

Name: Sweaba V. S

Roll No: 59



Rajagiri College of Social Sciences (Autonomous)
Continuous Assessment Examination - 1
January 2023

II MCA

Code: MCA201

Total Time : 90 minutes

Sub: Operations research

Total Marks : 40

Level	Blooms Taxonomy Levels of Learning
L1	Remembering
L2	Understanding
L3	Applying
L4	Analyzing
L5	Evaluating
L6	Creating

SECTION A

Each Question has 10 marks

Sl.no	Question	CO Mapped	Bloom's Taxonomy level
1	A firm can produce 3 types of cloth say A, B and C. Three kinds of wool are required for it say red, green and blue. One-unit length of type A cloth needs 2 meters of red wool and 3 meters of blue wool. One-unit length of B type cloth needs 3 meters of red wool, 2 meters of green wool and 2 meters of blue wool; and 1-unit length of type C cloth needs 5 meters of green wool and 4 meters of blue wool. The firm has a stock of 8 meters of red wool, 10 meters of green wool and 15 meters of blue wool, it is assumed that the income obtained from one-unit length of type A cloth is ` 3, of B ` 5 and of C ` 4. Determine how the firm should use the available material so as to maximize the income from the finished cloth. Formulate the above problem as LPP.	MCA201.1	L3
2	Solve the following LPP using simplex method. Maximize $z = 3x_1 + 2x_2$ Subject to $x_1 + x_2 \leq 4$ $x_1 - x_2 \leq 2$ $x_1, x_2 \geq 0$		

OR

3 Solve the LPP using Big M method.

$$\text{Max } Z = 3x_1 + 5x_2$$

$$x_1 + x_2 \geq 2$$

$$x_2 \leq 6$$

$$3x_1 + 2x_2 = 18$$

SECTION B

Each Question has 10 marks

~~4~~

Solve the following LPP using dual simplex method

MCA201.2

L3

$$\text{Minimize } Z = 80x_1 + 100x_2$$

$$80x_1 + 60x_2 \geq 1500$$

$$20x_1 + 90x_2 \geq 1200$$

$$x_1, x_2 \geq 0$$

~~5~~

Solve the following transportation problem.

Destination					Supply(S _i)	
Source	01	3	1	7	4	250
	02	2	6	5	9	350
	03	8	3	3	2	400
Demand(D _j)		200	300	350	150	

OR

6

Solve the following TSP problem.

	P	Q	R	S	T
P	-	4	7	3	4
Q	4	-	6	3	4
R	7	6	-	7	5
S	3	3	7	-	7
T	4	4	5	7	-

Rajagiri College of Social Sciences (Autonomous)
Continuous Assessment Examination - 1
January 2022
II MCA

Code: MCA201
Sub: Operations Research

Total Time : 1 hr
Total Weightage : 16

SECTION A

Each question has a weightage of 4

1. Rajiv has two courses to prepare for final examination. Each hour of study, he devotes to course A is expected to return Rs.600 in terms of long range job benefits. Each hour devoted to course B is expected to return Rs.300 in terms of long range job benefits. The stores are closed and Rajiv has only 15 chewing gums. He finds that he consumes one chewing gum every 20 minutes while studying course B and every 12 minutes while studying course A. Time is running short only four hours are left to prepare. Rajiv feels that he must devote at least two hours to study. Using linear programming, determine an optimal policy for Rajiv that would maximise his returns in terms of long range job benefits. – (Embedded Question – Compulsory)
2. Solve the following LPP using simplex method

$$\text{Max } Z = 22x_1 + 18x_2$$

Subject to

$$3x_1 + 2x_2 \leq 48$$

$$x_1 + x_2 \leq 20$$

$$x_1, x_2 \geq 0$$

OR

3. Solve the LPP using Big M method.

$$\text{Min } Z = 5x_1 + 3x_2$$

Subject to

$$2x_1 + x_2 \geq 3$$

$$x_1 + x_2 \geq 2$$

$$x_1, x_2 \geq 0$$

P.T.O

SECTION B

Each question has a weightage of 4

4. Find the feasible solution using Vogel's approximation method— (Embedded Question – Compulsory)

	P	Q	R	SUPPLY
A	2	7	4	5
B	3	3	1	8
C	5	4	7	7
D	1	6	2	14
Demand	7	9	18	

5. Solve the following assignment problem.

	w	x	y	z
A	11	17	8	16
B	9	7	12	6
C	13	16	15	12
D	14	10	12	11

OR

6. Discuss the characteristics of a dual in LPP.

Name: Sweaba VS
Reg. No.: 2224059

Rajagiri College of Social Sciences (Autonomous)
Second semester MCA Degree Examination
April, 2023
(Regular - 2022 Admissions)

Code: 4541
Sub: (MCA201) Operations Research

Max. Marks: 75
Duration: 3 Hrs.

