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Question Bank

Module 1: Introduction, Linear Programming

1. Explain the different phases of OR. Explain them briefly.

2. Give any four definitions and impact of OR. Also Define feasible region, unbounded solution & feasible solution.

3. What is the historical development of OR? What are the advantages and limitations of OR studies? Also name few organizations that are taking the advantage of OR.

4. A company makes two kinds of leather belts. Belt A is a high quality belt, and belt B is of low quality. The respective profits are Rs.4 and Rs.3 per belt. Each belt 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 1000 per day. The supply of leather is sufficient for only 800 belts per day (A & B combined). Belt A requires a fancy buckle and only 400 per day are available. There are only 700 buckles in a day available for belt B. Formulate it as LPP and solve it by graphical method

5. Old hens can be bought at Rs. 2 each and young ones at Rs. 5 each. The old hens lay 3 eggs per week and the young ones lay 5 eggs per week, each egg being worth 30 paise. A hen (young or old) costs Re. 1 per week to feed. I have only Rs. 80 to spend for hens, how many of each kind should I buy to give a profit of more than Rs. 6 per week, assuming that I cannot house more than 20 hens. Use graphical method to solve.

6. A marketing manager wishes to allocate his annual advertising budget of Rs. 20,000 in two media groups M&N. The unit cost of the message in the media M is Rs.200 & N is Rs.300. The media M is monthly magazine & not more than two insertions are desired in one issue. At least five messages should appear in the media N. The expected effective audience per unit message for media M is 4000 & for N is 5000. Formulate the LPP.

7. A retailer deals in two only A & B. he has 50000 to invest and a space to store at most 60 pieces. An item A costs him 2500 and B costs 500. A net profit to him on item A is 500

and B is 150. If he can sell the entire item he purchases, how should he invest his amount to have max profit? Solve graphically.

8. A company has 3 operational departments (weaving processing & packing) with capacity to produce 3 different types of cloths namely suiting, shirting & woolen yielding the profit of Rs.2, Rs.4 & Rs.3 per meter respectively. 1 meter suiting requires 3 minutes in weaving, 2 min processing & 1 min in packing, 1 meter of shirting requires 4 min in weaving, 1 min in processing & 3 min in packing. While 1 meter woolen requires 3 min in each department. In a week total run time of each dept. is 60,40 & 80 hr of weaving, processing & packing the dept. respectively. Formulate the LPP to find the product mix to max the profit.

9. Solve the following LPP by Graphically

   $z_{\max} = 8000x_1 + 7000x_2 \quad subjected\ to \quad 3x_1 + x_2 \le 6\ ,\ x_1 + x_2 \le 45\ ,\ \ x_1 \le 20\ ,\ x_2 \le 40,\ x_1, x_2 \ge 0.$

10. Solve the following LPP by Graphically

    $z_{\min} = -6x_1 - 4x_2 \quad STC \quad 2x_1 + 3x_2 \ge 30\ ,\ 3x_1 + 2x_2 \le 24\ ,\ \ x_1 + x_2 \ge 3 \qquad x_1, x_2 \ge 0.$

11. A company produces 3 items A, B, C. Each unit of A requires8 minutes, 4 minutes and 2 minutes of producing time on machine M1, M2 and M3 respectively. Similarly B requires 2, 3, 0 and C requires 3, 0, 1 minutes of machine M1, M2 and M3 respectively. For maximum profit, how many numbers of products A, B and C are to be produced? Find maximum profit. Given machine M1, M2, M3 are available for 250, 100 and 60 minutes per day.

12. Solve by graphical method, Minimize $Z = 20x + 10y$ under the constraints

    $2x + y \ge 0, x + 2y \le 40, 3x + y \ge 0, 4x + 3y \ge 60; x, y \ge 0.$

13. Solve the following by graphical method to maximize $z = 50x + 60y$ subject to the constraints, $2x + 3y \le 1500, 3x + 2y \le 1500, 0 \le x \le 400\ and\ 0 \le y \le 400.$

14. The Apex television company has to decide on the number of 27-inch and 20-inch sets to be produced at one of its factories. Market research indicates that at most 40 of the 27-inch sets and 10 of 20-inch sets can be sold per month. The maximum number of work hours available is 500 per month. A 27- inch set requires 20 work hours and 20-inch set requires 10 work hours. Each 27-inch set sold produces a profit $120 and each 20-inch produces a profit of $80. A wholesaler agreed to purchase all the television set produced, if the number do not exceed the maxima indicated by market research. Formulate LPP.

