

UG Department Of Computer Applications

NGM College, Pollachi

17UBC4A4 -Computer Based Optimization Techniques

UNIT-1

1. Operations research is the application of _____ methods to arrive at the optimal solutions to the problems.

A. Economical B. Scientific C. A and B both D. Artistic

2. Feasible solution satisfies _____

A. Only constraints B. only non-negative restriction C. [a] and [b] both

D. [a], [b] and Optimum solution

3. In Degenerate solution value of objective function _____.

A. increases infinitely B. decreases infinitely C. basic variables are nonzero

D. One or more basic variables are zero

4. Minimize $Z =$ _____

A. $-\text{maximize}(Z)$ B. $\text{maximize}(-Z)$ C. $-\text{maximize}(-Z)$ D. none of the above

5. In graphical method the restriction on number of constraint is _____.

A. 2 B. 3 C. not more than 3 D. none of the above

6. In graphical representation the bounded region is known as _____ region.

A. Solution B. feasible solution C. basic solution D. optimal

7. Graphical optimal value for Z can be obtained from

A. Corner points of feasible region B. corner points of the solution region
C. Both a and c D. none of the above

8. In LPP the condition to be satisfied is

A. Constraints have to be linear B. Objective function have to be linear

C. both [a]and [b] D. none of the above

9. Alternative solution exist in a linear programming problem when

A. one of the constraint is redundant B. objective function is parallel to one of the constraints

C. two constraints are parallel D. all of the above

10. Linear programming problem involving only two variables can be solved by

A. Big M method B. Simplex method C. Graphical method D. none of these

UNIT-2

11. From the following methods _____ is a method to obtain initial solution to Transportation Problem.

A. North-West B. Simplex C. Hungarian D. Newton Raphson

12. The Penalty in VAM represents difference between _____ cost of respective row / column.

A. Two Largest B. smallest two C. largest and smallest D. none of them

13. Number of basic allocation in any row or column in Assignment Problem can be

A. Exactly one B. at most one C. at least one D. none of them

14. North – West corner refers to _____.

A. top left corner B. top right corner C. both of them D. none of them

15. The _____ method's solution for transportation problem is sometimes an optimal solution itself.

A. NWCM B. VAM C. LCM D. Row Minima

16. If number of sources is not equal to number of destination in Assignment problem then it is called _____.

A. unbalanced B. symmetric C. unsymmetric D. balanced

17. The _____ method used to obtain optimum solution of travelling salesman problem.

A. Simplex B. Hungarian C. dominance D. graphica

18. The purpose of a dummy row or column in an assignment problem is to

- A. obtain balance between total activities and total resources
- B. prevent a solution from becoming degenerate
- C. provide a means of representing a dummy problem
- D. none of the above

19. An optimal of an assignment problem can be obtained only if

- A. each row and column has only one zero element
- B. each row and column has at least one zero element
- C. the data are arrangement in a square matrix
- D. none of the above

20. The method used for solving an assignment problem is called

- A. reduced matrix method B. MODI method C. Hungarian method D. none of the above

UNIT-3

21. EOQ means _____

- A. Economical Order Quantity B. Economically Order Quality C. Economical undo Quantity
- D. Economical undo quality

22. EOQ is also referred to as the _____

- A. Lot Sized B. Optimum Sized C. optimum lot sized D. Sized

23. In _____, economic order quantity (EOQ) is the order quantity that minimizes the total holding costs and ordering costs

- A. inventory management B. Inventory C. Inventory Control D. Inventory Controller

24. There are _____ types of costs that must be considered in setting inventory levels

- A. three B. two C. four D. one

25. The _____ is a not-to-exceed amount used for inventory planning.

A. maximum stock level B. minimum stock level C. medium stock level D. low level stock

26. Economic Order Quantity is a formula used to calculate_____.

A. non inventory stocking level B. inventory stock level

C. inventory stocking levels D. inventory stack levels

27. Inventories in general are build up to

A.satisfy demand during period of replenishment B.carry reserve stocks to avoid shortage

C.keep pace with changing market conditions D.all of the above

28. if small orders are placed frequently (rather than placing large orders infrequently), then total inventory cost is

A. reduced B.increased C.either reduced or increased D. minimized.

29. economic order quantity (EOQ) results in

A. equalisation of carrying cost and procurement cost and procurement cost

B. minimization of set up cost

C. favourable procurement price

D. reduced chance of stocks out

30. which cost can vary with order quantity ?

