K1-LEVEL QUESTIONS

UNIT I

1. The maximin or minimax principle of optimality was postulated by----------

   a. John Von Neumann

   b. Zadeh

   c. John

   d. None of the above

2. In a two-person zero-sum game, the pay-off matrix of player B is the ---------- of the pay-off matrix of the player A.
   a. **negative**
   b. positive
   c. neither a or b
   d. both a and b

3. Two-person zero-sum games are also called ----------games.
   a. square
   b**. Rectangular**
   b. neither a or b
   d. both a and b

4. In a competitive game, every play determines ---------- to each player.
   a. an income
   b.**an outcome**
   c. both a and b
   d. neither a or b

5. In two-person game, if the gains of one player are equal to the losses of the other player, such a game is called ------
   a. two-person game
   b. **zero-sum game**
   c. neither a or b
   d. both a and b

6. The predetermined rule by which a player decides as to how to use his courses of action in the different plays of a game from his own list of available courses of action during the game is termed as the ----------of the player.

a. pure strategy
b. **strategy**
c. mixed strategy
d. neither a or b

7. A decision to always choose only one particular course of action out of the list of all the courses of action available to him is termed as ----------
   A .**pure strategy**
   b. strategy
   c. both a and b
   d. mixed strategy

8. A decision to choose a course of action for each play, in accordance with some particular probability distribution, is termed as ----------

   a. pure strategy

   b**. mixed strategy**

   c. strategy

   d. none of the above

9. In a rectangular game, the maximum guaranteed gain to the maximizing player, when both the players use their optimal strategies, is called the----------
   a. sum of the game
   b. strategy
   c. **value of the game**
   d. none of the above

10. If the value of a two-person zero-sum game is equal to zero, such a game is called a ----------
    a. **fair game**
    b. value of the game
    c. sum of the game
    d. none of the above

UNIT II

11. In a sequencing problems, a general methodology of solution to find the optimal sequence for n jobs and m machines, where n and m are finite numbers, is ----------.
    a. available

b. zero
c. five
d. **not available**

12. To determine the optimal sequence for a n job 3 machine problem, the condition to be satisfied is ----------
    a. $(t_1)_{min} \geq (t_2)_{max}$
    b. $(t_1)_{max} \leq (t_2)_{min}$
    c. $(t_3)_{min} \geq (t_2)_{max}$
    d. **both a and c**
13. Which one is correct, while in terms of the processing times of the jobs on the 3 machines, and when the processing order of all the jobs on the 3 machines ?
14. To determine the optimal sequence for a n job m machines problem, the condition to be satisfied is ----------
    a. $(t_1)_{min} \geq (t_2,t_3,t_4,...,t_{m-1})_{max}$
    b. $(t_m)_{min} \geq (t_2,t_3,t_4,....,t_{m-1})_{max}$
    c. **both a and b**
    d. $t_1 > t_2$
15. What is the condition to determine the optimum for processing times of the jobs on the m machines, and when the processing order of all the jobs on the m machines ?
16. To determine the optimal sequence for a 2 job n machine problem, the order of processing of the machines for both the jobs----------
    a. **Need not be the same**
    b. be the same
    c. n>2
    d. n<2
17. Consider a 5-job 3-machine problem with the processing order as A-B-C for all the 5-jobs with processing time as follows:

Job	1	2	3	4	5
Processing time on A(hrs)	3	8	7	4	9
Processing time on B(hrs)	6	7	5	11	5
Processing time on C(hrs)	4	3	2	5	1

    Is it possible to determine the optimal sequence of the jobs on the three machines for this problem?
    a. **yes**
    b. no
    c. indefinable
    d. neither a or b
18. Consider a 6-job 3-machine problem with the processing order as A-B-C for all the 6-jobs with processing time as follows:

Job	1	2	3	4	5	6
Processing time on A(hrs)	3	8	7	4	9	8
Processing time on B(hrs)	6	7	5	11	5	9
Processing time on C(hrs)	4	3	2	5	1	6

Is it possible to determine the optimal sequence of the jobs on the three machines for this problem?

a. yes

b. no

c. indefinable

d. neither a or b

19. Consider a 4-job 5-machine problem with the processing order as A-B-C-D-E for all the 4-jobs and with processing time as follows:

Machines

Jobs	A	B	C	D	E
1	8	4	3	2	8
2	9	6	5	4	11
3	5	5	2	3	9
4	6	2	4	6	7

Is it possible to determine the optimal sequence of the jobs on the five machines for this problem?

