		Destination				
		D_1	D_2	D_3	D_4	Supply
Factory	F_1	3	3	4	1	100
	F_2	4	2	4	2	125
	F_3	1	5	3	2	75
Demand		120	80	75	25	300

17. A small project consists of seven activities for which the relevant data are given below : **10**

Activity	Preceding Activities	Activity Duration
A	—	4
B	—	7
C	—	6
D	A, B	5
E	A, B	7
F	C, D, E	6
G	C, D, E	5

i) Draw the network and find the project completion time.

ii) Calculate total float for each of the activities.

18. Solve the following game using dominance method to reduce the matrix, write the strategies adopted by each player and value of game.   10

		Y_1	Y_2	Y_3	Y_4	Y_5
		B_1	B_2	B_3	B_4	B_5
X_1	A_1	4	4	2	– 4	– 6
X_2	A_2	8	6	8	– 4	0
X_3	A_3	10	2	4	10	12

SECTION – C

III. Answer **any four** of the following :   (4×10=40)

19. a) Compare between assignment problem and transportation problems.   4

   b) Solve the following LPP using Simplex Method.   6

   Maximize $z = 3x_1 + 2x_2$

   Subject to constraints

   $x_1 + x_2 \leq 4$

   $x_1 - x_2 \leq 2$

   $x_1, x_2 \geq 0$

20. Use Big M Method to solve   10

   Minimize $z = 4x_1 + 3x_2$

   Subject to

   $2x_1 + x_2 \geq 10$

   $- 3x_1 + 2x_2 \leq 6$

   $x_1 + x_2 \geq 6$

   $x_1, x_2 \geq 0$

21. a) Luminus camps has three factories F_1, F_2 and F_3 with production capacity 30, 50 and 20 units per week respectively. These units are to be shipped to four warehouses W_1, W_2, W_3 and W_4 with requirements 20, 40, 30 and 10 units per week respectively. The transportation costs (in Rs.) per unit between factories and warehouses are given below :

Factory	Warehouse				Supply
	W_1	W_2	W_3	W_4	
F_1	1	2	1	4	30
F_2	3	3	2	1	50
F_3	4	2	5	9	20
Demand	20	40	30	10	

Find the initial basic feasible solution of the given transportation problem using North West corner rule.　**5**

b) Give mathematical formulation of a transportation problem.　**5**

22. a) Mention the types of assignment problem. Describe the methods of an assignment problem.　**5**

b) Solve the assignment problem given below :　**5**

	A	B	C	D
I	1	4	6	3
II	9	7	10	9
III	4	5	11	7
IV	8	7	8	5

23. a) Difference between PERT and CPM.　**4**

b) Calculate the earliest start, earliest finish, least start, least finish of each activity of the project given below :　**6**

Activity	1 – 2	1 – 3	2 – 4	2 – 5	3 – 4	4 – 5
Duration (in days)	8	4	10	2	5	3

24. a) Explain the following terms :
   i) Pay off matrix　ii) Fair game　iii) Strategy.　**(2+2+2=6)**

b) Solve the following game whose payoff matrix is given below :　**4**

$$\begin{vmatrix} 9 & 3 & 1 & 8 & 0 \\ 6 & 5 & 4 & 6 & 7 \\ 2 & 4 & 3 & 3 & 8 \\ 5 & 6 & 2 & 2 & 1 \end{vmatrix}$$