15. A manufacturer produces 3 models 1, 2, 3 of certain product using raw materials A & B, the following data is given below. Formulate LPP.

Raw Material	Requirements per unit			Availability
	1	2	2	
A	2	3	5	4000
B	4	2	7	6000

Minimum demand	200	200	150	-
Profit per unit	30	20	50	-

Module 2: Simplex Method, Big –M –Method, Dual simplex method, two phase simplex method

16. Define feasible solution, basic feasible solution, slack variable, surplus variable and optimal solution.

17. Explain the concept of degeneracy in simplex method.

18. Briefly explain assumptions required in linear programming models? Why is simplex method a better technique than graphical for most real case? Explain.

19. Explain the special cases that arise in the use of the simplex method.

20. ABC firm manufactures 3 products p1, p2, p3. The profits are 30, 20 & 40 respectively. The firm has 2 machines m1 and m2 and requires processing time in minutes for each machine on each product and total machine available minutes on each machine are given below.

Machine	Machine minutes required			Total machine minutes available
	P1	P2	P3	
M1	4	3	5	2000
M2	2	2	4	2500

The firm must manufacture at least 100 p1 and 200 p2 and 50 p3 but not more than 150 p1's.solve by simplex method.

21. solve by simplex method also write the type of solution

$$\text{Max } Z = 4x_1 + x_2 + 3x_3 + 5x_4$$

$$\text{STC} \quad 4x_1 - 6x_2 - 5x_3 - 4x_4 \geq -20$$

$$-3x_1 - 2x_2 + 4x_3 + x_4 \leq 10$$

$$-8x_1 - 3x_2 + 3x_3 + 2x_4 \leq 20$$

$$x_1, x_2, x_3, x_4, \geq 0$$

22. Find all the basic solutions of the following system of equations identifying in each case the basic and non basic variables.

$2x_1 + x_2 + 4x_3 = 11$, $3x_1 + x_2 + 5x_3 = 14$

23. Solve the LPP, Maximize Z= $2x_1 + 2x_2$

STC $5x_1 + 3x_2 \le 8$

$2x_1 + 4x_2 \le 8$

$x_1, x_2 \ge 0$

24. Solve the LPP, Maximize $Z = 3x_1 + 2x_2$

STC $4x_1 + 3x_2 \le 12$

$4x_1 + x_2 \le 8$, $4x_1 - x_2 \le 8$

$x_1, x_2 \ge 0$

25. Determine all Alternate solution of the LPP

Solve the LPP, Maximize $Z = 2x_1 + 4x_2$

STC $x_1 + 2x_2 \le 5$

$x_1 + x_2 \le 4$

$x_1, x_2 \ge 0$

26. Check for Unbounded solution in the LPP

Solve the LPP, Maximize $Z = 4x_1 + x_2 + 3x_3 + 5x_4$

STC $4x_1 - 6x_2 - 5x_3 - 4x_4 \ge -20$

$-3x_1 - 2x_2 + 4x_3 + x_4 \le 10$

$-8x_1 - 3x_2 + 3x_3 + 2x_4 \le 20$

$x_1, x_2, x_3, x_4 \ge 0$

27. Solve using simplex method

$z_{Max} = 10x_1 + 6x_2$ STC $x_1 + x_2 \le 4$, $2x_1 + x_2 \le 4$, $3x_1 + 8x_2 \le 12$, $x_1, x_2 \ge 0.$

28. Solve using simplex method

$z_{Max} = x_1 + 2x_2 + x_3$ STC $2x_1 + x_2 - x_3 \le 2$, $-2x_1 + x_2 - 5x_3 \ge -6$,

$4x_1 + x_2 + x_3 \le 6, x_1, x_2, x_3 \ge 0.$

29. A gear manufacturing company received an order for 3 specific types of gears for regular supply. The management is considering devoting the available excess capacity to one or more of the 3 types, saying A, B, C. The available capacity on the machines which might limit output and the number of machine hours required for each unit of the respective gear is given in the table

Machine Type	Available Machine Hours/Week	Productivity in Machine Hours/ Unit		
		Gear A	Gear B	Gear C
Gear Hobbing Machine	250	8	2	3
Gear Shaping Machine	150	4	3	0
Gear Grinding Machine	50	2	-	1

The unit profit would be Rs 20, 6, 8 respectively for gear A, B and C. Optimize the problem.

