4/3/20

K20P 0074

Reg. No. : .....

Name : .....

IV Semester M.Sc. Degree (CBSS-Reg./Suppl./Imp.) Examination, April 2020
COMPUTER SCIENCE
MCS 4E08 : Operations Research
(2014 Admission Onwards)

Time : 3 Hours Max. Marks : 80

Instructions : *1) Answer **any ten** questions from Section – **A**. **Each** question carries **three** marks.*

*2) Answer **all** questions from Section – **B**. **Each** question carries **ten** marks.*

SECTION – A

Note : Answer **any ten** questions. **Each** question carries **three** marks.

1. Define the following :
   i) Feasible solution ii) Basic feasible solution.
2. Define degenerate solution in Linear Programming Problem.
3. When can the dual Simplex method be applied ?
4. How does a travelling salesman problem differ from a routine assignment model ?
5. Explain Hungarian algorithm.
6. Define a stage in dynamic programming.
7. Define the main characteristics of the queuing system.
8. What are the behaviours of customer in a queuing model ?
9. What is meant by critical path ?
10. What are the applications of Integer Programming ?
11. Explain branch and bound technique.
12. Illustrate the formation of duality from the given primal problem. **(10×3=30)**

P.T.O.

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SECTION – B

Note : Answer **all** questions. **Each** question carries **ten** marks.

13. a) A firm manufactures two types of products A and B and sells them at a profit of Rs. 2 on type A and Rs. 3 on type B. Each product is processed on two machines G and H. Type A requires one minute of processing time on G and two minutes on H. Type B requires one minute on G and one minute on H. The machine G is available for not more than 6 hours 40 minutes while H is available for 10 hours during any working day. How many items of type A and type B should be produced so that the total profit is maximum ?

i) Use mathematical formulation to the LPP.

ii) Use graphical method to solve the problem. **10**

OR

b) Using Simplex method, solve the LPP.

Maximize $Z = 4x_1 + 3x_2 + 6x_3$

Subject to $2x_1 + 3x_2 + 2x_3 \leq 440$

$4x_1 + 3x_3 \leq 470$

$2x_1 + 5x_2 \leq 430$

$x_1, x_2, x_3 \geq 0$ **10**

14. a) Use dual Simplex method to solve the LPP.

Maximize $Z = -3x_1 - 2x_2$

Subject to $x_1 + x_2 \geq 1$

$x_1 + x_2 \geq 7$

$x_1 + 2x_2 \geq 10$

$x_2 \geq 3$

$x_1, x_2 \geq 0$ **10**

OR

b) The transportation costs per truck load of cement (in hundreds of rupees) from each plant to each project site are as follows :

Factories		Project sites				
		P1	P2	P3	P4	Supply
	F1	2	3	11	7	6
	F2	1	0	6	1	1
	F3	5	8	15	9	10
	Demand	7	5	3	2	

Determine the optimal distribution for the company so as to minimize the total transportation cost.

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15. a) Solve the following integer programming problem using cutting plane algorithm.

Maximize $Z = 2x_1 + 20x_2 - 10x_3$

Subject to the constraints $2x_1 + 20x_2 + 4x_3 \leq 15$

$6x_1 + 20x_2 + 4x_3 = 20$

$x_1, x_2, x_3 \geq 0$ and are integers. **10**

OR

b) Use Branch and Bound method to solve the following LPP.

Maximize $Z = x_1 + 4x_2$

Subject to $2x_1 + 4x_2 \leq 7$

$5x_1 + 3x_2 \leq 15$

$x_1, x_2 \geq 0$ and are integers. **10**

16. a) A project schedule has the following characteristics :

Activity	Time (Weeks)	Activity	Time (Weeks)
1-2	4	5-6	4
1-3	1	5-7	8
2-4	1	6-8	1
3-4	1	7-8	2
3-5	6	8-10	5
4-9	5	9-10	7

i) Construct the network.

ii) Compute E and L foe each event.

iii) Find the critical path. **10**

OR

b) There are seven jobs, each of which has to go through the machines A and B in the order AB. Processing times in hours are given as :

Job :	1	2	3	4	5	6	7
Machine A :	3	12	15	6	10	11	9
Machine B :	8	10	10	6	12	1	3

Determine a sequence of these jobs that will minimize the total elapsed time T. Also find T and idle time for machines A and B.