a. yes

b. no

c. indefinable

d. neither a or b

20. Suppose you have 2 jobs to be processed on 4 machines A, B,C and D. Should the processing order for both the jobs be the same on all the 4 machines?

a. no

b. yes

c. indefinable

d. neither a or b

UNIT III

21. Inventory may be defined as a

(a) Stocks of goods

(b) Capital invested in goods

(c) Space for storing goods

(d) Ledger to maintain the list of goods

22. The inventory may be categorized as

(a) Raw material inventory

(b) In-process inventory
(c) Finished goods inventory
(d) All the above

23. Which of the following is a controllable variable in inventory management?
(a) Cost of insurance
(b) Shortage cost
(c) Rent for the storage space
(d) None of the above

24. Which of the following is a controllable variable in inventory management?
(a) Cost of the staff
(b) Lead time
(c) **Frequency of acquisition of inventory**
(d) Deterioration cost

25. Which of the following is a uncontrollable variable in inventory management?
(a) The quantity acquired
(b) Lead Time
(c) Frequency of acquisition of inventory
(d) None of the above

26. Which of the following is a uncontrollable variable in inventory management?
(a) The Quantity acquired
(b) Frequency of acquisition of inventory
(c) **Interest on the money locked in the inventory**
(d) Stage of Completion of the stocked items

27. The inventory set-up costs are proportional to
(a) The level of inventory
(b) Time for which the inventory is held
(c) Delay time
(d) **None of the above**

28. The situation where the shortages can be fulfilled at a date later than the scheduled delivery date, when the commodity becomes available is called the
(a) Lead time
(b) Back logging
(c) Uniform replenishment
(d) Loss of good will

29. The lead time is placed in the category of
(a) Holding cost
(b) Shortage cost
(c) Uncontrollable variables of inventory
(d) Back logging

30. The unsatisfied demand is lost in the case of
(a) Shortages without back logging
(b) Shortages with back logging
(c) No lead time
(d) Too much lead time

Unit IV

31. The inventory needs to be maintained to decrease the --------
    (a) Shortage cost
    (b) Set-up cost
    (c) Loss of good will
    (d) All the above
32. Which of the following is needed to prevent the loss of goodwill due to unsatisfied demand-------
    (a) Backlogging of orders
    (b) Zero lead time
    (c) Finished goods
    (d) All the above
33. In which type of demand is the future demand determined by collecting the statistical data from past experience?
    (a) Deterministic demand
    (b) Probabilistic demand
    (c) Variable demand
    (d) Predictable demand
34. In which type of demand is the future demand assumed to be fixed and completely known?
    (a) Deterministic demand
    (b) Probabilistic demand
    (c) Uniform demand
    (d) Predictable demand
35. In the case of economic lot size model with uniform rate of demand r, infinite production rate, and having no shortages, the optimal quantity of items produced per production run is given by ----------
    (a) $\sqrt{\frac{rC}{C}}$
    (b) $\sqrt{\quad}$
    (c) $\frac{\quad}{2}$
    (d) $\sqrt{\quad . \quad \frac{\cdot}{\quad}}$

36. In the case of economic lot size model with uniform rate of demand r, infinite production rate, and having no shortages, the minimum average cost of inventory is given by ----
    (a) $\sqrt{\quad}$
    (b) $\sqrt{\quad}$
    (c) $\frac{\quad}{C\ C\ r}$

(d) $\sqrt{\quad .\quad \frac{\cdot}{\quad}}$

37. In the case of economic lot size model with uniform rate of demand r, infinite production rate, and having no shortages, the optimal frequency of acquisition of inventory is given by ----------

(a) $\sqrt{\quad}$

(b) $\sqrt{\frac{C}{rC}}$

(c) $\frac{}{2}$

(d) $\sqrt{\quad .\quad \frac{\cdot}{\quad}}$

38. In the case of economic lot size model, with different rates of demand in different production cycles, the total demand in total(fixed) period t being R, infinite production rate, and having no shortages, the optimal quantity of items produced per production run is given by ----------

(a) $\sqrt{\frac{R}{\quad}}$

(b) $\sqrt{\frac{R}{\quad}}$

(c) $\sqrt{\frac{C}{C}}$

(d) $\sqrt{\quad .\quad \frac{\cdot}{\quad}}$

39. In the case of economic lot size model, with different rates of demand in different production cycles, the total demand in total(fixed) period t being R, infinite production rate, and having no shortages, the minimum average cost of inventory is given by --------