SECTION A

Answer any **TEN** questions.
(Each question carries 3 marks)

[10 X 3 = 30]

- ✓ Define the following:- a) Feasible solution, b) Optimal Solution
- ✓ What are unbalanced transportation problems? How are they solved?
- ✓ Draw a network for the project whose activities and their precedence relationship are given below.

Activity	A	B	C	D	E	F
Predecessor	-	-	-	A,B	A,C	B,C

- ✓ Explain the characteristics of Poisson distribution.
- ✓ When it becomes difficult to use an optimization technique for solving a problem, one has to resort to simulation technique.' Discuss.
- ✓ A manufacturer produces two types of models M1 and M2. Each model of the type M1 requires 4 hours of grinding and 2 hours of polishing; whereas each model of M2 requires 2 hours of grinding and 5 hours of polishing. The manufacturer has 2 grinders and 3 polishers. Each grinder works for 40 hours a week and each polisher works 60 hours a week. Profit on M1 model is Rs.3.00 and on model M2 is Rs.4.00. Whatever produced in a week is sold in the market. How should the manufacturer allocate his production capacity to the two types of models, so that he makes maximum profit in a week? Formulate a mathematical model to the problem.
- ✓ Explain the term sensitivity analysis.
- ✓ What is dummy activity? Give example.
- ✓ Explain the basic structure of queuing systems.
- ✓ What are the advantages and disadvantages of simulation?
- ✓ What is a two person zero sum game?
- ✓ Define simulation. Why is simulation used?

P.T.O

SECTION BAnswer **ALL** questions.

(Each question carries 9 marks)

[5 X 9 = 45]

- 13 (a) A firm makes two products X and Y, and has a total production capacity of 9 tons per day, X and Y requiring the same production capacity. The firm has a permanent contract to supply at least 2 tons of X and at least 3 tons of Y per day to another company. Each ton of X requires 20 machine hours production time and each ton of Y requires 50 machine hours production time, the daily maximum possible number of machine hours is 360. All the first output can be sold and the profit made is Rs. 80 per ton of X and Rs.120 per ton of Y. It is required to determine schedule for maximum profit and calculate this profit.(Graphically)

[OR]

- (b) A toy company manufactures two types of doll; a basic version-doll A and a deluxe version doll B. Each doll of type B takes twice as long as to produce as one of type A, and the company would have time to make a maximum of 2000 per day if it produces only the basic version. The supply of plastic is sufficient to produce 1500 dolls per day (both A and B combined). The deluxe version requires a fancy dress of which there are only 600 per day available. If company makes profit of Rs.3 and Rs.5 per doll, respectively, on doll A and B; how many each should be produced per day in order to maximize profit. (Solve using Simplex method)

- 14 (a) Solve the following transportation problem to maximize profit. Profit in Rs/unit is given in the table.

	A	B	C	D	Supply
F1	15	51	42	33	23
F2	80	42	26	81	44
F3	90	40	66	60	33
Demand	23	31	16	30	

[OR]

- (b) Solve the following Assignment problem.

	I	II	III	IV	V
A	10	5	13	15	16
B	3	9	18	13	6
C	10	7	2	2	2
D	7	11	9	7	12
E	7	9	10	4	12

15 (a) i) Construct the project network comprised of activities A to L with the following precedence relationships:

- a) A, B and C, the first activities of the project can be executed concurrently
- b) A & B precede D
- c) B precedes E, F, H
- d) F and C precede G
- e) E and H precede I & J
- f) C, D, F and J precede K
- g) K precede L
- h) I, G, and L are terminal activities of the project.

ii) Solve the game with matrix,

		B		
		B1	B2	B3
A1		1	7	2
A	A2	6	2	7
	A3	5	1	6

that is find the value of the game and an optimal strategy for both players.