17. a) Write a note on :

i) Discrete parameter Markov chain

ii) Continuous parameter Markov chain. **(5+5)**

OR

b) Explain in detail about the Queuing model and its characteristics. **10**

(5×10=50)

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6/3/19

K19P 0073

Reg. No. : .....

Name : .....

IV Semester M.Sc. Degree (Reg./Supple./Imp.) Examination, April 2019
COMPUTER SCIENCE
MCS 4E 08 : Operations Research
(2014 Admission Onwards)

Time : 3 Hours Max. Marks : 80

Instructions : 1) *Answer* ***any ten*** *questions from Section – A.* ***Each*** *question carries* ***three*** *marks.*
2) *Answer* ***all*** *questions from Section – B.* ***Each*** *question carries* ***ten*** *marks.*

SECTION – A

Note : Answer **any ten** questions. **Each** question carries **three** marks.

1. What is the Procedure for forming a Linear Programming Problems Model ?
2. What is the difference between feasible solution and basic feasible solution ?
3. What are the advantages of dual simplex method ?
4. Differentiate between balanced transportation problem and unbalanced transportation problem.
5. What is need of dynamic programming ?
6. Write the method of forming a loop in transportation problem.
7. When can the dual simplex method be applied ?
8. Briefly explain what is cutting plane method in IPP.
9. List of the characteristics of dynamic programming problems.
10. Define float, total float and free float.
11. What is the importance of Poisson and exponential distribution in queuing theory ?
12. Write a short note on Continuous parameter Markov Chains. **(10×3=30)**

P.T.O.

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SECTION – B

Note : Answer **all** questions. **Each** question carries **ten** marks.

13. a) XYZ factory manufactures 2 articles A and B. To manufacture the article A, a certain machine has to be worked for 1.5 hours and in addition a craftsman has to work for 2 hours. To manufacture the article B, the certain machine has to be worked for 2.5 hours and the craftsman has to work for 1.5 hours. In a week the factory can avail 80 hrs. of machine time and 70 hrs. of craftsman's time. The profit on article A is Rs. 50 and on article B is Rs. 40. If all articles produced can be sold find how many articles of each kind should be produced to earn maximum profit. Formulate the problem as a LPP and solve it graphically. **10**

OR

b) Solve using Big-M method

Max. $Z = -2X_1 - X_2$

Subject to the constraints

$3X_1 + X_2 = 3$

$4X_1 + 3X_2 \geq 6$

$X_1 + 2X_2 \leq 4$

Where $X_1, X_2 >= 0$ **10**

14. a) A company has 5 jobs to be done. The following matrix shows the return in rupees on assigning i^{th} (i = 1, 2, 3, 4, 5) machine to the j^{th} job (j = A, B, C, D, E). Assign the five jobs to the five machines so as to maximize the total expected profit. **10**

		A	B	C	D	E
	1	5	11	10	12	4
	2	2	4	6	3	5
Machine	3	3	12	5	14	6
	4	6	14	4	11	7
	5	7	9	8	12	5

OR

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b) Use dual simplex method to solve the LPP.

Maximize $Z = -3x_1 - 2x_2$

Subject to $x_1 + x_2 \geq 1$

$x_1 + x_2 \leq 7$

$x_1 + 2x_2 \geq 10$

$x_2 \leq 3$

And $x_1, x_2 \geq 0$ 10

15. a) Use Branch and Bound method to slove the following LPP

Maximize $Z = 7x_1 + 9x_2$

Subject to $-x_1 + 3x_2 \leq 6$

$7x_1 + x_2 \leq 35$

$x_2 \leq 7$

$x_1, x_2 \geq 0$ and are integers. 10

OR

b) What is integer programming problem ? Write a note on cutting plane algorithm. 10

16. a) Assuming that the expected time are normally distributed, find the critical path and project duration of 10

Activity	Days		
	Optimistic time	Most likely time	Pessimistic time
1 – 2	2	5	14
1 – 3	9	12	15
2 – 4	5	14	17
3 – 4	2	5	8
3 – 5	8	17	20
4 – 5	9	9	12

OR

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b) Use the graphical method to minimize the time required to process the following jobs on the machine shown, i.e. each machine finds the job which should be done first. Also calculate the total elapsed time to complete both the jobs. 10

Job 1	**Machine**					
	Sequence	A	B	C	D	E
	Time (hrs)	5	4	2	6	2
Job 2	**Machine**					
	Sequence	B	C	A	D	E
	Time (hrs)	5	4	3	2	6

17. a) Explain in detail about the stochastic process and classification of stochastic process. 10

OR

b) Explain the pure death model in queuing theory. 10

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K18P 0343

Reg. No. : .....