30. Solve by Two Phase Method

Minimize $Z = x_1 - 2x_2 - 3x_3$

STC $-2x_1 + 3x_2 + 3x_3 = 2$

$2x_1 + 3x_2 + 4x_3 = 1$

$x_1, x_2, x_3 \geq 0$

31. Use two-phase simplex method to solve the problem:

Minimize $Z = 7.5x_1 - 3x_2$,

Subject to the constraints:

$3x_1 - x_2 - x_3 \geq 3$,

$x_1 - x_2 + x_3 \geq 2$ and

$x_1, x_2, x_3 \geq 0$

32. Solve by Big M Method

Minimize $Z = 4x_1 + x_2$

STC $3x_1 + 4x_2 \geq 20$

$-x_1 - 5x_2 \leq -15$

$x_1, x_2 \geq 0$

33. Solve by Big M Method Max Z = 6x+4y

S.T.C $2x+3y \leq 30$

$3x+2y \leq 24$

$x+y \geq 3$

x, y ≥ 0.

Does this problem have an alternate solution? If so, give the alternate solution.

34. Explain in detail the computer implementation of simplex method and available software option for linear programming.
35. Explain the two phase technique procedure for solving an LPP in simplex method.
36. Explain the Big M technique procedure for solving an LPP in simplex method.
37. Write a note on artificial variables.
38. Check for infeasible solution , Solve by two phase method

Max Z = 5x+3y

S.T.C $2x+y \leq 1$

$x+4y \geq 6$

x, y ≥ 0.

39. Solve using penalty method

$z_{Max} = x_1 + 2x_2 + 3x_3 - x_4$ *STC* $x_1 + 2x_2 + 3x_3 = 15$, $2x_1 + x_2 + 5x_3 \geq 20$

$x_1 + 2x_2 + x_3 + x_4 \geq 10, x_1, x_2, x_3, x_4 \geq 0$

40. Solve using Two Phase method

$z_{Max} = 2x_1 + x_2 + x_3$ *STC* $4x_1 + 6x_2 + 3x_3 \leq 8$, $3x_1 - 6x_2 - 4x_3 \leq 1$

$2x_1 + 3x_2 - 5x_3 \geq 4, x_1, x_2, x_3 \geq 0$

41. Solve the LPP

$z_{Max} = 2x_1 + 3x_2 + 5x_3$ *STC* $x_1 + x_2 - x_3 \geq -5$, $-6x_1 + 7x_2 - 9x_3 \geq 4$.

$x_1 + x_2 + 4x_3 = 10, x_1, x_2 \geq 0, x_3$ *is unrestricted*

42. Obtain the dual of the primal problem

Minimize $Z = x_1 - 3x_2 + x_3$

S.T.C $3x_1 - x_2 + 2x_3 \leq 7$, $2x_1 - 4x_2 \geq 12$, $-4x_1 + 3x_2 + 8x_3 = 10$

$x_1, x_2 \geq 0$ and x_3 is unrestricted.

43. Use revised simplex method to solve

Maximize $Z = x_1 + x_2$ S.T.C $x_1 + 2x_2 \geq 7$, $4x_1 + 3x_2 \geq 6$, $x_1, x_2 \geq 0$

44. Obtain the dual problem of the primal L.P.P

Max $Z = x_1 + x_2$

$2x_1 + x_2 = 5$

STC $3x_1 - x_2 = 6$

x_1, x_2 Unrestricted

45. Write a note on relation between primal and dual and The essence of duality theory

46. Convert from Dual to Primal

$Z_{\min} = 2x_2 + 5x_3$ Subject to

$x_1 + x_2 \geq 2$, $2x_1 + x_2 + 6x_3 \leq 6$, $x_1 - x_2 + 3x_3 = 4$; $x_1, x_2, x_3 \geq 0$

47. Show that Primal of the Dual is Primal by using simplex table

$Z_{\max} = x_1 + 2x_2 + x_3$ Subject to

$2x_1 + x_2 - x_3 \leq 2$, $-2x_1 + x_2 - 5x_3 \geq -6$, $4x_1 + x_2 + x_3 \leq 6$ *where* $x_1, x_2, x_3 \geq 0$.

