

II Semester M.B.A. (Day/Evening) Examination, July/August 2006

(Updated Scheme)

MANAGEMENT

2.1: Operations Research

Time: 3 Hours

Max. Marks: 75

SECTION – A

I. Answer any six questions:

(6×2=12)

- a) What is simulation ? When it is used ?
- b) Define saddle point in Game theory.
- c) What do you understand by the term total float, free float, independent float ?
- d) What is degeneracy in Transportation Problem ?
- e) How does Travelling Salesman Problem differ from Normal Assignment Problem ?
- f) Differentiate between waiting time in the queue to waiting time in the system.
- g) What are the assumptions considered in solving assignment problems ?
- h) What is sequencing ?
- i) Write two applications of linear programming.

## SECTION - B

Answer any four questions:

(4×5=20)

2. Five jobs pass through 3 machines. X, Y, Z in the order XYZ. Processing times in each machine is given in minutes.

| Jobs | Machines |   |    |
|------|----------|---|----|
|      | X        | Y | Z  |
| 1    | 11       | 7 | 6  |
| 2    | 12       | 8 | 11 |
| 3    | 9        | 6 | 9  |
| 4    | 8        | 5 | 8  |
| 5    | 13       | 6 | 6  |

Find the best sequence that will minimise the total elapsed time. Find the idle time of each machine.

3. Solve the assignment problem to maximise the sales.

| Salesman | Territory |    |    |    |
|----------|-----------|----|----|----|
|          | 1         | 2  | 3  | 4  |
| A        | 92        | 78 | 64 | 50 |
| B        | 68        | 58 | 48 | 38 |
| C        | 68        | 58 | 48 | 38 |
| D        | 56        | 48 | 40 | 32 |

## SECTION - B

Answer any four questions:

(4×5=20)

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| Jobs | Machines |   |    |
|------|----------|---|----|
|      | X        | Y | Z  |
| 1    | 11       | 7 | 6  |
| 2    | 12       | 8 | 11 |
| 3    | 9        | 6 | 9  |
| 4    | 8        | 5 | 8  |
| 5    | 13       | 6 | 6  |

Find the best sequence that will minimise the total elapsed time. Find the idle time of each machine.

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| Salesman | Territory |    |    |    |
|----------|-----------|----|----|----|
|          | 1         | 2  | 3  | 4  |
| A        | 92        | 78 | 64 | 50 |
| B        | 68        | 58 | 48 | 38 |
| C        | 68        | 58 | 48 | 38 |
| D        | 56        | 48 | 40 | 32 |

4. Schedule the following to get the same done at the lowest cost i.e. obtain the optimal crashing plan.

| Activity | Precedence | Time in weeks |       | Cost (Rs.) |        |
|----------|------------|---------------|-------|------------|--------|
|          |            | Normal        | Crash | Normal     | Crash  |
| A        | -          | 6             | 4     | 10,000     | 14,000 |
| B        | -          | 4             | 3     | 5,000      | 8,000  |
| C        | A          | 3             | 2     | 4,000      | 5,000  |
| D        | B          | 8             | 6     | 9,000      | 12,000 |
| E        | C          | 7             | 4     | 7,000      | 8,000  |

5. A bank withdrawers arrive with a mean inter-arrival time of 10 minutes. The service is at the rate of 12 customers/hr. Arrivals follow Poisson and service follows negative exponential distribution.

- What is the probability that a fresh arrival need not have to wait ?
- The bank is prepared to open one more counter if the arrival has to wait at least 8 minutes. By how much must the flow of arrivals be increased to justify the second counter ?