[OR]

(b) Use graphic method to solve the following game.

		Player B				
Player A		B ₁	B ₂	B ₃	B ₄	B ₅
A ₁		2	-4	6	-3	5
A ₂		-3	4	-4	1	0

16 (a) Explain the following.

- i) Pseudo random numbers.
- ii) Multiplication congruential algorithm.
- iii) Various steps in the simulation process.

[OR]

(b) Discuss the Monte Carlo method of solving a problem, illustrating it by outlining a procedure to solve a specified problem of your choice.

P.T.O

- 17/ (a) On an average 96 patients per 24 hour day require the service of an emergency clinic. Also on an average, a patient requires 10 minutes of active attention. Assume that the facility can handle only one emergency at a time. Suppose that it costs the clinic Rs. 100 per patient treated to obtain an average servicing time of 10 minutes and that each minute of decrease in this average time would cost Rs.10 per patient treated. How much would have to be budgeted by the clinic to decrease the average size of the queue from one and one third patients to half patient.

[OR]

- (b) Customers arrive at a one window drive in bank according to Poisson distribution with mean 10 per hour. Service time per customer is exponential with mean 5 minutes. The space in front of the windows, including that for the serviced car can accommodate a maximum of three cars. Other cars wait outside this space.
- i. What is the probability that arriving customer can drive directly to the space in front of the window?
 - ii. What is the probability that arriving customer will have to wait outside the indicated space?
 - iii. How long is an arriving customer expected to wait before starting service?

Name:
Reg. No. :

Rajagiri College of Social Sciences (Autonomous)
Second semester MCA Degree Examination
April, 2022
(Regular/Supplementary - 2020 admission onwards)

Swarn
2124057

Code: 4116
Sub: (MCA201) Operations Research

Max. Weightage: 30
Duration: 3 Hrs.

SECTION A
Answer any **TEN** questions.
(Each question carries a weightage of 1)

[$10 \times 1 = 10$]

- ✓ 1 The ABC Furniture Company produces tables and chairs. The production process for each is similar in that both require a certain number of hours of carpentry work and a certain number of labor hours in the painting and varnishing department. Each table takes 4 hours of carpentry and 2 hours in the painting and varnishing shop. Each chair requires 3 hours in carpentry and 1 hour in painting and varnishing. During the current production period, 240 hours of carpentry time are available and 100 hours in painting and varnishing time are available. Each table sold yields a profit of Rs.7; each chair produced is sold for a Rs.5 profit. ABC Furniture's problem is to determine the best possible combination of tables and chairs to manufacture in order to reach the maximum profit. Formulate a linear programming problem.
- ✓ 2 Explain the term sensitivity analysis.
- ✓ 3 Discuss the basic rules for constructing a network diagram?
- ✓ 4 Explain the term 'utilization factor'.
- ✓ 5 List the various steps included in a simulation process. 1
- ✓ 6 What are the advantages and disadvantages of simulation?
- ✓ 7 Explain the limitations of queuing theory.
- ✓ 8 What is PERT? What advantages does it have over CPM?
- ✓ 9 Explain how a dual is formed for a given primal.
- ✓ 10 A manufacturer produces two types of models M1 and M2. Each model of the type M1 requires 4 hours of grinding and 2 hours of polishing; whereas each model of M2 requires 2 hours of grinding and 5 hours of polishing. The manufacturer has 2 grinders and 3 polishers. Each grinder works for 40 hours a week and each polisher works for 60 hours a week. Profit on M1 model is Rs.3.00 and on model M2 is Rs.4.00. Whatever is produced in a week is sold in the market. How should the manufacturer allocate his production capacity to the two types of models, so that he makes maximum profit in a week? Formulate a mathematical model to the problem.
- 11 What is crashing?

P.T.O

12 When it becomes difficult to use an optimization technique for solving a problem, one has to resort to simulation technique.' Discuss.

