Reg. No. : | | | | | | | | | | | |

# Z 4503

M.B.A. DEGREE EXAMINATION, MAY/JUNE 2008.

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 integer programming differs 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) The ISRA is about to conduct a series of experiments with satellites carrying animals. The animal in 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) Solve the following by integer linear programming using cutting plane method :

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

Subject to constraints

$2X_1 + 20X_2 + 4X_3 \leq 15$

$6X_1 + 20X_2 + 4X_3 = 20$

and $X_1, X_2, X_3$ are non-negative integers.

Also show that it is not possible to obtain a feasible integer solution by using the method of simple rounding off.

Or

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

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

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 |

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

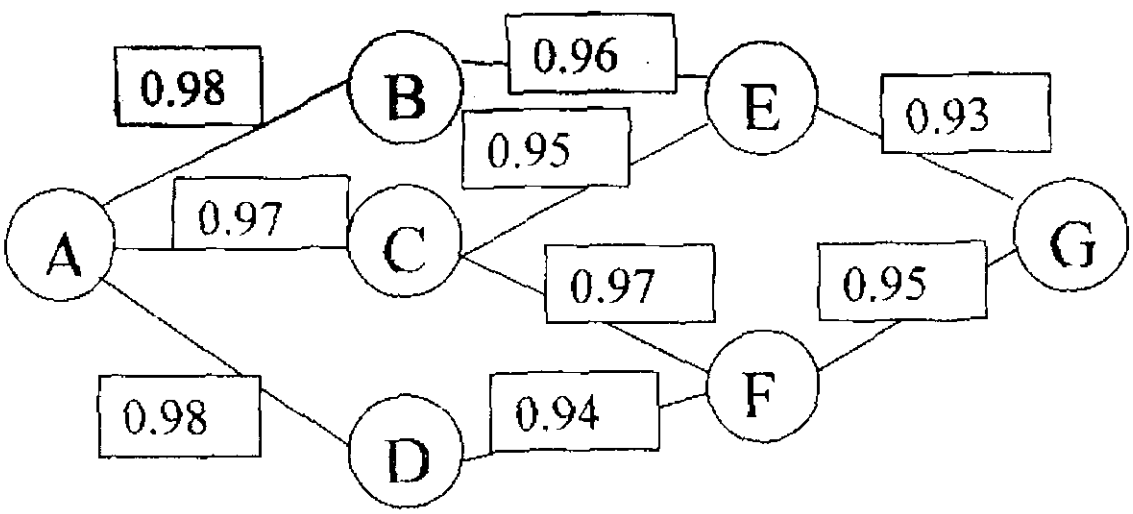
$d_1$ = invest in solar R and D only

$d_2$ = 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 |

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?

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