Enrollment No. 04801172022

MID-TERM EXAMINATION
B. Tech. CSE-AI / ECE-AI/Reappear Semester: IV
(March, 2024) OFF LINE mode

Code: BAI 204 | **Optimization Techniques and Decision Making**

Time : 1 ½Hours | **Maximum Marks : 30**

Note: Q. 1 is compulsory.

Q1		**(2.5*4)**	
	(a) Explain Optimization, and its applications in Engineering		
	(b) Depending on whether a particular point belongs to the acceptable or unacceptable region, it can be identified as one of the four types. Define and explain these types?		
	(c) Explain the merits and limitations of the graphical method?		
	(d) Explain decision variables, objective function, and constraints. Write an LPP to illustrate these terms?		

Q2	**(Attempt any Two Parts) UNIT-1**	**(5,5)**
	(a) A soft drink manufacturing company has 300 ml and 150 ml canned cola as its products with profit margin of Rs. 4 and Rs. 2 per unit respectively. Both the products have to undergo process in three types of machine. The following data indicates the time required on each machine and the available machine-hours per week. Formulate the optimization problem as an LPP to maximize the total profit considering the limited resources.	

Requirement	Cola 300 ml	Cola 150 ml	Available machine hours per week
Machine 1	3	2	300
Machine 2	2	4	480
Machine 3	5	7	560

	(b) Discuss briefly about multiple and unbounded optimization Linear Programming Problems. Use appropriate example to justify your answer.
	(C) Explain in detail the steps involved in formulating problems as mathematical programming problems? Explain the process, including the translation of design objectives and constraints into mathematical formulations

Q3	**(Attempt any Two Parts) UNIT-2**	**(5,5)**
	(a) An airplane can carry a maximum of 200 passengers. A profit of Rs 1000 is made on each executive class ticket and a profit of Rs 600 is made on each economy class ticket. The airline reserves at least 20 seats for executive class. However, at least 4 times as many passengers prefer to travel by economy class than by the executive class. Determine using a graphical method how many tickets of each type must be sold in order to maximize the profit for the airline. What is the maximum profit?	
	(b) Use Simplex method to solve the following LP problem Maximize $Z = 50x + 60y$ subject to: $2x + y <= 300$; $3x + 4y <= 509$; $4x + 7y <= 812$; $x, y >= 0$.	
	(C) Write the algorithm to solve LPP using the simplex method OR explain the Integer Programming Problems in Optimization with an example.	

[END-TERM EXAMINATION

B. TECH. CSE-AI / ECE-AI SEMESTER: IV

(May, 2024) OFFLINE MODE

Code: BAI 204	Optimization Techniques & Decision Making
Time : 3 Hours	Maximum Marks :60

Note: Q.1 is compulsory. Attempt one question each from the Units I, II, III & IV.

Q1		(5*4 =20)	
	(a) Discuss two applications of optimization in engineering. Explain the steps and general structure of optimization algorithms.		
	(b) A logistics company must decide which routes to use for transporting goods from warehouses to retail stores. There are five possible routes, each with different costs and capacities. Develop an integer programming model to minimize transportation costs while ensuring that all demand is met and each route is used at most once.		
	(c) What is crossover in the context of genetic algorithms, and how does it combine genetic information from two parent solutions to generate offspring? Explain the applications of Ant Colony Optimization problems?		
	(d) Explain the steps in Decision Analysis and the applications of decision trees in optimization methods in engineering.		
	UNIT-I		
Q2	Explain classification of optimization problems based on the nature of the equations involved, and give an example for each type of optimization problem in engineering.	(10)	
Q3	Define and explain role of constraints in defining feasible region. Illustrate how constraints are incorporated into the formulation of optimization problems using an example.	(10)	
	UNIT-II		
Q4	a) A manufacturer produces two products A and B. Both products are processed on two different machines. The available capacity of first machine is 12 hours and that of second machine is 9 hours per day. Each unit of A requires 3 hours on both machines and each unit of B requires 2 hours on first machine and 1 hour on second machine. Each unit of A is sold at Rs 7 profit and that of B at a profit of Rs 4 per unit. Compute maximum profit using Graphical Method. b) Discuss the limitations of the Graphical Method compared to more advanced solution techniques like the Simplex Method.	(10)	
Q5	a) Discuss conditions under which Simplex method terminates b) Discuss the possibility of an unbounded solution in linear programming and how Simplex method detects it?	(10)	

UNIT-III

Q6 (10)

a) Explain how Genetic Algorithms are applied to solve Knapsack Problem, highlighting the encoding, fitness function, selection, crossover, and mutation

b) Compare and contrast different selection mechanisms in Genetic Algorithms

Q7 (10)

a) Design Ant Colony Optimization algorithm for Traveling Salesman Problem, outlining the pheromone update rule, ant movement strategy, and construction of solutions.

b) Implement a simple PSO algorithm to optimize a basic mathematical function, specifying the initialization, update rules, termination condition, and parameter settings

UNIT-IV

Q8 (10)

A glass factory that specializes in crystal is developing a substantial backlog and for this the firm's management is considering three courses of action: To arrange for subcontracting (S1), to begin overtime production (S2), and to construct new facilities (S3). The correct choice depends largely upon the future demand, which may be low, medium, or high. By consensus, management ranks the respective probabilities as 0.10, 0.50 and 0.40. A cost analysis reveals the effect upon the profits. This is shown in the table below:

Demand	*Probability*	*Course of Action*		
		S_1 (*Subcontracting*)	S_2 (*Begin Overtime*)	S_3 (*Construct Facilities*)
Low (L)	0.10	10	– 20	– 150
Medium (M)	0.50	50	60	20
High (H)	0.40	50	100	200

Formulate this situation in the form of a decision tree and indicate the most preferred decision and its corresponding expected value.

