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M 9903

M.B.A. DEGREE EXAMINATION, MAY/JUNE 2009.

First Semester

BA 1603 — APPLIED OPERATIONS RESEARCH FOR MANAGEMENT

(Regulation 2005)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are three properties of linearity?

2. What are the assumptions that must be satisfied in order for a problem to be solved in LP?

3. How is degeneracy handled in MODI method?

4. List some applications of the assignment model.

5. How does integer programming differ from the Linear Programming?

6. What is Game Theory?

7. State Bayes Theorem algebraically.

8. Define Alternative Optima in LP.

9. What are the basic elements of Queuing system?

10. What is meant by "Queue Discipline"?

PART B — (5 × 16 = 80 marks)

11. (a) Solve by Simplex method

Maximize $Z = 15R + 10P$

Subject to restrictions :

$3R + 0R \leq 180$

$0R + 5P \leq 200$

$4R + 6P \leq 360$

and $R, P \geq 0$.

Or

(b) An organisation is about to conduct a series of experiments with satellites carrying animals. The animal in each satellite is to be fed two types of meals L and M, in the form of bars that drop into a box from automatic dispensers. The minimum daily nutritional requirements for the animal in terms of nutrients A, B and C, can be supplied with different combinations of quantities for foods. The content of each food type and the weight of a single bar are shown below.

Nutrient	Nutrient content, units		Daily requirements in units
	L	M	
A	2	3	90
B	8	2	160
C	4	2	120
Weight per bar, gm	3	2	

Using graphical method, find the combination of food types to be supplied so that daily requirements can be met while minimizing the total daily weight of the food needed.

12. (a) The Burgraf Co. distributes its products from 2 warehouses to 5 major metropolitan areas. Next month's anticipated demand exceeds the warehouse supplies and the management at Burgraf would like to know how to distribute their product in order to maximize the revenue. Their distribution costs per unit are shown in the table. To be competitive Burgraf must charge a different price in different cities. Selling prices are Rs. 9.95, Rs. 10.5, Rs. 9.5, Rs. 11.15, Rs. 10.19 in cities 1, 2, 3, 4 and 5.

TO CITY

From warehouse	1	2	3	4	5	Supply
1	1.5	1.65	2.05	1.4	1.35	800
2	1.6	2.1	1.8	1.65	2	1000
Demand	500	200	300	600	800	

Find the optimal allocation to maximize the revenue.

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(b) A delivery truck must leave a warehouse and visit four customer delivery points and return to the warehouse. Find out the best route where (1 represents the warehouse).

Distance (Miles)

From \ To	1	2	3	4	5
1	–	10	7	5	5
2	11	–	4	6	8
3	7	4	–	7	8.
4	5	5	7	–	3
5	3	8	8	3	–

13. (a) Solve the following by integer linear programming using cutting plane method.

Maximize $Z = 2X_1 + 20X_2 + 4X_3$

Subject to constraints

$2X_1 + 20X_2 + 4X_3 \le 15$
$6X_1 + 20X_2 + 4X_3 = 20$

And X_1, X_2, X_3 are non-negative integers.

Or

(b) Find the value of the game by using Linear Programming A_1, A_2, A_3 are A's strategy B_1, B_2, B_3 are B's strategy

	B_1	B_2	B_3
A_1	3	–1	–3
A_2	–2	4	–1
A_3	–5	–6	2

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14. (a) The president of a large oil company must decide how to invest the company's Rs. 10 million of excess profits. He could invest the entire sum in solar energy research or he could use the money to research better ways of processing coal so that it will burn more cleanly. His only other opinion is to put half of this R and D money into solar research and half into coal research. The president estimates 1000 percent return on investment if the solar research is successful and a 500 percent return if the coal research is successful.

(i) Construct a payoff table for the president's R and D investment problem.

(ii) Based on the maximin criterion, what decision should the president make?

(iii) Based on the minimax regret criterion, what decision should the president make?

S_1 = neither coal nor solar research is successful

S_2 = solar research is successful and coal research is not

S_3 = coal research is successful and solar research is not

S_4 = both coal and solar research are successful

d_1 = invest in solar R and D only

d_2 = invest in coal R and D only

d_3 = invest 50% in coal and 50% in solar R and D.

Or

(b) Consider a telecommunications problem. The numbers on each arc of the network represent probabilities that the line will not have a failure or incur random noise during data transmissions from one point to another.
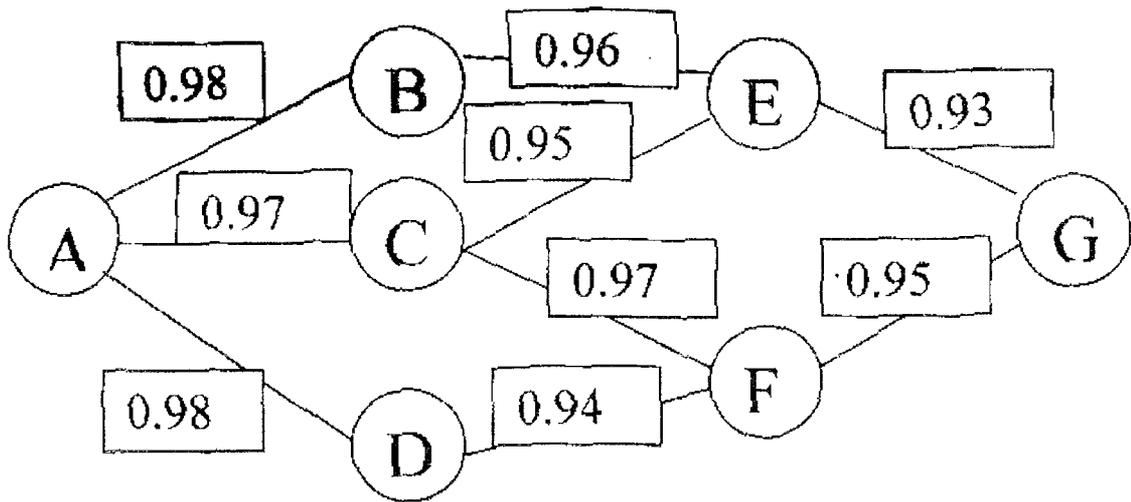
Determine the most reliable path of lines from node A to node G.

15. (a) The city council of a small town has decided to build a tennis court in the central park. Players are expected to arrive on the average of 10 sets of players per 12-hour a day. Playing time is exponentially distributed with a mean of 1 hour. Arrivals are Poisson. What are the expected queuing statistics assuming the basic single-server model?

Or

(b) A plant has 60 number of cells and a study has been made on the nature of deterioration with time. The following is the probability of failure after replacement :

Months after replacement : 1 2 3 4 5

Probability of failure : 0.20 0.15 0.10 0.30 0.25

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The cost of replacement as and when it fails has been found to be Rs. 200 per unit. Now it has been proposed to replace all the items at a specified frequency and in such a case the cost of such a replacement comes to Rs. 60 per unit. Can we accept this proposal? If so, at what frequency we have to undertake replacement of all the cells at a time?