Name : .....

Fourth Semester M.Sc. Degree (Reg./Suppl./Imp.) Examination, March 2018

COMPUTER SCIENCE

MCS4E08 : Operations Research

(2014 Admission Onwards)

Time : 3 Hours

Max. Marks : 80

Instructions : 1) *Answer **any ten** questions from Section – **A**. **Each** question carries **three** marks.*

2) *Answer **all** questions from Section – **B**. **Each** question carries **ten** marks.*

SECTION – A

Note : Answer **any ten** questions. **Each** question carries **three** marks.

1. What is linear programming ?
2. Define Slack, Surplus variables.
3. Define degenerate solution in Linear Programming Problem.
4. What are the advantages of duality ?
5. How does a travelling salesman problem differ from a routine assignment model ?
6. What is an assignment problem ?
7. Differentiate between pure and mixed integer programming.
8. List the applications of dynamic programming.
9. Define sequencing problem.
10. List the application of queueing theory.
11. What is meant by critical path ?
12. List out the rules of network construction.

(10×3=30)

P.T.O.

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SECTION – B

Note : Answer **all** questions. **Each** question carries **ten** marks.

13. a) A firm makes 2 types of furniture namely chair and table. The profit on each chair is Rs. 20 and on each table is Rs. 30. Both products are processed on machines A, B and C. The time required in hours by each product and the total time available in hours per week on each machine are given below.

Machines	A	B	C
Chair	3	5	2
Table	3	2	6
Available Time	36	50	60

How should the manufactures schedule his production to maximize product ? Use graphical method.

OR

b) Using simplex method, solve the LPP.

Maximize $Z = 5x + 4y$

Subject to the constraints :

$4x + 5y \leq 10$

$3x + 2y \leq 9$

$8x + 3y \leq 12$

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

14. a) Obtain the initial basic feasible solution by using Vogel's approximation method and hence obtain the optimal solution, where A, B, C, D and E are factories and X, Y and Z are retail shops.

	A	B	C	D	E	Availability
X	5	8	6	6	3	80
Y	4	7	7	6	6	50
Z	8	4	6	6	3	90
Requirement	40	40	50	40	80	

OR

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b) i) Briefly explain any five applications of LPP.

ii) Find the dual of the following :

Min. $Z = 2X_1 + 3X_2 + 4X_3$

subject to the constraints

$2X_1 + 3X_2 + 5X_3 \geq 2$,

$3X_1 + X_2 + 7X_3 = 3$,

$X_1 + 4X_2 + 6X_3 \leq 5$,

$X_1 \geq 0$, $X_2 \geq 0$ and X_3 is unrestricted in sign. **(10)**

15. a) Use Branch and Bound method to solve the following integer programming problem.

Maximise $z = 3x_1 + 4x_2$

Subject to $7x_1 + 16x_2 \leq 52$

$3x_1 - 2x_2 \leq 18$

And $x_1, x_2 \geq 0$ and integers. **(10)**

OR

b) What is integer programming problem ? Write a note on cutting plane algorithm. **(10)**

16. a) Tasks A, B, C ..., H, I constitute a project. The precedence relationships are

A < D; A < E; B < F; D < F; C < G; C < H; F < I; G < I

Draw a network to represent the project and find the minimum time of completion of the project when time, in days, of each unit task is as follows :

Task	:	A	B	C	D	E	F	G	H	I
Time	:	8	10	8	10	16	17	18	14	9

Also identify the critical path. **(10)**

OR

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b) Solve the following sequencing problem giving an optimal solution when passing out is not allowed.

Machine	Job				
	A	B	C	D	E
M_1	11	13	9	16	17
M_2	4	3	5	2	6
M_3	6	7	5	8	4
M_4	15	8	13	9	11

17. a) Write a note on :

i) Discrete parameter Markov chain.

ii) Continuous parameter Markov chain.

OR

b) Explain in detail about the Queuing model and its characteristics.

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10/5/17

K17P 0425

Reg. No. : .....

Name : .....