A. unit cost only B. holding cost only C. re-order cost only D. all of the above

UNIT-4

31.In sequencing algorithm

A.the selection of an appropriate order for a series of jobs is to be done on a finite service facilities.

B.all the jobs must be processed on a first-come first service basis.

C.a service facility can process more than one job at a time.

D. all the service facilities are not of different type.

32.In sequencing problems

- A. all jobs are completely known and are ready for processing.
- B. jobs are processed sequentially, i.e., first on the first machine and then on the second machine, and so on.
- C. total elapsed time is determined by the point of time at which the first of then job k goes to machine A until the time when the last job comes off machine B.
- D. all of the above.

33. A sequencing problem involving six jobs and three machines requires evaluation of

- A. $(6!+6!+6!)$ sequences
- B. $(6!)^3$ sequences
- C. $(6*6*6)$ sequences
- D. $(6+6+6)$ sequences

34. The general assumption which is not correct in solving a sequencing problem is that:

- A. the time taken by different jobs in moving from one machine to another is negligible.
- B. the processing times on various machines are independent of the order in which different jobs are processed on them.
- C. a job once started on a machine would be performed to the point of completion uninterrupted.
- D. a machine can process more than one job at a given point of time.

35. In sequencing problems

- A. gantt charts can be used to determine optimum sequence in relatively small-sized problems.
- B. gantt charts provide a very effective technique for solving large sized sequencing problems.
- C. a unique optimum solution exists.
- D. first-come-first served basis of job performance is the ideal one since it involves a sense of fair play.

36. In 'n' jobs and two machine (say A and B) sequencing problems in which the order of processing is AB

- A. job having minimum time on machine B is processed first.
- B. job having minimum time on machine A is processed last.
- C. job having minimum time on machine B is processed in the last.
- D. job having maximum time on machine B is processed in the last

37. ----- time take a considerable amount of time to transport the items from one facility to another.

- A. Transportation
- B. Maintenance crew
- C. sequencing
- D. processing

38. A machine may break down and operator may be absent or injured at work.

- A. Machine breakdown
- B. machine shortages
- C. Expediting

D. overlap

39. Sequencing problems involving processing of two jobs on 'n' machines

A. can be solved graphically

B. cannot be solved graphically

C. have a condition that the processing of two jobs must be in the same order

D. none of the above

40. Which of the following is not correct?

A. there is no general solution procedure available for solving sequencing problems involving processing of n jobs through three machines.

B. in case of two jobs needing processing on some machines in varying order, the problem may be solved graphically.

C. Solution to a sequencing problem is found in such a manner that none of the machines is idle at any time.

D. Maintenance crew scheduling problems can also be considered as sequencing problems

UNIT-5

41. PERT analysis is based on

A. optimistic time

B. pessimistic time

C. most likely time

D. all the above.

42. Critical path method

A. is an improvement upon bar chart method

B. provides a realistic approach to daily problems

C. avoids delays which are very common in bar charts

D. All the above.

43. While scheduling a project by C.P.M.

A. a project is divided into various activities

B. required time for each activity is established

C. sequence of various activities is made according to their importance

D. All the above

44. The performance of a specific task in CPM, is known

A. Dummy

B. Event

C. Activity

D. Contract.

45. PERT technique of network analysis is mainly useful for

- A. small projects B. large and complex projects
C. research and development projects D. deterministic activities

46. Which of the following is a weakness of bar chart?

- A. interdependencies of activities B. project progress
C. uncertainties D. all of the above

47. The critical activity has

- A. maximum float
B. minimum float
C. zero float
D. none of these.

48. The time by which activity completion time can be delayed without affecting the start of succeeding activities, is known as

- A. duration
B. total float
C. free float
D. interfering float.

