Babu Banarasi Das
National Institute of Technology and Management

Department of Computer Applications

Question Bank

Masters of Computer Applications (MCA) NEW Syllabus
(Affiliated to U. P. Technical University, Lucknow.)

III Semester

MCA315: Computer Based Optimization Techniques

(Short-to-Medium-Answer Type Questions)

UNIT I

1. Explain the various inventory model with suitable real life examples.

2. Briefly describe the procedure to select the best machine from the two available machines?

3. What do you mean by Replacement Problem also describe various types of failures?

4. Discuss Group Replacement and also State the Group Replacement Policy.

5. Discuss the concept of Price- Break and Briefly describe One and Two Price-Break with examples.

6. Briefly describe various kinds of inventories also differentiate between direct and indirect inventories?

7. Briefly describe the various costs involved in inventory management?

8. What do you understand by Inventory management also describe different types of Inventories.

9. What do you mean by EOQ also discuss at least three EOQ models.

10. Discuss the Economic lot size model with different rates of demands in different cycles.

11. How the gradual failure is different from sudden failure, explain with real life examples.

12. Discuss the multi-item deterministic models with constraints.

UNIT II

1. What do you mean by Artificial Variables, Discuss their role in the solution of L.P.P.

2. Briefly describe the steps to solve two variable L.P.P. using Graphical Method.

3. Discuss the various steps of Simplex algorithm in Detail.

4. Discuss the steps of Dual Simplex Method for solving Linear Programming Problem.

5. Explain the advantages of Revised Simplex Method over simplex method.

6. "In dual simplex we move from infeasibility to feasibility while in simplex we move towards optimality", Explain.

7. Solve the following L.P.P. using Graphical method

   Min $Z = 1.5 X1 + 2.5 X2$
   s.t. $X1 + 3 X2 >= 3$
   $X1 + X2 >= 2$
   $X1, X2 >= 0$

8. Solve the following L.P.P. using 2-Phase method

   Max $Z = 5X1 + 3X2$
   s.t. $2X1 + X2 <= 1$
   $X1 + 4X2 >= 6$
   $X1, X2 >= 0$

9. Solve the following L.P.P. using Big-M method.
   Min $Z = 4X1 + 3X2$
   s.t. $2 X1 + X2 >= 10$
   $- 3X1 + 2 X2 <= 6$
   $X1 + X2 >= 6$
   $X1, X2 >= 0$

10. Solve the following L.P.P. using Big-M method

    Max $Z = 3X1 + 2.5X2$
    s.t. $2X1 + 4X2 >= 40$
    $3X1 + 2X2 >= 50$
    $X1, X2 >= 0$

11. Solve the following using Dual Simplex

    Max $Z = -3X1 - X2$
    s.t. $X1 + X2 >= 1$
    $2X1 + 3X2 >= 2$
    $X1, X2 >= 0$

12. Solve the following using Graphical method

    Max $Z=3X1+2X2$
    s.t.
    $-2X1+X2<=1$
    $X1<=2$
    $X1+X2<=3$
    $X1,X2>=0$

UNIT III

1. What do you mean by Degeneracy in Transportation Problem, how can we remove it?

2. What do you understand by I.P.P. and how it different from L.P.P.

3. Discuss the step wise algorithm for All-Integer I.P.P. using Gomory's Cutting Plane Method.

4. "A necessary and sufficient condition for the existence of feasible solution of the transportation problem is $\sum ai = \sum bj$ (i=1,2,…….m; j=1,2,…………..n)", Prove it.

5. Describe the procedure to deal with unbalance Transportation and Assignment problems.

6. Solve the following Transportation Problem:

Warehouse	W1	W2	W3	W4	Capacity
F1	19	30	50	10	7
F2	70	30	40	60	9

F3	40	8	70	20	18
Requirement	5	8	7	14	34

7. Obtain the Initial Basic Feasible Solution to the following transportation problem:

	D	E	F	G	Availble
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Req.	200	225	275	250	

8. Five salesman are to be assigned to five Zones. Based on the past performance, the following table shows the annual sales that can be generated by each salesman in each zone. Find the optimum assignment.

		Zones				
		Z1	Z2	Z3	Z4	Z5
Salesman	S1	26	14	10	12	9
	S2	31	27	30	14	16
	S3	15	18	16	25	30
	S4	17	12	21	30	25
	S5	20	19	25	16	10

9. Find the optimum solution for the following Transportation Problem

	D1	D2	D3	D4	Supply
O1	23	27	16	18	30
O2	12	17	20	51	40
O3	22	28	12	32	53
Demand	22	35	25	41	

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

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

11. Write the steps for obtaining optimal solution of Transportation Problem with proper illustration.

12. What do you mean by Assignment Problem, Also write the steps to find the optimal Assignment.

UNIT IV

1. State the kuhn-Tucker necessary and sufficient conditions.
2. Discuss the characteristics of Dynamic Programming Problem.
3. State the principle of Bellman's Optimality and also discuss its utility.
4. Discuss the various applications of Dynamic Programming Problem
5. What do you mean by Non Linear Programming Problems, Also discuss the Wolfe's Method.
6. Write the Kuhn-Tucker Conditions for Non Linear Programming Problems.
7. Solve the following non-linear programming problem using Graphical method

   Max $Z=2x1+3x2$
   s.t. $(x1)^2+(x2)^2<=20$
   $x1x2<=8$
   $x1,x2>=0$

8. Discuss the steps of Wolfe's method to solve a quadratic programming problem.
9. Briefly describe the procedure to solve a quadratic programming problem using Beale's method.
10. Write the kuhn-tucker necessary conditions for the following problem.