48. Obtain the dual solution directly, using the inverse from solution of the primal

$Z_{\max} = 5x_1 + 2x_2 + 3x_3$ Subject to

$x_1 + 5x_2 + 2x_3 = 30$, $x_1 - 5x_2 - 6x_3 \leq 40$ *where* $x_1, x_2, x_3 \geq 0$.

49. Apply revised simplex method to solve Maximize $Z = 6x_1 - 2x_2 + 3x_3$

STC $2x_1 - x_2 + 2x_3 \leq 2$

$x_1 + 4x_3 \leq 4$

$x_1, x_2, x_3 \geq 0$

50. What is the important characteristic of duality? Explain weak duality property, strong duality property & complementary solutions property.

51. Explain the conceptual procedure of revised simplex method in standard form.
52. Apply revised simplex method to solve Minimize $Z = x_1 + x_2$

STC $x_1 + 2x_2 \geq 7$

$4x_1 + x_2 \geq 6$

$x_1, x_2 \geq 0$

53. Solve the following problem by dual simplex method.
    Minimize $Z = 2x_1 + x_2$
    Subject to $3x_1 + x_2 \geq 3$
    $4x_1 + 3x_2 \geq 6$
    $x_1 + 2x_2 \geq 3$ and $x_1, x_2 \geq 0$
54. Obtain the optimal solution, using the dual simplex method for the dual problem of the following: Maximize $Z = 3x_1 + 5x_2$
    Subject to constraints $x_1 \leq 4$; $2x_2 \leq 12$; $3x_1 + 2x_2 \leq 18$ and $x_1, x_2 \geq 0$

55. Solve the following problem by dual simplex method
    Maximize $z = -4y_1 - 12y_2 - 18y_3$
    Subject to constraints $y_1 + 3y_3 \geq 3$
    $2y_2 + 2y_3 \geq 5$
    And $y_1, y_2, y_3 \geq 0$
56. Find the maximum of $z = 6x_1 + 8x_2$
    Subject to $5x_1 + 2x_2 \leq 20$
    $x_1 + 2x_2 \leq 10$ and $x_1, x_2 \geq 0$
57. Use dual simplex method and solve the following
    Minimize $Z = 3x_1 + x_2$
    Subject to $x_1 + x_2 \geq 1$
    $2x_1 + 3x_2 \geq 2$
    and $x_1, x_2 \geq 0$
58. Write the working procedure of dual simplex method.
59. Explain parametric integer linear programming and its importance.

Module 3 : Transportation and Assignment Problems

60. Write different steps in Hungarian algorithm to solve assignment problem
61. Find the initial basic feasible solution of transportation problem where cost- matrix is given below

	A	B	C	D	Supply
I	1	5	3	3	34
Source II	3	3	1	2	15
III	0	2	2	3	12
IV	2	7	2	4	19
Demand	21	25	17	17	

62. A department has five employees with five jobs to be performed. The time (in hours) each men will take to perform each job is given in the effectiveness matrix.

		Employees				
		I	II	III	IV	V
Jobs	A	10	5	13	15	16
	B	3	9	18	13	6
	C	10	7	2	2	2
	D	7	11	9	7	12
	E	7	9	10	4	12

How the jobs be allocated? One per employee, so as to minimize the total man hours, use the Hungarian method.

63. The following table shows all the necessary information on the availability of supply to each warehouse, the requirement of each market and unit transport cost from each warehouse to each market

		P	Q	R	S	Supply
Warehouse	A	6	3	5	4	22
	B	5	9	2	7	15
	C	5	7	8	6	8
	Demand	7	12	17	9	45

The shipping clerk has worked out the following schedule from experience, 12 units from A to Q, 1 unit from A to R, 8 units from A to S, 1.5 units from B to R, 7 units from C to P and 1 unit from C to R.

i. Check and see if the clerk has optimal schedule
ii. Find the optimal schedule and minimum total transport cost.

64. Write different steps in Hungarian algorithm to solve an assignment problem.

The transportation costs per truck load of cement (in hundreds of rupees) from each plant to each project site are as follows:

		Project Sites				
		P	Q	R	S	Supply
Warehouse	1	2	3	11	7	6
	2	1	0	6	1	1

3	5	8	15	9	10
Demand	7	5	3	2	17

Determine the optimal distribution for the company so as to minimize the total transportation cost.