(a) $\sqrt{\frac{C\ C}{\quad}}$

(b) $\sqrt{\frac{R}{\quad}}$

(c) $\sqrt{\frac{R}{\quad}}$

(d) $\sqrt{\quad .\quad \frac{\cdot}{\quad}}$

40. In the case of economic lot size model, with uniform rate of demand r, finite rate of replenishment k, and having no shortages, the optimal quantity of items produced per production run is given by--------

(a) $\sqrt{\frac{R}{\quad}}$

(b) $\sqrt{\frac{R}{}}$

(c) $\sqrt{\frac{}{C} \quad \frac{r.}{r}}$

(d) $\sqrt{\quad . \quad \frac{.}{\quad}}$

41. In the purchase inventory model with one price breaks, the price break quantity being , and shortages not being allowed, if * , and if (*) < , then which of the following is the optimal order quantity?
    (a) *
    (b) – *
    (c) *
    (d)

UN T-

42. Network analysis is applied to projects which are
    (a) Routine or Repetitive
    (b) Not Routine or repetitive
    (c) Used only once
    (d) Used very rarely
43. Network analysis is a technique to minimize some performance measure of the system such as
    (a) total completion time of the project
    (b) The overall cost of the project
    (c) The resources used for the project
    (d) All the above
44. The two major aspects of the critical path method are
    (a) Planning and Scheduling
    (b) Planning and implementation
    (c) Planning and organization
    (d) Organization and scheduling
45. In the critical path method, determination of the activities to be performed, and the order in which these activities shall be performed come under the aspect of
    (a) Planning
    (b) Scheduling
    (c) Organizing
    (d) None of the above
46. In the critical path method, preparing the time estimates for each activity comes under the aspect of
    (a) Planning
    (b) Organizing
    (c) Scheduling
    (d) Estimating
47. In the program evaluation and review technique, the expected time of completion of an activity is computed from 3 time estimates, which are the
    (a) Favourable time, normal time , and unfavourable time
    (b) Optimistic time, Normal time, and Pessimistic time

(c) Optimistic time, Favourable time, and Pessimistic time
(d) Optimistic time, Most likely time, and Pessimistic time

48. In CPM/PERT, the critical path is the path having the
(a) Minimum time duration
(b) Normal time duration
(c) Most difficult to achieve time duration
(d) None of the above

49. Which of the following is not involved in determining the time estimates of activities in the critical path method?
(a) Role of the project management
(b) Statistical analysis
(c) Skills of the concerned personnel
(d) Mathematical reasoning

50. In the critical path method , it is assumed that the time required for each activity is
(a) Known precisely
(b) Known Approximately
(c) Known in a probabilistic sense
(d) Uncertain

51. In PERT, it is assumed that the time required to perform each activity is
(a) Known precisely
(b) Known Approximately
(c) Known in a probabilistic sense
(d) Uncertain

OPERATIONS RESEARCH II

K2-LEVEL QUESTIONS

UNIT I

1. In a two-person zero-sum game, the pay-off matrix of player B is the ---------- of the pay-off matrix of the player A.
   negative
2. Write the another name of Two-person zero-sum game.
   Rectangular
3. Say True or False: In a competitive game, every play determines an outcome to each player.
   True
4. Define zero-sum game.
   In two-person game, if the gains of one player are equal to the losses of the other player, such a game is called zero-sum game.
5. Define strategy of the player.
   The predetermined rule by which a player decides as to how to use his courses of action in the different plays of a game from his own list of available courses of action during the game is termed as the strategy of the player.
6. Define pure strategy.
   A decision to always choose only one particular course of action out of the list of all the courses of action available to him is termed as pure strategy.
7. Define value of the game.
   In a rectangular game, the maximum guaranteed gain to the maximizing player, when both the players use their optimal strategies, is called the value of the game.
8. Define Fair game.
   If the value of a two-person zero-sum game is equal to zero, such a game is called a fair game.
9. In a rectangular game, if the maximin value of the maximizing player is less than the minimax value of the minimizing player, the former is termed as:
   Lower value of the game
10. Define saddle point.
    In a rectangular game, if the upper value of the game coincides with the lower value of the game, the element in this position is termed as the saddle point.