49. For completion of a project, the critical path of the network represents

- A. minimum time
B. maximum time
C. maximum cost
D. minimum cost.

50. In a certain project an activity C can only be started when activities A and B have been completed, which have no bearing on each other and can be started independently. The correct network for the activities, is

- A. Activities A and B can be started independently
B. Activity C can be started only on completion of activity A
C. Activity D can be started only on completion of activity
D. all the above

KEY ANSWERS:

1.B	2.C	3.D	4.C	5.D	6.B	7.A	8.C	9.B	10.C
11.A	12.B	13.A	14.A	15.B	16.C	17.B	18.A	19.B	20.C
21.A	22.C	23.A	24.A	25.B	26.B	27.D	28.C	29.A	30.D
31.A	32.D	33.B	34.D	35.A	36.C	37.A	38.A	39.A	40. C
41.D	42.D	43.D	44.C	45.C	46.D	47.C	48.C	49.A	50.D

U.G. Department of Computer Applications

N.G.M College, Pollachi

17 UBC 4A4 – MATHEMATICS-II COMPUTER BASED OPTIMIZATION TECHNIQUES

K3-Level Questions

1. Use the graphical method to solve the following LPP:

Minimize $z = -x_1 + 2x_2$ subject to the constraints:

$-x_1 + 3x_2 \leq 10$, $x_1 + x_2 \leq 6$, $x_1 - x_2 \leq 2$ and $x_1 \geq 0$, $x_2 \geq 0$.

2. Rewrite in standard form the following LPP:

Minimize $z = 2x_1 + x_2 + 4x_3$ subject to the constraints:

$-2x_1 + 4x_2 \leq 4$, $x_1 + 2x_2 + x_3 \geq 5$, $2x_1 + 3x_3 \leq 2$, $x_1, x_2 \geq 0$ and x_3 unrestricted in sign.

3. Explain the advantages of linear program problem.

4. Use simplex method to solve the LPP Maximize $z = 4x_1 + 10x_2$; subject to constraints : $2x_1 + x_2 \leq 50$, $2x_1 + 5x_2 \leq 100$, $2x_1 + 3x_2 \leq 90$ and $x_1 \geq 0$, $x_2 \geq 0$.

5. Obtain an initial basic feasible solution to the following T.P. using the matrix minima method:

	D ₁	D ₂	D ₃	D ₄	Capacity
O ₁	1	2	3	4	6
O ₂	4	3	2	0	8
O ₃	0	2	2	1	10
Demand	4	6	8	6	

where O_i and D_j denote ith origin and jth destination respectively.

6. Solve the assignment problem using Hungarian method. In this problem, 5 different jobs are to be assigned to 5 different operators such that the total processing time is minimized. The matrix entries represent processing times in hours. Find total processing time.

times to process items in hours: 1 and total processing time.						
Job	Operator					
		1	2	3	4	5
	1	10	12	15	12	8
	2	7	16	14	14	11
	3	13	14	7	9	9
	4	12	10	11	13	10
	5	8	13	15	11	15

7. Use Vogel's approximation method to obtain an initial basic feasible solution of the transportation problem

	Distribution				Supply
	2	3	11	7	6
Sources	1	0	6	1	1
	5	8	15	9	10
Demand	7	5	3	2	

8. Solve the following assignment problem:

18	26	17	11
13	28	14	26
38	19	18	15
19	26	24	10

9. Write about types of Inventories.

10. The demand for a certain item is 16 units per period. Unsatisfied demand causes a shortage cost of Rs. 0.75 per unit per short period. The cost of initiating purchasing action is Rs. 15 per purchase and the holding cost is 15% of average inventory valuation per period. Item cost is Rs. 8 per unit. (Assume that shortages are being back ordered at the above mentioned cost). Find the minimum cost purchase quantity.

11. A Manufacturer has supplied his customers with 600 units of his product/year. Shortages are not allowed and the shortage cost amount rs 0.60/unit for year. The setup cost per annum is Rs.80.Find the optimum run size and the minimum average yearly cost.