65. Four jobs are to be done on four different machines. The cost (in rupees) of producing i^{th} job in the j^{th} machine is given below:

		Machines			
		M1	M2	M3	M4
Jobs	J1	15	11	13	15
	J2	17	12	12	13
	J3	14	15	10	14
	J4	16	13	11	17

Assign the jobs to different machines so as to minimize the total cost.

66. Define feasible solution, basic feasible solution, non degenerate solution and optimal solution in a Transportation problem.
67. A product is produced in 4 factories F1, F2, F3 and F4. Their unit production costs are Rs 2, 3, 1 and 5 respectively. The product is supplied to 4 stores S1, S2, S3 and S4 the requirements of which are 25, 35,105 and 20 respectively. Unit costs of transportation are given below:

Stores Factories	S1	S2	S3	S4
F1	2	4	6	11
F2	10	8	7	5
F3	13	3	9	12
F4	4	6	8	3

Find the transportation plan such that the total production and transportation cost is minimum.

68. Find the initial solution to the following transportation problem

		Destination					
		D1	D2	D3	D4	D5	Supply
Origin	O1	7	6	4	5	9	40
	O2	8	5	6	7	8	30

O3	6	8	9	6	5	20
O4	5	2	7	8	6	10
Demand	30	30	15	20	5	10

69. The owner of a small machine shop has four machines available to assign for the jobs. Five jobs are offered to assign, with the expected profits in hundreds of rupees for each machine on each job being as follows:

	Job				
Machines	1	2	3	4	5
A	6.2	7.8	*	10.1	8.2
B	7.0	8.4	6.5	7.5	6.0
C	8.7	9.2	11.1	7.0	8.2
D	*	6.4	8.7	7.7	8.0

*indicates that machine A and D cannot perform the jobs 3 and 1 respectively. Find the assignment of jobs to machines that will result in the maximum profit.

70. Solve the assignment problem represented by the following matrix using column reduction.

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

Module 4 & 5: Game Theory, Network Analysis

71. Explain basic characteristics of two person, zero sum game. For the game having following payoff table, determine the optimal strategy for each player by successively eliminating dominated strategies. Indicate the order in which you eliminate strategies.

Player -2

	1	2	3
1	1	2	0

2	2	-3	-2
3	0	3	-1

Player-1

72. Explain the details of solving simple games in game theory.
73. Explain the various variations in solving games, with examples.
74. Solve the game whose payoff matrix the player A is given below:

	I	II	III
I	1	7	2
II	6	2	7
III	5	2	6

75. Solve the following (2 x 3) game graphically.

		Y_1	Y_2	Y_3
		I	II	III
X_1	I	1	3	11
$1-X_1$	II	8	5	2

A

76. Solve the following game graphically:

		Player B		
		B1	B2	B3
Player A	A1	2	6	22
	A2	16	10	4

77. Solve the following assignment problem. If it is treated as a salesman problem and the cell entries represent cost in rupees, find the least cost route such that salesman does not visit any city twice.

	A	B	C	D	E
A	-	2	5	7	1
B	6	-	3	8	2
C	8	7	-	4	7
D	12	4	6	-	5
E	1	3	2	8	-

78. Explain the following
    i. Minimax criterion
    ii. Pure and Mixed strategies
    iii. Two person zero sum game
    iv. Saddle point
    v. Value of game
79. Solve the game whose pay off matrix is given below.

	B1	B2	B3	B4
A1	-5	2	0	7
A2	5	6	4	8
A3	4	0	2	-3

Give the value of game and strategies adopted by A and B.

80. Find out the value of game, given the following pay off matrix

	B1	B2
A1	4	-4
A2	-4	4

81. Explain how to construct a decision tree and how it is used for decision analysis.
82. Explain in detail decision making without experimentation
83. Write a short note decision trees.
84. Differentiate between PERT and CPM.
85. With reference to CPM explain:

- Total float
- Free float
- Independent float.

86. Define the following terms:
    i. Early start
    ii. Latest start
    iii. Slack
    iv. Critical path
    v. PERT

87. Explain the following terms.
    i. PERT and CPM
    ii. Optimistic and pessimistic time estimates
    iii. Slack and float.

88. A project consists of 9 tasks with the following relationships (P<Q means that task Q can not start until P is completed). With this notation construct the network diagram having the following constraints,
A<D, E; B, D<F; C< G; B<H; F, G<I.

Task	A	B	C	D	E	F	G	H	I

Time in days	23	08	20	16	24	18	19	04	10

Determine the critical path and minimum completion time of the project. Also tabulate the valves of total float and independent float of each task.