UNIT II

11. What is the condition, to determine the optimal sequence for a n job 3 machine problem?
    $(t_1)_{min} \geq (t_2)_{max}$ and . $(t_3)_{min} \geq (t_2)_{max}$
12. What are the conditions to determine the optimal sequence for a n job m machines problem?
    $(t_1)_{min} \geq (t_2,t_3,t_4,...,t_{m-1})_{max}$ and $(t_m)_{min} \geq (t_2,t_3,t_4,....,t_{m-1})_{max}$

13. To determine the optimal sequence for a 2 job n machine problem, the order of processing of the machines for both the jobs must be same. Say True or False.
    False
14. Consider a 5-job 3-machine problem with the processing order as A-B-C for all the 5-jobs with processing time as follows:

Job	1	2	3	4	5
Processing time on A(hrs)	3	8	7	4	9
Processing time on B(hrs)	6	7	5	11	5
Processing time on C(hrs)	4	3	2	5	1

    Is it possible to determine the optimal sequence of the jobs on the three machines for this problem?
    yes
15. Consider a 6-job 3-machine problem with the processing order as A-B-C for all the 6-jobs with processing time as follows:

Job	1	2	3	4	5	6
Processing time on A(hrs)	3	8	7	4	9	8
Processing time on B(hrs)	6	7	5	11	5	9
Processing time on C(hrs)	4	3	2	5	1	6

    Is it possible to determine the optimal sequence of the jobs on the three machines for this problem?
    no
16. Consider a 4-job 5-machine problem with the processing order as A-B-C-D-E for all the 4-jobs and with processing time as follows:

Machines

Jobs	A	B	C	D	E
1	8	4	3	2	8
2	9	6	5	4	11
3	5	5	2	3	9
4	6	2	4	6	7

    Is it possible to determine the optimal sequence of the jobs on the five machines for this problem?
    yes
17. Suppose you have 2 jobs to be processed on 4 machines A, B,C and D. Should the processing order for both the jobs be the same on all the 4 machines?
    no
18. Suppose you have 3 jobs to be processed on 4 machines A,B,C and D. The processing order for all the 3 jobs on the 4 machines should be
    A-B-C-D or D-C-B-A or B-C-D-A
19. The graphical method of solution can be applied to determine the optimal sequence for the problem of :

2 jobs and m machines

20. In an n job 2 machine sequencing problem, the sum of total processing times for all the jobs on a machine and the total idle time of the machine shall be =

The total elapsed time

UNIT III

21. Inventory may be defined as:
    Stocks of goods
22. Mention atlest one uncontrollable variable in inventory management?
    Lead Time
23. The situation where the shortages can be fulfilled at a date later than the scheduled delivery date, when the commodity becomes available is called:
    Back logging
24. The lead time is placed in the category of
    Uncontrollable variables of inventory
25. The unsatisfied demand is lost in the case of
    Shortages without back logging
26. The deterioration costs come under the category of
    Holding cost
27. The demand of an inventory item is a
    Uncontrollable variable
28. In which situation, is the number of items required in a future period is not known exactly?
    Probabilistic demand
29. In which situation, is the number of items required in a future period is known exactly
    Deterministic demand
30. The time gap between the time of placing an order and the time of arrival of goods is called:
    Lead time

UNIT IV

31. The inventory needs to be maintained to decrease:
    The Shortage cost, Set-up cost and Loss of good will
32. Which one is needed to prevent the loss of goodwill due to unsatisfied demand
    Backlogging of orders
33. In which type of demand is the future demand determined by collecting the statistical data from past experience?
    Probabilistic demand
34. In which type of demand is the future demand assumed to be fixed and completely known?
    Deterministic demand
35. In the case of economic lot size model with uniform rate of demand r, infinite production rate, and having no shortages, the optimal quantity of items produced per production run is given by :

$$\sqrt{\frac{rC}{C}}$$

36. In the case of economic lot size model with uniform rate of demand r, infinite production rate, and having no shortages, the optimal frequency of acquisition of inventory is given by :

$$\sqrt{\frac{C}{rC}}$$

37. In the case of economic lot size model, with uniform rate of demand r, finite rate of replenishment k, and having no shortages, the optimal quantity of items produced per production run is given by:

$$\sqrt{\frac{}{C}\ \frac{r.}{-r}}$$

38. In the case of economic lot size model, with uniform rate of demand r, finite rate of replenishment k, and having no shortages, the minimum average cost of inventory is given by:

$$\overline{r\quad -\frac{r}{}}$$

39. In the purchase inventory model with one price breaks, the price break quantity being , * will be the optimal order quantity if:

* ≥

40. In the purchase inventory model with one price breaks, the price break quantity being , and shortages not being allowed, if * , and if C (*) < C , then which of the following is the optimal order quantity?