    Max $f(x) = (X1)^3 - (X2)^3 + X1(X3)^2$
    s.t. $X1 + (X2)^2+X3 = 5$
    $5(X1)^2 + (X2)^2 - x3 >= 2$
    $X1,X2,x3 >=0$

11. Solve the following Non Linear Programming Problem using the method of Lagrangian multiplier

Min $Z = (x1)^2+(x2)^2+(x3)^2$
s.t. $x1+x2+3x3=2$
$5x1+2x2+x3=5$
$X1,X2,x3 >=0$

12. Find the necessary conditions for the following Non Linear Programming Problem.

Min $Z = 2(x1)^2 – 24x1 + 2(x2)^2 – 8x2 + 2(x3)^2 -12x3 +200$
s.t. $x1+x2+x3=11$
$X1,X2,X3 >=0$

UNIT V

1. Discuss the concept of Queues in Operations Research through some real life examples.

2. Why the Exponential Distribution is known as Memory Less Distribution, Explain.

3. Discuss the Erlang distribution in Queuing theory, Also write its mean, Variance and Probability Density Function

4. Discuss the Service-time distribution in Queuing theory.

5. Discuss the Kendall’s Notations for representing Queuing Models.

6. Briefly describe the basic elements of Queuing Model.

7. Explain the Pure-Birth or Poisson Process of queuing theory.

8. “If number of arrivals in time t follow Poisson distribution then the inter-arrival time will follow negative exponential law”, Prove it.

9. Differentiate between Steady and Transient States, also describe the concept of Traffic Intensity.

10. State and prove the Markovian property of inter-arrival time.

11. Establish the formula to find the expected waiting time in the queue (excluding the service time) (Wq).

12. Discuss the inter-relationship among Ls, Lq, Ws and Wq.

(Long Answer Type Questions)

UNIT I

1. A manual stamper currently valued at Rs.1000 is expected to last 2 yearsand costs Rs.4000 per year to operate. An automatic stamper which can be purchased for Rs.3000 will last 4 years and can be operated at an annual cost of Rs.3000. If money carries the rate of interest 10% per year, determine which stamper should be purchased.

2. Explain the concept of Economic Order Quantity and discuss the models with and without shortages.

3. Briefly Describe the following:
   a. Steady State
   b. Transient State
   c. Economic Order Quantity
   d. Two Price Break
   e. Present Worth Factor

4. A customer has to supply 10,000 bearings per day to an automobile company. He finds that when he starts a production run, he can produce 25000 bearings per day. The cost of holding a bearing in stock for one year is 20 paise and setup cost is Rs.180. How frequently should production run be made?

5. Explain the rules for determining the economic lot size in case of one and two price-break models.

6. A computer contains 10000 resistors. When any one of the resistor fails, it is replaced. The cost of replacing a single resistor is Rs.10 only. If all the resistors are replaced at the same time, the cost per resistor would be reduced to Rs3.50. The percent surviving by the end of month t is as follows:

Month(t) :	0	1	2	3	4	5	6
% surviving :	100	97	90	70	30	15	0

UNIT II

1. Solve the following L.P.P.

Min $Z = X1 - 3X2 + 2X3$

s.t. $3 X1 - X2 + 3X3 <= 7$

$-2 X1 + 4 X2 <= 12$

$-4 X1 + 3X2 + 8X3 <=10$

$X1,X2,X3 >= 0$

2. Solve the following L.P.P.

Max $Z=107 X1 + X2 + 2X3$

s.t. $14 X1 + X2 + 3X4 – 6X3 = 7$
$16 X1 + .5 X2 – 6X3 <= 5$
$3 X1 – X2 – X3 <= 0$
$X1,X2,X3,X4 >= 0$

3. Solve using Simplex method

Max $Z=4X1+5X2 + 9X3 + 11X4$
s.t.
$X1+X2+X3+X4<=15$
$7X1+5X2+3X3+2X4<=120$
$3X1+5X2+10X3+15X4<=100$
$X1,X2,X3,X4>=0$

4. Solve the following L.P.P. using 2-Phase method

Min $Z = X1 – 2X2 – 3X3$
s.t. $- 2X1 + X2 + 3X3 = 2$
$2X1 + 3X2 + 4X3 = 1$
$X1,X2,X3 >= 0$

5. Solve using Revised Simplex method

Max $Z=2X1 +X2$
s.t.
$2X1+X2 - 6X3=20$
$6X1+5X2+10X3<=76$
$8X1-3X2+6X3<=50$
$X1,X2,X3>=0$

