Enroll. No._____

MARWADI UNIVERSITY

Faculty of Engineering/ Technology

Information Communication and Technology **B.E**

SEM: 6th **MU FINAL EXAM** **April-May : 2024**

Subject: - Optimizing Techniques (01CT0614) **Date:- 30-April-2024**

Total Marks:-100 **Time: - 9.00 AM - 12.00 PM**

Instructions:

1. **All Questions are Compulsory.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Do not write/sign/indication/tick mark anything other than Enroll No. at a specific place on the question paper.**

Question: 1.

Question-1

(a) Multiple Choice Questions **[10]**

1 Operations research practitioners do not
   a. Predict future operations
   b. Build more than one model
   c. Collect relevant data
   d. Build mathematical models

2 If two constraints do not intersect in a graph, then
   a. The problem is infeasible
   b. The solution is unbounded
   c. One of the constraint is redundant
   d. None of the above

3 Graphical method of Linear Programming uses
   a. Objective function equation
   b. Constraint equations
   c. Linear equations
   d. All of the above

4 Which of the following method is used to verify the optimality of the current solution of the transportation problem?
   a. North West Method
   b. Modified Distribution Method
   c. Least Cost Method
   d. All of the above

5 If a non-redundant constraint is removed from a LP problem then
   a. Solution will become always infeasible
   b. Feasible region will always become smaller
   c. Feasible region will always become larger
   d. None of the above

6 While solving an assignment problem, an activity is assigned to a resource through a square with zero opportunity cost because the objective is to
   a. Minimize the total assignment cost to zero
   b. Minimize the value of cost for that assignment as zero
   c. Minimize the total cost of the assignment
   d. None of the above

7

The Optimal solution for an assignment problem is obtained only if

a. Each row and column has only one zero element
b. Each row and column has at most two zero element
c. The data are arranged in a square matrix
d. None of the above

8 While drawing a network diagram, for each activity project, we must look for the

a. Which activity precede the current activity
b. Which activity follow the current activity
c. Which activity can concurrently take place with the current activity
d. All of the above

9 In any time cost trade off analysis,

a. Cost increases as the time decreases
b. Cost at the normal time is zero
c. Cost increases as the time increases
d. None of the above

10 If an opportunity cost value is used for an unused cell to test optimality, it should be

a. Equal to Zero
b. Most Negative Number
c. Most Positive number
d. Any value depending on experience

(b) **[10]**

1 Give one real life example with mathematical model that resembles to linear programming model.

2 Enlist two points of difference between Linear and Non Linear Programming model.

3 What is meant by feasible solution of an LP problem?

4 What is the use of slack variables in Simplex method of LP problem?

5 Can transportation problem be applied to the triangular matrix?

6 What is the purpose of selecting the highest negative opportunity cost for MODI method in transportation problem?

7 There are N paths from source to destination in any network diagram. If for any non-critical random path, the time taken for reaching the destination from source is 52 hours, what will be the estimated time taken for the critical path?

8 Let SI and DJ (I=1,2,….., m; J=1,2,…..,n) be the supply and demand available, respectively, for a commodity at M godowns and N shopping malls. Let CIJ be the cost of transporting one unit of commodity from godown I to shopping mall J. Assume that

$$\sum_{I=1}^{M} S_I = \sum_{J=1}^{N} D_J$$

Then, for the calculation of the minimum cost using the optimality test MODI method, let NOU denote the number of unknown variables.
If NOU = f(M,N) i.e. NOU is an arbitrary function in form of variables M and N, then what could be the value of NOU?