UNIT V

41. Network analysis is applied to projects which are
    Not Routine or repetitive
42. The two major aspects of the critical path method are
    Planning and Scheduling
43. In the critical path method, preparing the time estimates for each activity comes under the aspect of:
    Scheduling
44. In the program evaluation and review technique, the expected time of completion of an activity is computed from 3 time estimates, which are:
    Optimistic time, Most likely time, and Pessimistic time
45. In the critical path method , it is assumed that the time required for each activity is
    Known precisely
46. In PERT, it is assumed that the time required to perform each activity is

Uncertain

47. Which of the following represents a point of start or a point of completion of an activity?

Event

48. In PERT terminology, each event in a network diagram is represented by

A Circle

49. In a network diagram, an event which is a beginning event for two or more activities is called:

A Node

50. In a network diagram, an event where two or more activities end is called

A Burst

K3 LEVEL QUESTIONS

UNIT I

1. Explain about Features of competitive games.
2. Write the algorithm to find saddle point.
3. Explain Maxmin and Minmax principle with example.
4. How to find the solution for two person zero sum game without saddle point?
5. For the game with the following pay-off matrix, determine the optimum strategies and the value of the game .$\begin{bmatrix} 5 & 1 \\ 3 & 4 \end{bmatrix}$
6. For the game with the following pay-off matrix, determine the optimum strategies and the value of the game .$\begin{bmatrix} 6 & -3 \\ -3 & 0 \end{bmatrix}$
7. Solve the following 2 x 2 game graphically.$\begin{bmatrix} 2 & 1 & 0 & -2 \\ 1 & 0 & 3 & 2 \end{bmatrix}$
8. Solve the following 2 x 2 game graphically.$\begin{bmatrix} 1 & 3 & -3 & 7 \\ 2 & 5 & 4 & -6 \end{bmatrix}$
9. Solve the following 2 x 2 game graphically. $\begin{matrix} 1 & -3 \\ 3 & 5 \\ -1 & 6 \\ 4 & 1 \\ 2 & 2 \\ -5 & 0 \end{matrix}$
10. Solve the following 2 x 2 game graphically. $\begin{matrix} 3 & -4 \\ 2 & 5 \\ -2 & 8 \end{matrix}$

UNIT II

1. Explain about optimum sequence algorithm for processing n jobs through two machines.
2. Explain about optimum sequence algorithm for processing n jobs through k machines.
3. How to get optimum value using graphical method for processing two jobs through k machines.
4. In a factory, there are 6 jobs to perform each opf which should go through 2 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	J1	J2	J3	J4	J5	J6
Machine A	1	3	8	5	6	3
Machine B	5	6	3	2	2	10

5. A book binder has one printing press, one binding machine, and the manuscript of a number of different books. The time required to performing to printing and binding

operations for each book is shown below. Determine the order in which books should be processed, in order to minimize the total time require to turn out all the books:

Book	1	2	3	4	5	6
Printing time(hrs)	30	120	50	20	90	100
Binding time(hrs)	80	100	90	60	30	10

6. We have five jobs each of which must go through the two machines A and B in the order AB. Processing times in hours are given in the table below:

Job	1	2	3	4	5
Machine A	5	1	9	3	10
Machine B	2	6	7	8	4

Determine a sequence for the five jobs that will minimize the elapsed time.

7. A ready-made garment company has to process seven items through two stages of production, viz., cutting and sewing. The time taken by each of these items at the different stages are given as:

Item :	1	2	3	4	5	6	7
Cutting:		4	8	3	5	5	12	7
Sewing:		3	5	6	4	8	5	8

Find an order in which these seven items are to be processed so as to minimize the total processing time.

8. Determine 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 M1	3	8	7	4	9	8	7
Machine M2	4	3	2	5	1	4	3
Machine M3	6	7	5	11	5	6	12

9. We have four jobs each of which has to go through the machines M_j (j = 1,….6) in the order M_1,….M_6. Processing time (in hrs) 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

Determine a sequence of these four jobs that minimizes the total elapsed time.

10. We have five jobs, each of which must go through the machines A, B and C in the order ABC. Processing times (in hrs) are given in the following table:

Job	1	2	3	4	5	6	7
Machine A	7	8	11	14	21	17	8
Machine B	6	3	1	2	5	4	1
Machine C	10	9	15	13	18	11	9