Fourth Semester M.Sc. Degree (Reg./Suppl./Imp.) Examination, March 2017
COMPUTER SCIENCE
MCS4E08 – Operations Research
(2014 Admission Onwards)

Time : 3 Hours Max. Marks : 80

Instructions : 1) *Answer **any ten** questions from Section **A**. **Each** question carries **three** marks.*
2) *Answer **all** questions from Section **B**. **Each** question carries **ten** marks.*

SECTION – A

Answer **any ten** questions. **Each** question carries **three** marks.

1. Define slack and surplus variable.
2. Explain the terms.
   a) Alternative optima
   b) Degeneracy
   c) Unbounded solution.
3. Compare simplex method and dual simplex method.
4. Differentiate between assignment and transportation problem.
5. Illustrate the formation of duality from the given primal problem.
6. What are the three basic elements of the DP model ?
7. What are the steps involved in the strategy of integer programming problem ?
8. List any three applications of integer programming problem.
9. Distinguish between CPM and PERT.
10. Define float, total float and free float.
11. What is the importance of Poisson and exponential distribution in queuing theory ?
12. What is balking, reneging and jockeying in queuing theory ?

P.T.O.

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SECTION – B

Answer all questions. **Each** question carries **ten** marks.

13. a) Solve the following LPP by simplex method.

Maximise $z = x_1 + 9x_2 + x_3$

Subject to $x_1 + 2x_2 + 3x_3 < 9$

$3x_1 + 2x_2 + 2x_3 \leq 15$

$x_1, x_2, x_3 \geq 0$ 10

OR

b) Solve the following LPP by BIG-M method.

Minimise $z = 4x_1 + x_2$

Subject to $3x_1 + x_2 = 3$

$4x_1 + 3x_2 \leq 6$

$x_1 + 2x_2 \geq 4$

$x_1, x_2 \geq 0$ 10

14. a) Five different machines can do any of the required five jobs with different profits resulting from each assignment as depicted in the table below.

		Machines				
		A	B	C	D	E
Job	1	30	37	40	28	40
	2	40	24	27	21	36
	3	40	32	33	30	35
	4	25	38	40	36	36
	5	29	62	41	34	39

Find out the maximum profit possible through optimal assignment. 10

OR

b) i) Briefly explain any five applications of LPP.

ii) Write the dual of

Min $Z = 12x_1 + 15x_2$

Subject to $5x_1 + 3x_2 \geq 10$

$x_1 + x_2 \leq 5$

$x_1 \geq 0$

x_2 is unrestricted in sign. (5+5)

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15. a) Use Branch and Bound method to solve the following LPP :

Maximise $Z = 7x_1 + 9x_2$

Subject to $-x_1 + 3x_2 \leq 6$

$7x_1 + x_2 \leq 35$

$x_2 \leq 7, x_1, x_2 \geq 0$ and are integers. **10**

OR

b) Briefly describe the applications of dynamic programming. **10**

16. a) A small project is composed of activities whose time estimates are listed in the table below :

Activities are identified by their beginning (i) and ending (j) node numbers.

i) Draw the project network.

ii) Find the expected duration and variance for each activity. What is the expected project length ?

iii) Calculate the variance and standard deviation of the project length. What is the probability that the project will be completed. (a) at least 4 weeks earlier than expected ? (b) no more than 4 weeks later than expected ?

iv) If the project due is 19 in weeks, what is the probability of meeting the due date, given :

z	0.5	0.67	1.00	1.33	2.00
p	0.1915	0.2486	0.3413	0.4082	0.4772

Activity	Estimated duration (weeks)		
i – j	Optimistic	Most likely	Pessimistic
1 – 2	1	1	7
1 – 3	1	4	7
1 – 4	2	2	8
2 – 5	1	1	1
3 – 5	2	5	14
4 – 6	2	5	8
5 – 6	3	6	15

10

OR

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b) Use graphical method to minimize the time needed to process the following jobs on the machines shown, that is, for each machine find the job that should be done first. Also calculate the total elapsed time to complete both the jobs.

Job 1	Sequence of machine	A	B	C	D	E
	Time	3	4	2	6	2
Job 2	Sequence of machine	B	C	A	D	E
	Time	5	4	3	2	6

10

17. a) Write a note on :

i) Discrete parameter Markov chain.

ii) Continuous parameter Markov chain. 10

OR

b) Explain the pure death model in queuing theory. 10

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20/4/2016.