9 Explain in short about any simulation model that you have developed in your real life.

10 Give an example of mathematical model satisfying unbounded region feasible solution using graphical representation.

Question-2

(a) Write the advantages of operational research in different domains. **[08]**

(b) Define Operational Research. State and explain in brief the applications of Operational Research in four different sectors/fields. **[08]**

OR

(b) Explain the scope and methodology of OR, the main phases of OR and techniques used in solving an OR problem. **[08]**

Question-3

(a) A manufacturing company is engaged in producing three types of products: A, B and C. The production department produces, each day, components sufficient to make 50 units of A, 25 units of B and 30 units of C. The management is confronted with the problem of optimizing the daily production of the products in the assembly department, where only 100 man-hours are available daily for assembling the products. The following additional information is available: **[08]**

Type of Product	*Profit Contribution per Unit of Product (Rs)*	*Assembly Time per Product (hrs)*
A	12	0.8
B	20	1.7
C	45	2.5

The company has a daily order commitment for 20 units of products A and a total of 15 units of products B and C. Formulate this problem as an LP model so as to maximize the total profit.

(b) Use the graphical method to solve the following LP problem **[04]**
Maximize $Z= 15X_1 + 10X_2$ subject to the constraints
$4X_1 + 6X_2 \leq 360$ (ii) $3X_1 \leq 180$ (iii) $5X_2 \leq 200$
$X_1, X_2 \geq 0$

(c) What is meant by the term 'infeasible region'? Why must this be a well-defined boundary for the maximization problem? In which situation the solution is not possible? **[04]**

OR

(a) A company makes two kinds of leather belts, belt A and belt B. Belt A is a high quality belt and belt B is of lower quality. The respective profits are Rs 4 and Rs 3 per belt. The production of each of type A requires twice as much time as a belt of type B, and if all belts were of type B, the company could make 1,000 belts per day. The supply of leather is sufficient for only 800 belts per day (both A and B combined). Belt A requires a fancy buckle and only 400 of these are available per day. There are only 700 buckles a day available for belt B. What should be the daily production of each type of belt? Formulate this problem as an LP model and solve it to get the solution. **[08]**

(b) The ABC Company has been a producer of picture tubes for television sets and certain printed circuits for radios. The company has just expanded into full scale production and marketing of AM and AM-FM radios. It has built a new plant that can operate 48 hours per week. Production of an AM radio in the new plant will require 2 hours and production of an AM-FM radio will require 3 hours. Each AM radio will contribute Rs 40 to profits while an AM-FM radio will contribute Rs 80 to profits. The marketing department, after extensive research has determined that a maximum of 15AM radios and 10 AM-FM radios can be sold each week. **[04]**

(a) Formulate a linear programming model to determine the optimum production mix of AM and FM radios that will maximize profits.

(b) Solve this problem using the graphical method.

(c) Consider a mathematical model M with 1 objective function, 3 functional constraints and non-negative constraints. Let F denote the feasible solution pertaining to intersection of all the constraints defined for the model M. On removing one functional constraint, the feasible region becomes F' (F-DASH). Design such model M such that F=F' and represent in the graphical format. **[04]**

Question: 4.

(a) Find initial solution of given method using VAM method. **[08]**

	D1	D2	D3	D4	
O1	8	9	6	14	18
O2	9	3	4	7	26
O3	12	8	15	13	16
O4	9	2	5	11	20
	12	14	22	32	

(b) Initial solution is computed using North-West method compute 2 iterations of steeping stone methods. **[08]**

	D1	D2	D3	
O1	9 [10]	15	7	10
O2	4 [7]	12	6	7
O3	11 [6]	2 [8]	8	14
O4	7	11 [4]	3 [5]	9
O5	13	4	5 [13]	13
	23	12	18	53

OR

(a) Find the initial solution using Least-Cost method. **[08]**

	D1	D2	D3	
O1	9	15	7	10
O2	4	12	6	7
O3	11	2	8	14
O4	7	11	3	9
O5	13	4	5	13
	23	12	18	

(b) Initial solution of Transportation problem is computed using North-West methods perform 2 iterations of MODI optimizing methods. **[08]**

					Supply
	12 8	6 9	6	14	18
	8 9	18 3	4	7	26
	4 12	8	15	12 13	16
	20 9	2	5	11	20
Demand	12	14	22	32	80

Question: 5.