UNIT III

1. Explain the reasons for carrying inventories
2. What are the different types of inventories? Explain.
3. What are the factors affecting inventory control? Explain.
4. Explain about the concept of EOQ.
5. What are the assumptions involved in deterministic inventory problems with no shortages?
6. An oil engine manufacturer purchases lubricants at the rate of Rs.42 per piece from a vendor. The requirement of these lubricants is 1800 per year. What should be the order quantity per order, if the cost per placement of an order is Rs.16 and inventory carrying charge per rupee per year is only 20 paise.
7. A manufacturing company purchases 9000 parts of a machine for its annual requirements, ordering one month usage at a time. Each part costs Rs.20. The ordering cost per order is Rs. 15 and The carrying charges are 15% of the average inventory per year. You have been assign to suggest a more economical purchasing policy for the company. What advice would you offer and how much would it save the company per year?
8. Given the annual consumption of material is 3600 units, ordering costs are Rs.400 per order. Cost per unit of material is Rs 64 and storage cost or annual carrying cost is 50% of inventory value. Find out economic order quantity, EOQ in (i) units, (ii) Rupees.
9. A manufacturer has to supply his customer with 600 units of his product per year. Shortages are not allowed and the storage cost amounts to Rs.0.60 per unit per year. The set-up cost per run is Rs.80.00. find the optimum run-size and the minimum average yearly cost.
10. A shopkeeper has a uniform demand of an item at the rate of 600 items per year. He buys from a supplier at a cost of Rs.8 per item and the cost of ordering is Rs.12 each time. If the stock holding cost is 20% per year of stock value, how frequently should he replenish his stock and what is the optimal order quantity?

UNIT IV

1. A contactor has to supply 10,000 bearings per day to an automobile manufacturer. He finds that when he start a production run, he can produce 25,000 bearings/day. The cost of holding a bearing in stock for one year is Rs.2 and the set-up cost of the production run is Rs.1800. How frequently should production run be made?
2. A manufacturing company needs 2500 units of a particular components every year. The company buys it at a rate of Rs.30/unit. The order processing cost for this part is estimated at Rs.15 and the cost of carrying a part in stock comes to about Rs. 4/year. The company can manufacture this part internally. In that case it saves 20% of the price of the product. However, estimates a set-up cost of Rs. 250/production run. The annual production rate would be 4800 units. However, the inventory holding cost remain unchanged.
   a. Determine the EOQ and the optimal number of orders placed in a year.

b. Determine the optimum production lot size and the average duration of the production run.
c. Should the company manufacture the component internally or continue to purchase it from the supplier?

3. A. At present a company is purchasing an item 'X' from outside suppliers. The assumption is 10,000 units/year. The cost of the item is Rs. 5/unit and the ordering cost is estimated to be Rs.100/order. The cost of carrying inventory is 25%. If the consumption rate is uniform, determine the economic purchasing quantity.
   B. In the above problem, assume that a company is going to manufacture the item with the equipment that is estimated to produce 100 units/day. The cost of the unit thus produced is Rs. 3.50/unit. The set-up cost is Rs.150/set-up and the inventory carrying charge is 25%. How has your answer changed?
4. An item is produced at the rate of 50 items /day. The demand occurs at the rate of 25 items /day. If the set-up cost is Rs.100.00 and holding cost is Re.0.01/unit of item per day, find the economic lot size for one run, assuming that the shortages are not permitted. Also find the time of cycle and minimum total cost for one run.
5. An item is produced at the rate of 128 units/day. The annual demand is 6400 units. The set-up cost for each production run is Rs.24 and inventory carrying cost is Rs. 3/unit/year. There are 250 working days for production each year. Develop an inventory policy for this item.
6. A contractor has to supply 20,000 units/day. He can produce 30,000 units/day. The cost of holding a unit in stock is Rs. 3 /year and the set-up cost /run is Rs.50. how frequently, and of what size, the production runs be made?
7. Amit manufactures 50,000 bottles of tomato ketchup in an year. The factory cost /bottle is Rs.5, the set-up cost /production run is estimated to be Rs.90 and the carrying costs on finished goods inventory amount to 20% of the cost /annum. The production rate is 600 bottles /day and sales amount to 150 bottles /day. What is the optimum production lot size and the number of production runs?
   If the costs increase to Rs.7.50 /bottle, what will be the optimum production lot size?
8. What is the procedure for obtaining EOQ with One price break?
9. Explain the computational procedure for obtaining the optimum order quantity with more than one price break.
10. Find the optimum order quantity for a product for which the price breaks are as follows:

Quantity	Unit Cost(Rs)
$0 \leq Q_1 \leq 500$	10.00
$500 \leq Q_2$	9.25

The monthly demand for the product is 200 units the cost of storage is 2% of the unit cost and the cost of ordering is Rs.350.

UNIT V

1. What are the basic components of network ?
2. Explain the rules of constructing a network.
3. What are the rules to numbering the events?
4. Explain the steps involved in Forward pass calculations.
5. How to calculate backward pass? Explain.