6. a) Solve graphically

$$\text{Maximize: } 10x_1 + 6x_2$$

$$\text{s.t. } 5x_1 + 4x_2 \leq 800$$

$$3x_1 + 2x_2 \leq 450$$

$$x_1, x_2 \geq 0$$

- b) Write the dual only

$$\text{Maximize: } 2y_1 + 3y_2 + y_3$$

$$\text{s.t. } 4y_1 + 3y_2 + y_3 = 6$$

$$y_1 + 2y_2 + 5y_3 = 4$$

$$y_1, y_2, y_3 \geq 0$$

7. Solve the simulation problem for 10 days

| Scooter<br>Production/day | Prob.       |
|---------------------------|-------------|
| 97                        | 0.05        |
| 98                        | 0.10        |
| 99                        | 0.20        |
| 100                       | 0.25        |
| 101                       | 0.20        |
| 102                       | 0.15        |
| 103                       | 0.05        |
|                           | <u>1.00</u> |

Produced scooters should be sent through a tempo which has space only for 100 scooters. If more than 100 scooters are produced the extra scooter produced to be kept and clubbed with next day's production. Find the average empty space as well as average waiting of scooters for want of space.

Random Nos. for 10 days } 1010, 0730, 7040, 6080, 9130, 4870, 5170,  
2180, 8730, 9833

SECTION - C

Answer any three questions:

(3×10=30)

8. Minimise :

$$\begin{aligned}
 & Z = x_1 - 3x_2 + 2x_3 \\
 \text{s.t. } & 3x_1 - x_2 + x_3 \leq 7 \\
 & 2x_1 - 4x_2 \geq -12 \\
 & -4x_1 + 3x_2 + 8x_3 \leq 10 \\
 & x_1, x_2, x_3 \geq 0
 \end{aligned}$$

9. Solve the following Assignment problem to minimise the layover time of drivers. The drivers must have a minimum layover of 2.5 hrs. between trips. Obtain the pair of trips that minimises the layover time.

| Route No. | Bangalore-Hassan |         | Route No. | Hassan-Bangalore |        |
|-----------|------------------|---------|-----------|------------------|--------|
|           | Dep.             | Arr.    |           | Dep.             | Arr.   |
| 101       | 7 A.M.           | 10 A.M. | 201       | 10 A.M.          | 1 P.M. |
| 102       | 9 A.M.           | 12 Noon | 202       | 11 A.M.          | 2 P.M. |
| 103       | 11 A.M.          | 2 P.M.  | 203       | 2 P.M.           | 5 P.M. |
| 104       | 3 P.M.           | 6 P.M.  | 204       | 4 P.M.           | 7 P.M. |

10. Find the project duration for 95% probability completion for the following data:

| Activity | Precedence | Time in weeks |    |    |
|----------|------------|---------------|----|----|
|          |            | a             | m  | b  |
| A        | -          | 3             | 5  | 7  |
| B        | A          | 9             | 12 | 15 |
| C        | B          | 7             | 9  | 10 |
| D        | -          | 5             | 7  | 9  |
| E        | C          | 5             | 9  | 12 |
| F        | A, D       | 5             | 9  | 12 |
| G        | A, D       | 6             | 10 | 12 |
| H        | E, F       | 2             | 4  | 6  |
| I        | E, F       | 5             | 10 | 12 |
| J        | G, H       | 2             | 4  | 6  |

Calculate TF, FF and IF for the activities.

11. An electronic equipment has 5000 IC's. If any one IC fails it has to be replaced. Cost of replacing a single IC is only Rs. 10. If all IC's are replaced simultaneously at a time it would cost Rs. 3.5/IC. The data of failures are as given:

| Month   | 0     | 1   | 2   | 3   | 4    | 5   | 6  |
|---|-------|-----|-----|-----|------|-----|----|
| Percentage surviving at the end of each month | 100 % | 97% | 90% | 70% | 30 % | 15% | 0% |

Obtain the best replacement policy i.e. replace as and when IC fails or replace all IC's at fixed intervals and replace the individual IC's which fail during the fixed interval.