(a) Draw the network model using precedence table as shown below. **[06]**

Activity	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**	**N**
	-	**-**	**-**	**A**	**B**	**C**	**C**	**D,E**	**F**	**I**	**H**	**I**	**J**	**K,L,M**

(b) Draw the network model for the given table and compute the earliest time and latest time for all the events. **[06]**

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

(c) Compute critical path and CPM length **[04]**

OR

(a) Compute expected time of each event and draw the network model. **[06]**

Activity	1-2	1-3	1-4	2-5	3-5	3-6	4-6	5-7	6-7
To	2	4	4	2	5	4	9	3	8
Tm	6	8	10	7	10	12	18	12	14
Tp	10	12	16	12	15	26	27	21	20

(b) Compute earliest time and latest time to find critical path. **[06]**

(c) Explain different types of error that can happen during network modeling. **[04]**

Question: 6.

(a) Draw the flow diagram of Genetic Algorithm and explain each process block. **[08]**

(b) For the given bit-strings perform three point crossover and uniform crossover to generate all offspring. Current population [101011011], [11011001]. **[04]**

(c) Explain difference between fuzzy optimizing and deterministic optimizing techniques. **[04]**

OR

(a) Explain components of Particle Swarm Optimization (PSO) equation. Draw flow diagram for PSO algorithms. **[08]**

(b) For 0/1 knapsack problem compute the fitness function. Assume penalty of over-boarding in 50 Units. Value **V=[5, 6, 8, 3, 9, 7, 10, 6]**, Weight **W=[3, 4, 5, 1, 6, 2, 4, 2],** and capacity **C=25**. Let initial population is [10110111], [110111011], and [11001000]. **[04]**

(c) Explain 4 different convergence criteria for evolutionary algorithms. **[04]**

---Best of Luck---

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– Bloom'S Taxonomy Report –

Sub: Optimization Techniques (01CT0614)
Sem. 6th
Branch: Information Communication and Technology

Que. Paper weightage as per Bloom's Taxonomy

LEVEL	% of weightage	Question No.	Marks of Que.
Remember/Knowledge	14	1a,6b	10,4=14
Understand	40	1b,2a,2b,4a,5a	10,8,8,8,6=40
Apply	16	3a,6a,3c	8,8,4 = 20
Analyze	16	3b,4b,5c	4,8,4=16
Evaluate	6	5b,	6=6
Higher order Thinking/ Creative	4	6c	4=4