Q9 **(10)**

The following matrix gives the payoff (in Rs) of different strategies (alternatives) S_1, S_2 and S_3 against the four states of nature (events) N_1, N_2, N_3 and N_4 :

Strategy	*State of Nature*			
	N_1	N_2	N_3	N_4
S_1	4,000	– 100	6,000	18,000
S_2	20,000	5,000	400	0
S_3	20,000	15,000	– 2,000	1,000

Indicate the decision taken under the following approaches: (i) Maximin criterion (ii) Maximax criterion (iii) Equal probability (iv) Regret criterion (v) Hurwicz criterion where the degree of optimism is 0.7

(Please write your Enrollment Number) **Enrollment No._____**

End-Term Examination
(CBCS)(SUBJECTIVE TYPE)(OffLine)
Course Name: B.TECH, Semester:5th
(December, 2024)

Subject Code: BAM 301	**Subject: Optimization Techniques and Decision Making**
Time :3 Hours	**Maximum Marks :60**

Note:Q1 is compulsory. Attempt one question each from the Units I, II, III & IV.

<table>
<tr><td>Q1</td><td></td><td>(2.5*8 =20)</td><td>CO Mapping</td></tr>
<tr><td></td><td>a) State associated Issues with Iterative Methods.</td><td>2.5</td><td>1</td></tr>
<tr><td></td><td>b) What are the complementary slackness conditions?</td><td>2.5</td><td>1</td></tr>
<tr><td></td><td>c) Explain Curvature Analysis.</td><td>2.5</td><td>2</td></tr>
<tr><td></td><td>d) State disadvantages of Newton’s Method.</td><td>2.5</td><td>2</td></tr>
<tr><td></td><td>e) What is Bias-Variance tradeoff?</td><td>2.5</td><td>3</td></tr>
<tr><td></td><td>f) Differentiate overfitting and underfitting.</td><td>2.5</td><td>3</td></tr>
<tr><td></td><td>g) What are the "positive ideal solution" and "negative ideal solution" in the TOPSIS method?</td><td>2.5</td><td>4</td></tr>
<tr><td></td><td>h) What is the role of the kernel in Support Vector Machines?</td><td>2.5</td><td>4</td></tr>
<tr><td colspan="2">UNIT I</td><td></td><td>CO Mapping</td></tr>
<tr><td>Q2</td><td>The manager of an oil refinery must decide on the optimal mix of two possible blending processors of which the input and output production runs as follows-
<table>
<tr><td>Process</td><td>Input</td><td>Input</td><td>Output</td><td>Output</td></tr>
<tr><td></td><td>Crude A</td><td>Crude B</td><td>Gasoline X</td><td>Gasoline Y</td></tr>
<tr><td>1.</td><td>6</td><td>4</td><td>6</td><td>9</td></tr>
<tr><td>2.</td><td>5</td><td>6</td><td>5</td><td>5</td></tr>
</table>
The maximum amounts available of Crude A and B are 250 units and 200 units respectively. Market demand shows that atleast 150 units of Gasoline X & 130 units of Gasoline Y must be produced. The profits per production run from Process 1 & Process 2 are Rs.4 and Rs.5 respectively. Formulate the problem for maximizing the profit.</td><td>(10)</td><td>1</td></tr>
<tr><td>Q3</td><td>Minimize the quadratic function using Steepest Descent Method.
$f(x)=x^2+4x+4$</td><td>(10)</td><td>1</td></tr>
<tr><td colspan="2">UNIT II</td><td></td><td>CO Mapping</td></tr>
<tr><td>Q4</td><td>Explain the concept of lagrange variables. Find minimum value of the objective function $f(x,y)=x^2+y^2$
subject to: x+y=1, using Lagrange variables method.</td><td>(10)</td><td>2</td></tr>
<tr><td>Q5</td><td>What is the advantage of the Quasi Newton Method over Newton Method? Minimize the function using the Quasi Newton Method.
$f(X)=x^2+2x+1$
starting from an initial guess of $x_0=0$ and Take $\alpha=1$.</td><td>(10)</td><td>2</td></tr>
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<tr><th colspan="2">UNIT III</th><th></th><th>CO Mapping</th></tr>
<tr><td>Q6</td><td>Explain K Nearest Neighbors Algorithm with an example.</td><td>(10)</td><td>3</td></tr>
<tr><td>Q7</td><td>Define Prescriptive Analytics? What are its types and differentiate between them?</td><td>(10)</td><td>3</td></tr>
<tr><th colspan="2">UNIT IV</th><th></th><th>CO Mapping</th></tr>
<tr><td>Q8</td><td>Explain k-means algorithm. For the given data, compute two clusters using K-means algorithm for clustering where initial cluster centers are (1.0, 1.0) and (5.0, 7.0). Execute for two iterations.
<table>
<tr><td>Record No</td><td>R1</td><td>R2</td><td>R3</td><td>R4</td><td>R5</td><td>R6</td><td>R7</td></tr>
<tr><td>A</td><td>1</td><td>1.5</td><td>3</td><td>5</td><td>3.5</td><td>4.5</td><td>3.5</td></tr>
<tr><td>B</td><td>1</td><td>2</td><td>4</td><td>7</td><td>5</td><td>5</td><td>4.5</td></tr>
</table></td><td>(10)</td><td>4</td></tr>
<tr><td>Q9</td><td>(a) What is a Markov Decision Process (MDP), and why is it important in reinforcement learning?
(b) What is reinforcement learning? Write its applications.</td><td>(10)</td><td>4</td></tr>
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