6. Solve using Dual Simplex method

Min $Z=6X1 +7X2 + 3X3+5X4$
s.t. $5X1+6X2 - 3X3+4X4>=12$
$X2+5X3 – 6X4>=10$
$2X1+5X2+X3+X4>=8$
$X1,X2,X3,X4>=0$

UNIT III

1. Solve the following I.P.P. Using Gomory Cutting-Plane method

Max $Z=4X1 +6X2 + 2X3$

s.t. $4X1 - 4X2 <=5$
$- X1+6X2 <=5$
$- X1+X2+X3<=5$
$X1,X2,X3>=0$ & $X1,X3$ are integers

2. Solve the problem Using Gomory Cutting-Plane method

Max $Z=X1 +2X2$

s.t. $X1+ X2 <=7$

$2X1 <=11$

$2X2<=7$

$X1,X2>=0$ & integers

3. Solve the problem Using Branch and Bound method

Max $Z=6X1 +8X2$

s.t. $X1+ 4X2 <=8$

$7X1+2X2 <=14$

$X1,X2>=0$ & integers

4. Use Branch and Bound technique to solve the following integer programming problem.

Max $Z=4X1 +3X2$

s.t. $5X1+ 3X2 >=30$

$X1<=4$

$X2<=6$

$X1,X2>=0$ & integers

5. The owner of a small machine shop has four machinists available to do jobs for the day. Five jobs are offered with expected profit for each machinist on each job as follows:

	1	2	3	4
A	32	41	57	18
B	48	54	62	34
C	20	31	81	57
D	71	43	41	47
E	52	29	51	50

Find by using the assignment method, the assignment of machinists to jobs that will result in a maximum profit. Which job should be declined.

6. Solve the following Problem using Branch & Bound method

Max $Z = 4X1 + 3X2$

s.t. $5X1 + 3X2 >= 30$

$X1 <= 4$

$X2 <= 6$

$X1, X2 >= 0$ & Integers

UNIT IV

1. Determine X1, X2 and X3 so as to

   Max $f(x) = - (X1)2 – (X2)2 - (X3)2 + 4 X1 + 6X2$

   s.t. $X1 + X2 <= 2$

   $2X1 + 3X2 <= 12$

   $X1,X2 >=0$

2. Write the khun-Tucker conditions for the following Non Linear Programming Problem

   Min $f(X) = (X1)^2 + (X2)^2 + (X3)^2$

   s.t. $g_1(X) = 2 X1 + X2 <= 5$

   $g_2(X) = X1 + X3 <= 2$

   $g_3(X) = - X1 <= -1$

   $g_4(X) = - X2 <= -2$

   $g_5(X) = - X3 <= 0$

3. Determine X1, X2, X3 so as to maximize

   Max $Z= - (x1)^2- (x2)^2- (x3)^2+4x1+6x2$

   s.t. $x1+x2<=2$

   $2x1+3x2<=12$

   $x1,x2>=0$

4. Obtain the set of necessary conditions for the non-linear programming problem:

   Max $z= (x1)2+3(x2)2+5(x3)2$

   s.t. $x1+x2+3x3=2$

   $5x1+2x2+x3=5$

   $x1,x2,x3>=0$

5. Obtain the set of necessary and sufficient conditions for the optimum solution of the following non-linear programming problem:

   Min $z= 3e^{2x1+1} + 2e^{x2+5}$

   s.t. $x1+x2=7$

   $x1,x2>=0$

6. Apply Wolfe's method for Solving the following Quadratic Programming Problem

   Max $Z= 4x1+6x2 - 2(x1)2 - 2x1x2 – 2(x2)2$

   s.t. $x1+2x2<=2$

   $x1,x2>=0$

UNIT V

1. Explain the Birth and Death model (M|M|1):(∞|FCFS).

2. In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter-arrival time follows an exponential distribution and service time distribution is also exponential with an average 36 minutes. Calculate the following:
   (a)The average number of trains in the queue.
   (b)The probability that the queue size exceeds 10.
   If the input of trains increases to an average 33 per day, what will be change in (a) and (b)?
3. In the above problem calculate the following:
   (i) Expected waiting time in the queueu
   (ii) The probability that number of trains in the system exceeds 10
   (iii) Average number of trains in the queue.

4. "If the arrivals are completely random then the probability distribution of number of arrivals in a fixed time interval follows a poisson distribution", Prove it.

5. Consider an example from a maintenance shop. The inter-arrival times at toolcrib are exponential with an average time of 10 minutes. The length of service time is assumed to be exponentially distributed with mean 6 minutes. Find:
   a) The probability that a person arriving at the booth will have to wait
   b) Average length of the queue that forms and the average time that an operator spends in the Q-system.
   c) The probability that there will be six or more operators waiting for the service.
   d) Estimate the fraction of the day that toolcrib operator will be idle.

6. Find the system of differential-difference equations for pure birth process and derive the formula for the "($P_n(t)$) Probability of n arrivals in time 't' ".