

Reg. No. :

**D 4302**

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2008.

Sixth/Seventh Semester

Information Technology

CS 1001 — RESOURCE MANAGEMENT TECHNIQUES

(Regulation 2004)

(Common to B.E. Computer Science and Engineering)

Time : Three hours

Maximum : 100 marks

(Use of statistical tables permitted)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the limitations of an LPP.
2. A firm manufactures two products  $A$  and  $B$  on which the profits earned for unit are Rs. 3 and Rs. 4 respectively. Each product is processed on two machines  $M_1$  and  $M_2$ . Product  $A$  requires one minute of processing time on  $M_1$  and two minutes on  $M_2$ , while  $B$  requires one minute on  $M_1$  and one minute on  $M_2$ . Machine  $M_1$  is available for not more than 7 hours 30 minutes, while machine  $M_2$  is available for 10 hours during any working day. Find the number of units of products  $A$  and  $B$  to be manufactured to get maximum profit.
3. Define and brief about optimal solution.
4. Determine an initial basic feasible solution for the following transportation problem, using NW corner rule and test the optimality.

3	4	6	8	9	20
2	10	1	5	8	30
7	11	20	40	3	15
2	1	9	14	16	13
40	6	8	18	6	

5. List the characteristics of dynamic programming.
6. State Kuhn-Tucker necessary and sufficient conditions.
7. What is a saddle point?
8. Find the extreme point of the function  $f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$ .
9. A prize distribution function is to be organised. It has been fixed with the chief-guest. Prepare a W.B.S. and draw the precedence network. Also number the events.
10. Write short notes on the time estimate required for PERT system.

PART B — (5 × 16 = 80 marks)

11. (a) A farmer has a 100 acre farm. He can sell all the tomatoes, lettuce or radishes he can raise. The price he can obtain is Re. 1 per kg for tomatoes, Rs. 0.75 a head for lettuce and Rs. 2 per kg for radishes. The average yield per acre is 2,000 kg of tomatoes, 3,000 heads of lettuce and 1,000 kg of radishes. Fertilizer is available at Re. 0.50 per kg and the amount required per acre is 100 kg each for tomatoes and lettuce and 50 kg for radishes. Labour required for sowing, cultivating and harvesting per acre is 5 man-days for tomatoes and radishes and 6 man-days for lettuce. A total of 400 man-days of labour are available at Rs. 20 per man-day.

Formulate an L.P. model for this problem in order to maximise the farmer's total profit.

Or

- (b) A feed mixing operation can be described in terms of two activities. The required mixture must contain four kinds of ingredients  $w$ ,  $x$ ,  $y$  and  $z$ . Two basic feeds  $A$  and  $B$ , which contain the required ingredients are available in the market. 1 kg of  $A$  contains 0.1 kg of  $w$ , 0.1 kg of  $y$  and

0.2 kg of  $z$ . Likewise 1 kg of feed  $B$  contains 0.1 kg of  $x$ , 0.2 kg of  $y$  and 0.1 kg of  $z$ . The daily per head requirement is of, at least 0.4 of  $w$ , 0.6 kg of  $x$ , 2 kg of  $y$  and 1.6 kg of  $z$ . Feed  $A$  can be bought for Rs. 35 per kg and  $B$  for 25 per kg. Determine the quantity of feeds  $A$  and  $B$  in the mixture in order that the total cost is maximum.

12. (a) Use duality to solve the LPP :

$$\text{Maximise } Z = 3x_1 + 2x_2$$

subject to the constraints :

$$\begin{aligned} x_1 + x_2 &> 1 \\ x_1 + x_2 &\leq 7 \\ x_1 + 2x_2 &\leq 10 \\ x_2 &\leq 3. \end{aligned}$$

Or

- (b) Five mechanics are available to work on five machines and respective cost in rupees for each mechanic-machine combination is given in the matrix below. A sixth machine is available to replace one of the existing machines and the associated costs are given in the table.

	Machine					
	1	2	3	4	5	6
<i>A</i>	14	15	-	16	13	22
<i>B</i>	13	-	15	-	21	14
<i>C</i>	15	17	19	20	12	14
<i>D</i>	20	22	16	18	17	-
<i>E</i>	-	16	14	19	18	15
Dummy	0	0	0	0	0	0

Determine :

- (i) Whether the new machine can be accepted?
- (ii) The optional assignments and the associated costs.