12. Explain the cost involved in Inventory problem.

13. Determine the optimal sequence of jobs that minimizes the total elapsed time based on the following information. Processing time on machines is given in hours and passing is not allowed:

Job:	A	B	C	D	E	F	G
Machine M ₁ :	3	8	7	4	9	8	7
Machine M ₂ :	4	3	2	5	1	4	3
Machine M ₃ :	6	7	5	11	5	6	12

14. Solve the sequencing problem when passing out is not allowed:

Item	Machine (Processing time in hours)			
	A	B	C	D
I	15	5	4	15
II	12	2	10	12
III	16	3	5	16
IV	17	3	4	17

15. There are five jobs, each of which is to be processed through two machines M_1, M_2 in the order M_1, M_2 processing hours are as follows:

Job	1	2	3	4	5
Machine A	3	8	5	7	4
Machine B	4	10	6	5	8

Determine the optimum sequence for the jobs, and minimum elapsed time.

Also, find the idle time of machines A and B.

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

Job 1	Sequence of machines Time (in hrs)	A	B	C	D	E
		2	3	4	6	2
Job 2	Sequence of machines Time (in hrs)	C	A	D	E	B
		4	5	3	2	6

17. Write the distinction between PERT and CPM.

18. Explain Rules of Network Construction.

19. A small project consists of seven activities for which the relevant data are given below:

Activity	Preceding Activities	Activity Duration (Days)
A	-	4
B	-	7
C	-	6
D	A,B	5
E	A,B	7
F	C,D,E	6
G	C,D,E	5

Draw the network and find the project completion time.

20. A project consists of eight activities with the following relevant information:

Activity		Estimated duration		
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

Draw the project network and expected duration.

K4-Level Questions.

1. Use simplex method to solve the following LPP:

Maximize $z = 4x_1 + 10x_2$ subject to the constraints:

$2x_1 + x_2 \leq 50$, $2x_1 + 5x_2 \leq 100$, $2x_1 + 3x_2 \leq 90$ and $x_1 \geq 0$, $x_2 \geq 0$.

2. Consider the following LP model and solve it by using Big M method.

Minimize $z = 2x_1 + 3x_2$ subject to the constraints:

$x_1 + x_2 \geq 6$, $7x_1 + x_2 \geq 14$ and $x_1 \geq 0$, $x_2 \geq 0$.

3. Use the graphical method to solve the following LPP

Minimize $z = -x_1 + 2x_2$;

Constraints : $-x_1 + 3x_2 \leq 10$, $x_1 + x_2 \leq 6$, $x_1 - x_2 \leq 2$ and $x_1 \geq 0$, $x_2 \geq 0$

4. Use penalty (or Big M) method to Minimize $z = 4x_1 + 3x_2$

constraints: $2x_1 + x_2 \geq 10$, $-3x_1 + 2x_2 \leq 6$, $x_1 + x_2 \geq 6$ and $x_1 \geq 0$, $x_2 \geq 0$.

5. Use Vogel's Approximation method to obtain an initial basic feasible solution of the transportation problem:

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

6. A company has six machines which can process six different jobs. The processing time (minutes) of different machines is presented in table. Find the optimal assignment of the jobs to the machines such that the total processing time is minimized.

Job	Machine					
		A	B	C	D	E

	1	10	15	12	18	14	13
	2	17	14	22	16	19	20
	3	12	15	13	8	12	9
	4	11	16	15	22	21	18
	5	13	10	17	19	15	10
	6	15	8	14	25	16	18

7. Solve the following transportation problem

					Supply
	11	13	17	14	6
	16	18	14	10	1
	21	24	13	10	10
Demand	200	225	275	250	

8. Solve the following assignment problem:

10	5	13	15
3	9	18	3
10	7	3	2
5	11	9	7

9. A company operating 50 weeks in a year is concerned about its stocks of copper cable. This costs Rs. 240 a metre and there is a demand for 8,000 metres a week. Each replenishment costs Rs. 1,050 for administration and Rs. 1,650 for delivery, while holding costs are estimated at 25 per cent of value held a year. Assuming no shortages are allowed, what is the optimal inventory policy for the company? How would this analysis differ if the company wanted to maximize profit rather than minimize cost? What is the gross profit if the company sells cable for Rs. 360 a metre?