384

K16P 0184

Reg. No. : .....

Name : .....

Fourth Semester M.Sc. Degree (Regular/Supplementary/Improvement) Examination, March 2016

COMPUTER SCIENCE (2014 Admn.)

MCS 4E08 : Operations Research

Time : 3 Hours Maximum Marks : 80

Instructions : *1) Answer **any ten** questions from Section **A**. **Each** question carries **three** marks.*

*2) Answer **all** questions from Section **B**. **Each** question carries **ten** marks.*

SECTION – A

Answer **any ten** questions. **Each** question carries **three** marks.

1. Explain the terms

   a) Feasible solution b) Basis c) Optional solution.

2. Explain any three applications of LPP in management.

3. Briefly explain the steps for solving a transportation problem.

4. Write a short note on travelling salesman problem.

5. Explain the relation between the primal and dual of LPP.

6. State the features of Dynamic programming problem.

7. List the four applications of dynamic programming.

8. What are the steps involved in the strategy of integer programming problem ?

9. Mention the rules of drawing a network diagram.

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P.T.O.

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K16P 0184

10. Define three time estimates for PERT.

11. What are the basic characteristics of a queuing system ?

12. State the components of queuing system.

SECTION – B

Answer **all** questions. **Each** question carries **ten** marks.

13. a) Use graphical method to solve the following LPP.

Minimise $z = 20x + 10y$, Subject to

$x + 2y \leq 40$

$3x + y \geq 30$

$4x + 3y \geq 60$

and $x, y \geq 0$

OR

b) Use the two phase method to

Maximise $z = 3x_1 - x_2$

subject to $2x_1 + x_2 \geq 2$

$x_1 + 3x_2 \leq 2$

$x_2 \leq 4$

$x_1, x_2 \geq 0$

14. a) i) Write the dual of

Max $z = 40x_1 + 30x_2$

Subject to $10x_1 + 6x_2 \leq 15$

$5x_1 + 7x_2 \geq -10$

$x_1 + x_2 = 9$

$x_1 + x_2 \geq 10$

$x_1, x_2 \geq 0$

K16P 0184

ii) The following table depicts the cost efficients demands and supplies for a transportation problem. Solve it by using VAM. 5+5

	A	B	C	Supply
I	6	8	4	14
II	4	9	8	12
III	1	2	6	5
Demand	6	10	15	

OR

b) Solve the following LPP by dual simplex method

Minimize $z = 3x_1 + 2x_2 + x_3$

Subject to $3x_1 + x_2 + x_3 \geq 3$

$-3x_1 + 3x_2 + x_3 \geq 6$

$x_1 + x_2 + x_3 \leq 3$

$x_1, x_2, x_3 \geq 0$

a) Discuss the applications of ILP.

OR

b) Use branch and bound method to solve the following LPP :

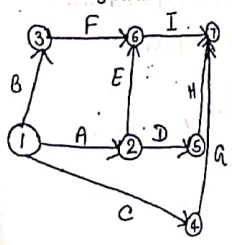
Maximize $z = 7x_1 + 9x_2$

Subject to $-x_1 + 3x_2 \leq 6$

$7x_1 + x_2 \leq 35$

$x_2 \leq 7, x_1, x_2 \geq 0$ and are integers

a) A project is represented by the network depicted in the figure below and has the following data.



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Task	A	B	C	D	E	F	G	H	I
Optimistic time	5	18	26	16	15	6	7	7	3
Pessimistic time	10	22	40	20	25	12	12	9	5
Most likely time	8	20	33	18	20	9	10	8	4

Determine the following :

i) Expected task times and their variances.

ii) The earliest and latest expected times to reach each event.

iii) The critical path.

iv) The probability of an event occurring at the proposed completion data original contract time of completing the project is 41.5 weeks.

v) The duration of the project that will have 97% channel of being comp

OR

b) Find the sequence that minimizes the total elapsed time (in hours) requ complete the following tasks on two machines.

Task	A	B	C	D	E	F	G	H	I
Machine I	2	5	4	9	6	8	7	5	4
Machine II	6	8	7	4	3	9	3	8	11

Also find the total elapsed time and idle time for both the machines

17. a) Briefly explain the classification of stochastic process.

OR

b) Explain the pure birth model in queuing theory.

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