13. (a) Maximize  $Z = 3x_1 + x_2 + 3x_3$

subject to  $-x_1 + 2x_2 + x_3 \leq 4$

$$2x_1 - \frac{3}{2}x_3 \leq 1$$

$$x_1 - 3x_2 + 2x_3 \leq 3$$

$$x_1, x_2, x_3 \geq 0 \text{ and integers.}$$

Or

- (b) Formulate the following problem as a dynamic programming problem and find the optimal solution :

$$\text{Maximize } Z = (x_1 + 2)^2 + x_2 x_3 + (x_4 - 5)^2$$

subject to  $x_1 + x_2 + x_3 + x_4 \leq 5$

$$x_i \text{ (} i = 1, 2, 3, 4 \text{) non-negative integers.}$$

14. (a) Minimize  $f(y) = \frac{1}{2}(y_1^2 + y_2^2 + y_3^2 + y_4^2)$

subject to  $g_1(y) = y_1^2 + 2y_2 + 3y_3 - 5y_4 - 10 = 0$ ,

$$g_2(y) = y_1^2 + 2y_2 + 5y_3 + 6y_4 - 15 = 0.$$

Or

- (b) Use Kuhn-Tucker condition to determine  $x_1, x_2, x_3$  so as to maximize

$$Z = x_1^2 - x_2^2 - x_3^2 + 4x_1 + 6x_3$$

subject to the constraints :  $x_1 + x_2 \leq 2$

$$2x_1 + 3x_2 \leq 12$$

$$x_1, x_2 \geq 0.$$

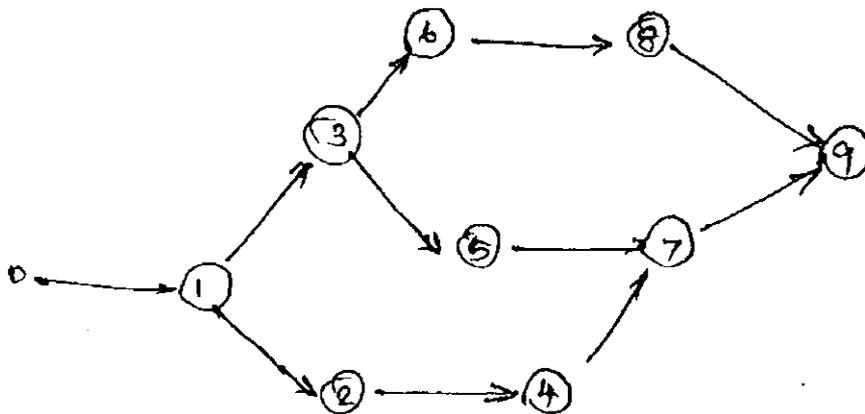
15. (a) The following table represents a set of activity lines for a PERT network :

$i-j$	A	B	C	D	E	F	G	H	I	J	K	L
$t_a$	10	12	8	4	0	12	6	9	4	0	5	9
$t_s$	13	15	11	7	0	18	12	12	6	0	8	12
$t_p$	22	18	20	16	0	36	18	27	8	0	11	33

- (i) Determine the expected completion time of each activity.
- (ii) Determine the earliest expected completion time, the latest expected completion time and float for each activity.
- (iii) What is the total project completion time and what are the activities on the critical path?
- (iv) Determine SD of expected completion time of only those activities which are on the critical path.
- (v) Determine the probability that the project will be completed within 41 weeks.

Or

- (b) Consider the network.



Activity times in days and the man power required for each activity is given in the table below :

Activity $i-j$	Time (days)	No. of men
0 - 1	2	4
1 - 2	3	3
1 - 3	4	3
2 - 4	2	5
3 - 5	4	3
3 - 6	3	4
4 - 7	6	3

Activity $i-j$	Time (days)	No. of men
5 - 7	6	6
6 - 8	5	2
7 - 9	4	2
8 - 9	4	9

Determine the critical path and the maximum duration of completing the project. If any man can work on any job, schedule for the project length to be minimized within resources and technological constraints.