10. The demand for an item in a company is 18,000 units per year, and the company can produce the items at a rate of 3,000 per month. The cost of one set-up is Rs. 500 and the holding cost of 1 unit per month is 15 paise. The shortage cost of one unit is Rs. 20 per month. Determine

- Optimum production batch quantity and the number of strategies.
- Optimum cycle time and production time

- iii) Maximum inventory level in the cycle
 - iv) Total associated cost per year if the cost of the item is Rs. 20 per unit.
11. The production department for a company requires 3,600 kg of raw material for manufacturing a particular item per year. It has been estimated that cost of placing an order is Rs.36 and the cost of carrying inventory is 25 per cent of the investment in the inventories. The price is Rs.10 per Kg. The purchase manager wishes to determine an ordering policy for the raw material.
12. A company operating 50 weeks in a year is concerned about its stocks of copper cable. This costs Rs.240 a meter and there is a demand for 8,000 meters a week. Each replenishment costs Rs.1,050 for administration and Rs.1,650 for delivery, while holding costs are estimated at 25 per cent of value held a year. Assuming no shortages are allowed, what is the optimal inventory policy for the company?
13. In a factory, there are six jobs to perform, each of which should go through two machines A and B, in the order A, B. The processing timings (in hours) for the jobs are given here. You are required to determine the sequence for performing the jobs that would minimize the total elapsed time, T. What is the value of T?

Job:	J ₁	J ₂	J ₃	J ₄	J ₅	J ₆
Machine A:	1	3	8	5	6	3
Machine B:	5	6	3	2	2	10

14. Using graphical method, calculate the minimum time needed to process job 1 and 2 on five machines A, B, C, D and E, i.e., for each machine find the job which should be done first. Also calculate the total time needed to complete both jobs.

		Machines				
Job 1	Sequence:	A	B	C	D	E
	Time (hours):	6	8	4	12	4
Job 2	Sequence:	B	C	A	D	E
	Time (hours):	10	8	6	4	12

15. Four jobs 1, 2, 3 and 4 are to be processed on each of the four machines A, B, C and D in the order ABCD. The processing time in minutes are given in table. Find for no passing, the minimum elapsed time.

machine/job	A	B	C	D
1	58	14	14	48

2	30	10	18	32
3	28	12	16	44
4	64	16	12	42

16. We have 4 jobs each of which has to go through the machines M_j ($j=1, 2, \dots, 6$) in the order $M_1, M_2, \dots, M_6$. Processing time (in hours) is given below:

	Machines					
	M_1	M_2	M_3	M_4	M_5	M_6
Job A	18	8	7	2	10	25
Job B	17	6	9	6	8	19
Job C	11	5	8	5	7	15
Job D	20	4	3	4	8	12

17. A small project consists of seven activities for which the relevant data are given below:

Activity	Preceding Activity	Activity Duration (Days)
A	-	4
B	-	7
C	-	6
D	A,B	5
E	A,B	7
F	C,D,E	6
G	C,D,E	5

- Draw the network and find the project completion time.
- Calculate total float for each of the activities and highlight the critical path.
- Draw the time scaled diagram.

18. A small project is composed of seven activities whose time estimates are listed in the table of follows:

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

- i) Draw the project network
- ii) Find the expected duration and variance of each activity. What is the expected project length?
- iii) Calculate the variance and standard deviation of 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?

19. A project has the following time schedule:

Activity	1 - 2	1 - 3	1 - 4	2 - 5	3 - 6	3 - 7	4 - 6	5 - 8	6 - 9	7 - 8	8 - 9
Duration	2	2	1	4	8	5	3	1	5	4	3

Draw the network and find the project completion time.

20. Three time estimates (in months) of all activities of a project are as given below:

Activity :	1 - 2	2 - 3	2 - 4	3 - 4	4 - 5	5 - 6
a :	0.8	3.7	6.2	2.1	0.8	0.9
m :	1	5.6	6.6	2.7	3.4	3.4
b :	1.2	9.9	15.4	6.1	3.6	2.7

Find the expected duration and standard deviation of each activity.