SECTION B

Answer **ALL** questions.
(Each question carries a weightage of 4)

[5 X 4 = 20]

✓ 13 (a) Use two phase method to solve the following

$$\text{Min } Z = x_1 + x_2$$

$$\text{Subject to } 2x_1 + x_2 \geq 4$$

$$x_1 + 7x_2 \geq 7$$

$$x_1, x_2 \geq 0$$

2
6.4
10.5
3 [OR]

(b) A firm makes two products X and Y, and has a total production capacity of 9 tons per day, X and Y requiring the same production capacity. The firm has a permanent contract to supply at least 2 tons of X and at least 3 tons of Y per day to another company. Each ton of X requires 20 machine hours production time and each ton of Y requires 50 machine hours production time, the daily maximum possible number of machine hours is 360. All the first output can be sold and the profit made is Rs. 80 per ton of X and Rs. 120 per ton of Y. It is required to determine schedule for maximum profit and calculate this profit.(Graphically)

14 (a) Solve the following LPP by dual simplex method:

$$\text{Min } Z = 2X_1 + X_2$$

Sub to:

$$3X_1 + X_2 \geq 3$$

$$4X_1 + 3X_2 \geq 6$$

$$X_1 + 2X_2 \geq 3$$

$$X_1, X_2 \geq 0$$

[OR]

(b) A company has four machines to do three jobs. Each job can be assigned to one and only one machine. The cost of each job on each machine is given in the following table. What are the job assignments which will minimize the cost?

Jobs	Machines			
	1	2	3	4
A	18	24	28	32
B	8	13	17	19
C	10	15	19	22

~~as to~~ 15 (a) Solve graphically the game whose pay off matrix is given below.

		Player B	
		B ₁	B ₂
Player A		A ₁	-6 7
		A ₂	4 -5
		A ₃	1 -2
		A ₄	2 5
		A ₅	7 -6

[OR]

(b) A project consisting of twelve distinct activities is to be analyzed by using PERT. The following information is given (time estimates are in days). Draw the PERT network and find the critical activities.

Activity	Predecessor	t _o	t _m	t _p
A	-	2	2	2
B	-	1	3	7
C	A	4	7	8
D	A	3	5	7
E	B	2	6	9
F	B	5	9	11
G	C,D	3	6	8
H	E	2	6	9
I	C,D	3	5	8
J	G,H	1	3	4
K	F	4	8	11
L	J,K	2	5	7

~~16~~ (a) Consider a box office ticket window being manned by a single individual. Customers arrive to purchase tickets according to a Poisson input process with a mean rate of 30 per hour. The time required to serve a customer has an exponential distribution with mean of 90 seconds. Find the following:

- i) Expected queue length. 2.25
- ii) Expected waiting time in the system. 6 min
- iii) Expected waiting time in the queue. 4.5

[OR]

(b) People arrive at a ticket booth in a Poisson distribution arrival rate of 25 per hour. Service time is exponentially distributed with an average time of two minutes. Calculate:

- i) The mean number in the waiting line.
- ii) The mean waiting time in the system.
- iii) The utilization factor

P.T.O

- 17 (a) A company manufactures around 200 mopeds every day. Due to reasons beyond control, variations occur in the output which varies from 196 to 204 mopeds and whose probability can best be described by the following distribution.

Production/day	196	197	198	199	200	201	202	203	204
probability	0.05	0.09	0.12	0.14	0.20	0.15	0.11	0.08	0.06

The finished mopeds are transported in a specially designed 3-storied lorry that can accommodate exactly 200 mopeds. Using the following 15 random numbers simulate the process for the next 15 days.

Random numbers : 82, 89, 78, 24, 53, 61, 18, 45, 04, 23, 50, 77, 27, 54, 10

Find: (i) Average number of mopeds waiting in the factory. 2.8

(ii) Average number of empty spaces in the lorry. 0.26

[OR]

- (b) At a service station a study was made over a period of 25 days to determine both the number of automobiles being brought in for service and the number of automobiles serviced. The results are given below.

No. of automobiles arriving and serviced	0	1	2	3	4	5
Frequency of arrivals (days)	2	4	10	5	3	1
Frequency of daily serviced (days)	3	2	12	3	4	1

Simulate the arrival/service pattern for a ten day period and estimate the mean number of automobiles that remain in service for more than a day.

(Use the random numbers: 09, 54, 42, 01, 80, 06, 06, 26, 67, 79, 49, 16, 36, 76, 68, 91, 97, 85, 56, 84. Use the first ten for arrivals and the next ten for serviced).

