Reg. No. :

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B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2009.

Seventh Semester

Information Technology

CS 1001 — RESOURCE MANAGEMENT TECHNIQUES

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

(Regulation 2004)

Time : Three hours Maximum : 100 marks

(Use of statistical tables permitted)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Obtain basic feasible solutions of the following linear programming problem :

   Maximize $2x_1 + 3x_2$

   Subject to $2x_1 + x_2 \leq 2$

   $x_1 + 3x_2 = 5$

   $x_1, x_2 \geq 0.$

2. Construct an example of linear program which has no feasible solution.

3. When is the dual simplex method is preferred to the simplex method for finding a solution of a linear programming problem?

4. What is the optimality criterion in the assignment problem?

5. What is the concept involved in the Gomory's cutting plane method?

6. List some applications of dynamic programming.

7. Define unconstrained and constrained extremal problems.

8. Write down the Kuhn-Tucker conditions for the following Non-linear programming problem.

Maximize $Z = f(x)$

Subject to $g(x) \leq b$

$x \geq 0, x = x_1, x_2 \ldots x_n$.

9. Discuss the importance of Total, Free Floats.

10. What is the probability that the protect will be completed in 20 days if the expected duration of the project is 19 days and standard deviation of the project is 2.08 days? 12.

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) An aircraft company which operates out of a central terminal has 8 aircrafts of Type I, 15 aircrafts of Type II and 12 aircrafts of Type III available for today's flights. The tonnage capacities (in thousands of tons) are 4.5 for Type I, 7 for Type II and 4 for Type III.

The company dispatches its planes to cities A and B. Tonnage requirements (in thousands of tons) are 20 at city A and 30 at city B; excess tonnage capacity supplied to a city has no value. A plan can fly once only during the day.

The cost of sending a plane from the terminal to each city is given by the following table :

	Type I	Type II	Type III
City A :	23	5	1.4
City B :	58	10	3.8

Formulate the LP model to minimize the air transportation cost. (8)

(ii) Solve by simplex method the following LP problem.

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

Subject to
$$3x_1 - x_2 + 2x_3 \leq 7$$
$$2x_1 + 4x_2 \geq -12$$
$$-4x_1 + 3x_2 + 8x_3 \leq 10$$
$$x_1, x_2, x_3 \geq 0.$$

Or

(b) The following table gives the caloric values and the protein contents of five types of foods along with their costs. Find the amount of each type of food to be purchased in order to meet exactly the daily requirements of a person at minimum cost. Assume that a person, on the average, requires 3000 calories and 100 grams of proteins.

	Bread	Meat	Potatoes	Cabbage	Milk
Calories :	2500	3000	600	100	600
Proteins (gms) :	80	150	20	10	40
Cost/kg (Rs.) :	3	10	1	2	3

12. (a) A company has factories at four different places which supply warehouses A, B, C, D, and E. Monthly factory capacities are 200, 175, 150 and 325 units respectively. Monthly warehouse requirements are 110, 90, 120, 230 and 160 units respectively. Unit shipping costs are given in the following table. The costs are in rupees.

Table

From \ To	A	B	C	D	E
1	13	–	31	8	20
2	14	9	17	6	10
3	25	11	12	17	15
4	10	21	13	–	17

Determine the optimum distribution to minimize shipping costs.

Or

(b) Consider the linear programming problem :

Maximize $Z = 2x_2 - 5x_3$

Subject to
$$x_1 + x_3 \geq 2$$
$$2x_1 + x_2 + 6x_3 \leq 6$$
$$x_1 - x_2 + 3x_3 = 0$$
$$x_1, x_2, x_3 \geq 0.$$

The final simplex table yielding the optimal solution is

Basis	x_1	x_2	x_3	s_1	s_2	A_1	A_3	Solution
x_2	0	1	0	0	1/3	0	–2/3	2
s_1	0	0	2	1	1/3	–1	1/3	0
x_1	1	0	3	0	1/3	0	1/3	2
$C_j - Z_j$	0	0	–5	0	–2/3	$-M$	$-M+\frac{4}{3}$	4

(i) What are the shadow prices of each of the constraints in the primal?

(ii) Over what range of coefficients for each variable in the objective function will the optimal solution remain optimal?

13. (a) In a cargo loading problem, there are 4 items of different weights/unit and different value/unit as give below :

Item	Weight/unit Kg/unit	Value/unit Rs./unit
1	1	1
2	3	5
3	4	7
4	6	11

The maximum cargo load is restricted to 17. How many units of each item be loaded to maximize the value? Use dynamic programming approach to solve this problem.

Or

(b) Solve by Branch and Bound technique

Maximize $Z = 2x_1 + 3x_2$

Subject to $5x_1 + 7x_2 \leq 35$

$4x_1 + 9x_2 \leq 36$

$x_1, x_2 \geq 0$ and integer.

14. (a) Solve the following non-linear programming problem using the Lagrangean Multiplier method :

Optimize $Z = 4x_1^2 + 2x_2^2 + x_3^2 - 4x_1x_2$

Subject to $x_1 + x_2 + x_3 = 15$

$2x_1 - x_2 + 2x_3 = 20$

$x_1, x_2, x_3 \geq 0.$

Or

(b) Solve the following problem :

Optimize $Z = 2x_1 + 3x_2 - x_1^2 - x_2^2 - x_3^2$

Subject to $x_1 + x_2 \leq 1$

$2x_1 + 3x_2 \leq 6$

$x_1, x_2 \geq 0.$

15. (a) A small project consists of seven activities for which the relevant data is given below :

(i) Draw the network diagram and find the project completion time.

(ii) Calculate the three floats for each activity.

Activity	Preceding activities	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

Or

(b) A Project has the following activities and other characteristics :

Activity	Preceding activity	Time in weeks		
		Least time	Most likely time	Greatest time
A	–	4	7	16
B	–	1	5	15
C	*A*	6	12	30
D	*A*	2	5	8
E	*C*	5	11	17

Activity	Preceding activity	Time in weeks		
		Least time	Most likely time	Greatest time
F	D	3	6	15
G	B	3	9	27
H	E, F	1	4	7
I	G	4	19	28

(i) Draw the PERT Network.

(ii) Identify the critical path.

(iii) Find the probability that the project is completed in 36 weeks.

(iv) If the project manager wants to be 99% sure that the project is completed on June 30, 2010, when should he start the project work?