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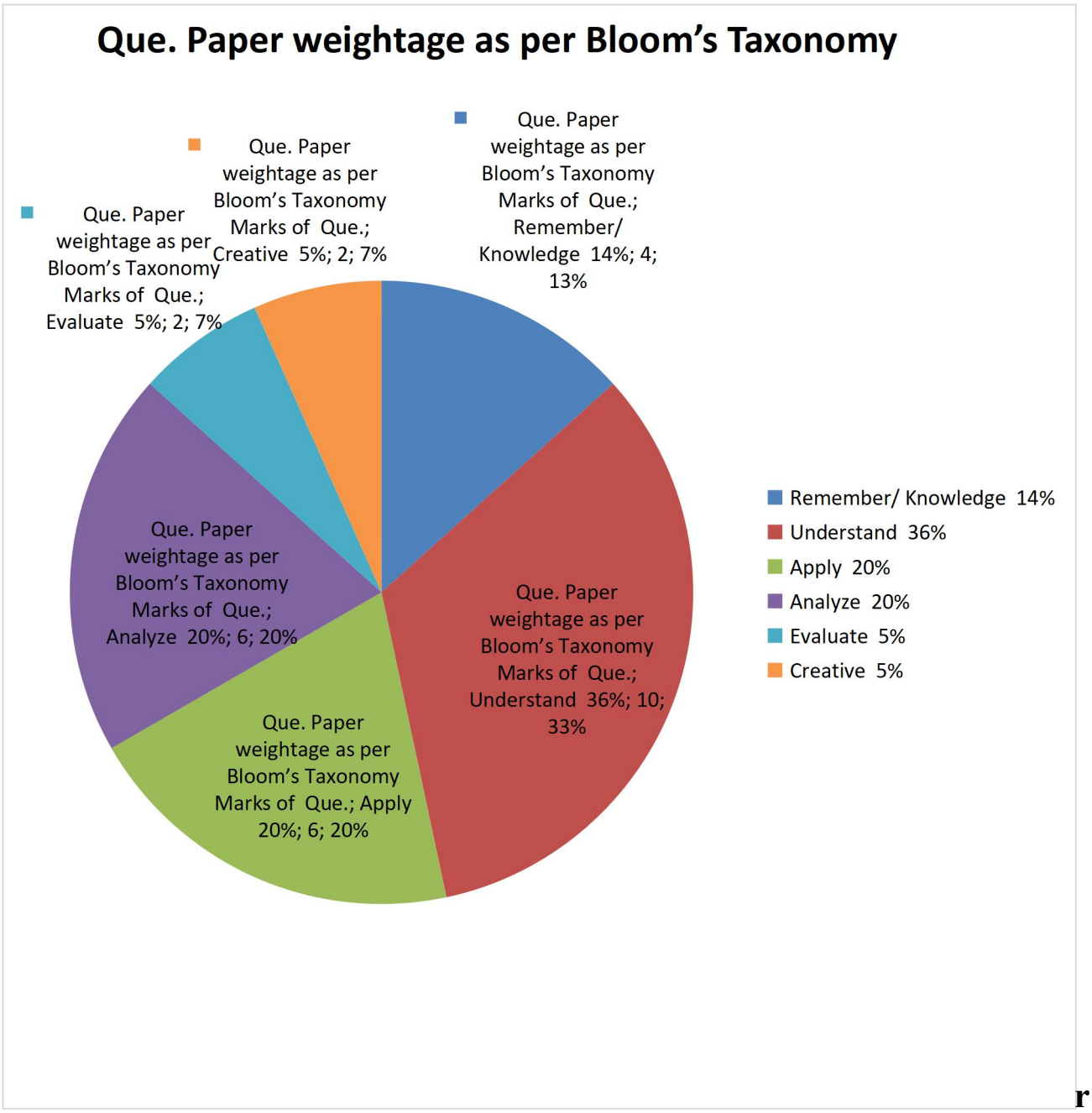

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t/Graph of Bloom's Taxonomy

Course Outcome Wise Questions

Subject Code	**01CT0614**	Subject	**OPTIMIZATION TECHNIQUES**

CO No.	Course Outcome
CO1	Cast engineering minima/maxima problems into optimization framework.
	1(A), 1(B), 2(A), 2(B), 2(B-Or), 4(A), 6(A-Or)
CO2	Learn efficient computational procedures to solve optimization problems
	1(A), 1(B), 2(B), 2(B-Or), 3(C), 3(C-Or), 4(B), 4(B-Or), 5(A), 6(A), 6(A-Or), 6(B), 6(B-Or), 6(C), 6(C-Or)
CO3	Apply optimization concepts to deal with real world situations
	1(A), 1(B), 3(A), 3(A-Or), 3(B), 3(B-Or), 3(C), 3(C-Or), 4(A), 4(A-Or), 5(A), 5(A-Or), 5(B), 5(B-Or), 6(B), 6(B-Or)
CO4	Design the simulation model for the given case study problem
	4(A-Or), 4(B-Or), 5(C), 5(C-Or), 6(C)

Blooms Taxonomy	Question List
Remember / Knowledge	1(A), 1(B), 2(A), 6(B), 6(B-Or)
Understand	1(A), 1(B), 2(A), 2(B), 2(B-Or), 3(C), 3(C-Or), 4(A), 4(A-Or), 4(B), 4(B-Or), 5(A), 5(A-Or)
Apply	1(A), 1(B), 3(A), 3(A-Or), 3(B), 3(B-Or), 6(A), 6(A-Or), 6(C), 6(C-Or)
Analyze	3(B), 3(B-Or), 3(C), 3(C-Or), 4(A), 4(A-Or), 4(B), 4(B-Or), 5(C), 5(C-Or), 6(B), 6(B-Or)
Evaluate	5(A), 5(A-Or), 5(B), 5(B-Or), 6(A), 6(A-Or)
Higher order Thinking / Creative	5(C), 5(C-Or), 6(C), 6(C-Or)