12. Solve the following transportation problem to minimise the transportation cost.

|                | M <sub>1</sub> | M <sub>2</sub> | M <sub>3</sub> | M <sub>4</sub> | Production |
|----------------|----------------|----------------|----------------|----------------|------------|
| F <sub>1</sub> | 5              | 14             | 9              | 6              | 18         |
| F <sub>2</sub> | 15             | 13             | 8              | 8              | 9          |
| F <sub>3</sub> | 7              | 12             | 16             | 13             | 11         |
| Requirement    | 10             | 7              | 5              | 6              |            |

SECTION - D

(Compulsory)

(1×13=13)

There are three products X, Y, Z which has three ingredients a, b, c in it. The selling price of X, Y, Z are 100 Rs., 120 Rs. and 140 Rs. each respectively. The cost of the ingredients a, b, c are Rs. 40, Rs. 50 and Rs. 120 each respectively.

| Raw Material | Products      |               |               |
|--------------|---------------|---------------|---------------|
|              | X             | Y             | Z             |
| a            | $\frac{1}{2}$ | $\frac{2}{7}$ | -             |
| b            | $\frac{1}{4}$ | $\frac{3}{7}$ | $\frac{2}{3}$ |
| c            | $\frac{1}{4}$ | $\frac{2}{7}$ | $\frac{1}{3}$ |

The available quantity of a, b, c are 20, 15, 10 units respectively.

Obtain the optimum product mix of X, Y, Z which maximises the profit.

Profit of X, Y, Z = Selling price - Cost of manufacturing X, Y, Z.

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## II Sem. M.B.A. (Day/Evening) Degree Examination, June/July 2007

(Updated Scheme)

MANAGEMENT

Paper – 2.1 : Operations Research

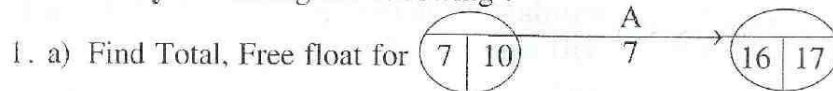
Time: 3 Hours

Max. Marks: 75

## SECTION – A

Answer **any six** among the following :

(6×2=12)



- b) What is meant by Resource Levelling ?
- c) What are the properties of Random numbers ?
- d) Give two areas where assignment problems could be used.
- e) Define “PURE STRATEGY” ?
- f) Give two examples of application of multiserver single queue models.
- g) Define “DUAL” in Linear Programming.
- h) Explain “Degeneracy” in transportation model.
- i) Distinguish between TF, FF and IF.

## SECTION – B

Answer **any four** questions :

(4×5=20)

2. What is simulation ? Simulate for 10 days.

| Driver's absentecism | Probability |
|----------------------|-------------|
| 0                    | 0.55        |
| 1                    | 0.20        |
| 2                    | 0.15        |
| 3                    | 0.05        |
| 4                    | 0.05        |
|                      | <hr/>       |
|                      | 1.00        |

P.T.O.

Total number of Drivers for 10 buses are Ten and they have two reserve drivers. If more than two Drivers are absent, the buses have to be cancelled which will cost Rs. 3,000/Bus and if the drivers are idle it will cost Rs. 500/Driver.

Find the total cost to the organisation. Use the following 10 Random numbers. 101, 737, 443, 242, 481, 517, 729, 066, 871, 913.

3. Write the dual of the following :

i) Minimize :  $5000x + 3000y$

$$\begin{aligned} \text{s.t} \quad & 60x + 20y \geq 300 \\ & 40x + 40y \geq 200 \\ & 40x + 70y \geq 500 \end{aligned}$$

$$x, y \geq 0$$

ii) Maximize :  $10x_1 + 6x_2$

$$\begin{aligned} \text{s.t} \quad & -5x_1 - 4x_2 \geq -800 \\ & 3x_1 + 2x_2 \leq 450 \end{aligned}$$

$$x_1, x_2 \geq 0$$

4. Five Jobs are to be performed on machine X and machine Y. Time taken in hours by each job on each machine is given as

| Machine \ Jobs | Jobs |    |   |    |    |
|----------------|------|----|---|----|----|
|                | A    | B  | C | D  | E  |
| x              | 7    | 11 | 9 | 8  | 10 |
| y              | 11   | 10 | 7 | 15 | 6  |

Determine the optimal sequence of jobs that minimises the total elapsed time to complete the jobs. Also compute the minimum time.