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Roll No:57

Rajagiri College of Social Sciences (Autonomous)
Continuous Assessment Examination - II
October 2021
II MCA

Code: MCA201

Sub: Operations Research

Total Weightage:4

Total Time : 60 minutes

SECTION A

Answer both questions - Each question has a weightage of 1

Weightage - 2 (2*1)

1. Draw a network diagram for the given project and explain the rules for constructing a network diagram. (Embedded Question – Compulsory)

Activity	A	B	C	D	E	F
predecessor	--	--	--	A,B	A,C	B,C

2. Define a) Saddle point b) Pay off matrix c) Minimax and Maximin principle
OR
3. Solve the following game graphically.

	B1	B2
A1	-6	7
A2	4	-5
A3	1	-2
A4	2	5
A5	7	-6

SECTION B

Answer both questions - Each question has a weightage of 1

Weightage - 2 (2*1)

4. Give the essential characteristics of a queuing process – (Embedded Question – Compulsory)
5. Problems arriving at a computer center is Poisson fashion with a mean arrival rate of 25 per hour. The average computing job requires 2 minutes. Calculate the following
- Average number of problems waiting for the computer use
 - Percent of times an arrival can walk right in without having to wait.

OR

6. Explain the objective of a queuing theory.

Name: Sweaba
Roll No: 59



Rajagiri College of Social Sciences (Autonomous)
Continuous Assessment Examination - II

March 2023

MCA

Code: MCA201

Total Time : 90 minutes

Sub: Operations Research

Total Marks : 40

Level	Blooms Taxonomy Levels of Learning
L1	Remembering
L2	Understanding
L3	Applying
L4	Analyzing
L5	Evaluating
L6	Creating

SECTION A

Each Question has 10 marks

Sl.no	Question	CO Mapped	Bloom's Taxonomy level																																				
1	Draw the network diagram and find the critical path. <table border="1"><tr><td>Job</td><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td><td>G</td><td>H</td><td>I</td><td>J</td><td>K</td></tr><tr><td>Duration</td><td>13</td><td>8</td><td>10</td><td>9</td><td>11</td><td>10</td><td>8</td><td>6</td><td>7</td><td>14</td><td>18</td></tr><tr><td>Predecessor</td><td>-</td><td>A</td><td>B</td><td>C</td><td>B</td><td>E</td><td>D&F</td><td>E</td><td>H</td><td>G&I</td><td>J</td></tr></table>	Job	A	B	C	D	E	F	G	H	I	J	K	Duration	13	8	10	9	11	10	8	6	7	14	18	Predecessor	-	A	B	C	B	E	D&F	E	H	G&I	J	MCA2015	L3
Job	A	B	C	D	E	F	G	H	I	J	K																												
Duration	13	8	10	9	11	10	8	6	7	14	18																												
Predecessor	-	A	B	C	B	E	D&F	E	H	G&I	J																												
2	Explain the following a) Objectives of game theory b) Saddle point c) Principle of dominance																																						

OR

3	Solve the following game graphically.																				
	<table border="1"><tr><td></td><td colspan="5">B</td></tr><tr><td>A</td><td>-5</td><td>5</td><td>0</td><td>-1</td><td>8</td></tr><tr><td></td><td>8</td><td>-4</td><td>-1</td><td>6</td><td>-5</td></tr></table>		B					A	-5	5	0	-1	8		8	-4	-1	6	-5		
	B																				
A	-5	5	0	-1	8																
	8	-4	-1	6	-5																

SECTION B*Each Question has 10 marks*

4	<p>In a service department manned by one server, on an average 8 customers arrive every 5 minutes while the server can serve 10 customers in the same time, assuming Poisson distribution for arrival and exponential distribution for service rate. Determine:</p> <ul style="list-style-type: none">a) Average number of customers in the system.b) Average number of customers in the queue.c) Average time a customer spends in the system.d) Average time a customer waits before being served	MCA201.4	L3
5	Explain the basic structure of a queuing system.	OR	
6	In bank every 15 minutes one customer arrives for cashing the cheque. The staff takes 10 minutes for serving a customer on an average. State suitable assumptions and find (1) Average queue length (2) Waiting time in the queue and system. (3) find the utilization factor		