89. A construction project consists of 8 activities. The data on time and cost of various activities are as follows:

Activity	Time in Weeks		Cost in Rs. Lakhs	
	Normal	Crash	Normal	Crash
1-2	16	14	15.00	20.00
1-3	25	20	20.00	25.00
2-4	10	7	25.00	40.00
3-4	32	26	10.00	16.00
3-5	40	35	17.50	22.50
4-5	16	12	40.00	60.00
4-6	12	8	30.00	42.00
5-6	9	6	15.00	30.00

The project overhead cost is Rs. 2.00lakhs per week. Determine:

i) Normal duration of the project and the corresponding project cost.

ii) Optimum duration of the project and corresponding project cost.

90. The activities of a project are tabulated below with immediate predecessors and normal and crash time cost.

Activity	Immediate Predecessor	Normal		Crash	
		Cost (Rs)	Time (Days)	Cost (Rs)	Time (Days)
A	--	200	3	400	2
B	--	250	8	700	5
C	--	320	5	380	4
D	A	410	6	800	4
E	C	600	2	670	1
F	B, E	400	6	950	1
G	D	550	12	1000	6
H	B, E	300	11	400	9

i. Determine the normal project duration.

ii. If the indirect cost is Rs. 25 per day determine the minimum cost schedule. What is the minimum length schedule of the project?

91. Assuming the expected times are normally distributed, find the probability of meeting the schedule date as given for the network.

Actually	Days		
	a	m	b
1-2	2	5	14
1-3	9	12	15
2-4	5	14	17

3-4	2	5	8
4-5	6	6	12
3-6	8	8	20

Scheduled project completion date is 30 days. Also find the date on which the Project manager can complete the project with a probability of 0.90%.

92. The time estimates of the activities of a project are given in the following table

Activity	Time estimates in weeks		
	Optimistic	Most likely	Pessimistic
1-2	1	2	3
2-3	1	2	3
2-4	1	3	5
3-5	3	4	5
4-5	2	3	4
4-6	3	5	7
5-7	4	5	6
6-7	6	7	8
7-8	2	4	6
7-9	4	6	8
8-10	1	2	3
9-10	3	5	7

i. Construct a PERT network
ii. Determine the expected completion time for the project and identify the critical Path
iii. What is the probability of completing the project in 30 weeks?

93. The normal and crash points for each activity are given in the table. Find the different minimum crash schedules (32 days) that can occur between normal and crash times.

Activity	Normal Duration	Normal Cost	Normal Duration	Crash Cost
1-2	20	2000	15	3000
1-3	10	1500	7	2400
2-5	15	1000	10	1500
3-4	16	3000	12	4000
3-5	22	4500	16	5700
4-5	14	1500	10	2100

94. For a project whose details are given below find normal duration and cost and optimum duration and cost schedule. Indirect cost works at Rs70 per day.

Task	Activity	Normal		Crash	
		Time	Cost	Time	Cost
1	A-B	08	100	06	200

2	A-C	04	150	02	350
3	A-C	02	050	01	090
4	B-E	10	100	05	400
5	C-D	05	100	01	200
6	D-E	03	080	01	100

95. A project consists of the activities as given below:

Activity	Immediate Predecessor	Time in weeks		
		t_o	t_p	t_m
A	---	1	7	1
B	A	1	7	4
C	---	2	8	2
D	B, C	1	1	1
E	C	2	14	5
F	A, C	2	8	5
G	D	3	15	6

i. Draw the project network.
ii. Identify the critical path and determine the expected completion time of the project. What is the probability that the project would be completed in 17 weeks?

96. A small maintenance project consist of jobs given in the table below:

Jobs	Normal		Crash	
	Time (Days)	Cost (Rs)	Time (Days)	Cost (Rs)
1-2	06	1200	04	1600
1-3	05	1500	03	2000
2-3	06	1700	03	2100
2-4	03	400	02	800
3-4	00	000	00	000
3-5	06	1300	04	1800
5-6	03	500	02	700
4-6	08	2200	06	2800

The indirect cost per day is Rs.250/-

i. What is the normal duration and cost of the project?
ii. What is the optimum schedule?
iii. What is the minimum length schedule and what is the corresponding cost?
iv. If all the activities are crashed indiscriminately, what is the duration and cost?