6. Discuss the three types of activity float with calculations.
7. A batch of four axles is to be processed on the following three machines in this sequence: lathe(L), Milling(M), Grinding(G) instead of first working these four axles on the lathe, then on milling and finally on grinding in the sequence, it is desired to process the first axle on the lathe and as and when it is processed, it is taken upon milling and the second axle on the lathe, and so on. In other words, each of the three activities L,M and G have been quartered for the sake of concurrent operations. You are required to draw the network.
8. Draw network diagram for the following data:

Activity	A	B	C	D	E	F	G	H	I	J
Preceding activity:	none	A	A	B	A	B,E	C	D,F	G	F,I

9. Construct the network diagram comprising activities B,C,….Q and N such that the following constraints are satisfied:
   B <E,F C<G,L E,G<H L,H<I L<M H<N H<I I,J < P P<Q.
   The notation ‘X<Y’ means that the activity X must be finished before Y can begin.
10. Draw a network diagram for the following data:

Task:	A	B	C	D	E	F	G
Immediate predecessor:	none	none	B	B	B	E	A,D,C

K4 LEVEL QUESTIONS

UNIT I

1. Solve the following 2 x 2 game graphically. $\begin{bmatrix} 2 & 2 & 3 & -2 \\ 4 & 3 & 2 & 6 \end{bmatrix}$
2. Solve the following 2 x 2 game graphically. $\begin{bmatrix} 3 & -3 & 4 \\ -1 & 1 & -3 \end{bmatrix}$
3. Solve the following 2 x 2 game graphically. $\begin{matrix} 1 & 2 \\ 5 & 4 \end{matrix}$ $\begin{matrix} -7 & 9 \\ -4 & -3 \end{matrix}$ $\begin{matrix} 2 & 1 \\ -4 & 3 \end{matrix}$ $\begin{matrix} -7 & 1 \\ -2 & -4 \end{matrix}$ $\begin{matrix} -5 & -2 \\ -1 & -6 \end{matrix}$
4. Solve the following 2 x 2 game graphically
5. For what value of , the game with following pay off matrix is strictly determinable?

$$\begin{matrix} 6 & 2 \\ -1 & -7 \\ -2 & 4 \end{matrix}$$

UNIT II

1. Determine the optimal sequence of jobs that minimizes the total elapsed time based on the following information.

Job	1	2	3	4	5	6	7
Machine A	10	8	12	6	9	11	9
Machine B	6	4	6	5	3	4	2
Machine C	8	7	5	9	10	6	5

Processing time on machines is given in hrs and passing is not allowed.

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

Job 1	Sequence	A	B	C	D	E
	Time	3	4	2	6	2
Job 2	Sequence	B	C	A	D	E
	Time	5	4	3	2	6

3. Using graphical method, calculate the minimum time needed to process job 1 and 2 on 5 machines A,B,C,D and E. , that is for each machine find the job which should be done first. Also calculate the total time elapsed to complete both the jobs:

Job 1	Sequence	A	B	C	D	E
	Time	6	8	4	12	4
Job 2	Sequence	B	C	A	D	E
	Time	10	8	6	4	12

4. A machine shop has four machines A,B,C and D. two jobs must be processed through each of these machines. The time taken on each of the machines and the necessary sequence of jobs through the shop are given below:

Job 1	Sequence	A	B	C	D
	Time	2	4	5	1
Job 2	Sequence	D	B	A	C
	Time	6	4	2	3

Use graphic method to obtain the total minimum elapsed time.

5. Use graphic method to find the minimum elapsed total time sequence of two jobs and five machines when we are given the following information:

Job 1	Sequence	A	B	C	D	E
	Time	2	3	4	6	2
Job 2	Sequence	C	A	D	E	B
	Time	4	5	3	2	6

UNIT III

1. A certain item costs Rs.235 per tonne. The monthly requirement is 5 tonnes and each time the stock is replenished, there is a set-up cost of Rs.1000. the cost of carrying inventory has been estimated at 10% of the value of the stock per year. What is the optimal order quantity?
2. A company manufacturers a product having a monthly demand of 2000 units. For one unit of product 2 kg of a particular raw material item is needed. The purchase price of the material is Rs 20 per kg. the ordering cost is Rs 120 per order and the holding cost is 10 per cent per annum.
   Calculate:
   1) Economic ordering quantity (EOQ), and
   2) Annual cost of purchasing and storage of the raw material at the quantity.
3. 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 8000 meters a week. Each replenishment costs Rs 1050 for administration and Rs 1650 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 is analysis differ if the company wanted to maximize profit rather than minimize cost? What is the gross profit if the company sell cable for Rs 360 a meter.
4. A company plans to consume 760 pieces of a particular component. Past records indicate that purchase department had used Rs 12000 for placing 15000 orders. The average inventory was valued at Rs 45000 and the total storage cost was Rs 7650 which included wages, rent, taxes, insurance, etc. related to store department. The company borrows capital at the rate of 10% a year.
   If the price of a component is Rs 12 and the order size is of 10 components, determine: purchase cost, purchase expenses, storage expenses, capital cost and total cost per year.
5. An aircraft uses rivets at an approximately constant rate of 5000 kg per year. The rivets costs Rs. 20/kg and the company personnel estimate that it cost Rs.200 to place an order, and the carrying cost of inventory is 10% per year.

a. How frequently should orders for rivets be places, and what quantities should be ordered for?
b. If the actual cost are Rs. 500 to place an order and 15% for carrying cost the optimum policy would change. How much is the company loosing per year because of imperfect cost information?

UNIT IV

1. Find the optimum order quantity for a product for which the price breaks are as follows:

Quantity	Unit Cost(Rs)
$0 \leq Q_1 \leq 800$	1.00
$800 \leq Q_2$	0.98

The yearly demand for the product is 1600 units per year, cost of placing an order is Rs. 5, the cost of storage is 10% per year.

2. The annual demand for an item of inventory whose price is Rs. 10/ unit is 2400 units, ordering cost per order is Rs. 350 and inventory holding costs are 2% /month. The supplier offers a quantity discount of 7.5% if the quantity ordered is 400 units or more. The rate of discount will increase to 12.5%, if the order is for 3000 units or more. Find out the economic order quantity.
3. A retailer gets discount for large orders. The discount is 4% if the quantity ordered is 500 or more, and an additional 1% discount is received if the quantity ordered is 1,000 or more. The product costs Rs.50 and sells uniformly at the rate of 25,000 units a year. The fixed order cost is Rs.50, while the inventory carrying cost is 20% of the value of the average inventory held.
   a. What is the best order quantity?
   b. What is the minimum total annual cost, including the purchasing cost?
4. A purchase manager has decided to place order for a minimum quantity of 500 numbers of a particular item in order to get a discount of 10%. From past records, it was found out that in the last year, 8 orders each of size 200 units were placed. Given the ordering cost equal to Rs.500 /order, inventory carrying cost of 40% of the inventory value and the price of the item of Rs. 400/unit. Is the purchase manager justified in his decision? What is the effect of his decision to the company?
5. A soft drinks manufacturing company buys a large number of pallets every year which it uses in the warehousing of its bottled products. A local vendor has offered the following discount schedule for pallets:

Order Quantity	Unit price(Rs)
$0 \leq Q_1 \leq 699$	10.00
700 and above	9.25

The average yearly replacement is 2400 pallets. The carrying cost is 12% of the average inventory and ordering cost /order is Rs.100. find out the optimum order quantity.

UNIT V

1. A project consist of a series of task labeled A,B, ….H,I with the following relationship (W<X,Y means X and Y cannot start until W is completed; X, Y < W

means W cannot start until both X and Y are completed). With this notation construct the network diagram having the following constraints:

A<D, E B,D<F C<G B,G<H F,G<I

Find also the minimum time of completion of the project, when the time (in days) of completion of each task is as follows:

Task:	A	B	C	D	E	F	G	H	I
Time:	23	8	20	16	24	18	19	4	10

2. 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

a. Draw the network and find the project completion time

b. Calculate total float for each of the activities and highlight the critical path.

3. Given the following information:

Activity :	0-1	1-2	1-3	2-4	2-5	3-4	3-6	4-7	5-7	6-7
Duration (in days):	2	8	10	6	3	3	7	5	2	8

a. Draw the arrow diagram

b. Identify the critical path and find the total project duration

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

Activity	immediate predecessor	estimated duration(days)		
		optimistic	most likely	pessimistic
A	-	1	1	7
B	-	1	4	7
C	-	2	2	8
D	A	1	1	1
E	B	2	5	14
F	C	2	5	8
G	D,E	3	6	15
H	F,G	1	2	3

a. Draw the PERT network and find out the expected project completion time

b. What duration will have 95% confidence for project completion

c. If the average duration for activity F increases to 14 days, what will be its effect on the expected project completion time which will have 95% confidence?

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

Activity	estimated duration(days)		
	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

a. Draw the PERT network and find out the expected project completion time.
b. Calculate the variance and standard deviation of project length.