5. Find the value of the game for the following mixed strategy problem.

|            |            | Player 'B' |            |
|------------|------------|------------|------------|
|            |            | Strategy-1 | Strategy-2 |
| Player 'A' | Strategy 1 | 4          | 1          |
|            | Strategy 2 | 2          | 3          |

6. For the following travelling salesman problem find the best cycle and find the total

|                |                |                |                |                |                |
|----------------|----------------|----------------|----------------|----------------|----------------|
|                | A <sub>1</sub> | A <sub>2</sub> | A <sub>3</sub> | A <sub>4</sub> | A <sub>5</sub> |
| A <sub>1</sub> | ∞              | 2              | 5              | 7              | 1              |
| A <sub>2</sub> | 6              | ∞              | 3              | 8              | 2              |
| A <sub>3</sub> | 8              | 7              | ∞              | 4              | 7              |
| A <sub>4</sub> | 12             | 4              | 6              | ∞              | 5              |
| A <sub>5</sub> | 1              | 3              | 2              | 8              | ∞              |

7. Find the economic life of the machine which was purchased for Rs. 12,000. The interest rate is 0%.

| End of Year (n) | Operation cost (Rs.) | Maintenance cost (Rs.) | Salvage value (Rs.) |
|-----------------|----------------------|------------------------|---------------------|
| 1               | 2000                 | 2500                   | 8000                |
| 2               | 3000                 | 3000                   | 7000                |
| 3               | 4000                 | 3500                   | 6000                |
| 4               | 5000                 | 4000                   | 5000                |
| 5               | 6000                 | 4500                   | 4000                |
| 6               | 7000                 | 5000                   | 3500                |
| 7               | 8000                 | 5500                   | 2500                |
| 8               | 9000                 | 6000                   | 1000                |

SECTION – C

Answer any three questions :

(3×10=30)

8. Minimise using simplex method :

$$z = 4x_1 + x_2$$

$$\text{s.t. } 3x_1 + x_2 \geq 27$$

$$x_1 + x_2 \geq 21$$

$$x_1 + 2x_2 \geq 30$$

$$x_1, x_2 \geq 0.$$

9. Solve the following profit matrix of the transportation problem to maximise the profit, how much profit is possible ?

|                |                |                |                |            |
|----------------|----------------|----------------|----------------|------------|
|                | M <sub>1</sub> | M <sub>2</sub> | M <sub>3</sub> | Production |
| F <sub>1</sub> | 8              | 6              | 6              | 98         |
| F <sub>2</sub> | 8              | 12             | 10             | 78         |
| F <sub>3</sub> | 11             | 10             | 10             | 58         |
|                | 108            | 68             | 38             |            |

REQUIREMENTS

10. In a Bank withdrawers arrive at the rate of 18/Hr. and depositors arrive @ the rate of 12/Hr. Both follow Poisson distribution. The service for both depositors and withdrawers take 3 minutes per customer. Service time follows negative exponential distribution.
- Find the average waiting time of customers in the withdrawal counter and deposit counter.
  - If both counters were to handle both deposits and withdrawal what would be the average waiting time for a customer ?
11. Solve the following transportation problem for minimising the transportation cost.

|       |       |       |       |    |
|-------|-------|-------|-------|----|
|       | $M_1$ | $M_2$ | $M_3$ |    |
| $F_1$ | 6     | 7     | 8     | 20 |
| $F_2$ | 10    | 4     | 7     | 30 |
| $F_3$ | 4     | 7     | ?     | 80 |
|       | 40    | 30    | 60    |    |

12. Explain the following :

- Reorder point
- Sensitivity analysis
- Saddle point.

SECTION – D

Case study

(Compulsory)

13. Draw the network for the following data and find out :

(1×13=13)

- Total, Free, Independent floats.
- Variance of the critical path.
- Days for completing the project for the probability of 95%.

| Activity | Precedence | Duration in days |    |    |
|----------|------------|------------------|----|----|
|          |            | a                | m  | D  |
| A        | –          | 7                | 9  | 12 |
| B        | A          | 10               | 14 | 16 |
| C        | A          | 3                | 4  | 6  |
| D        | C          | 4                | 6  | 8  |
| E        | –          | 10               | 14 | 18 |
| F        | E          | 4                | 6  | 8  |
| G        | B, D       | 4                | 5  | 6  |
| H        | F, G       | 1                | 2  | 3  |

a = Most Optimistic Time

M =

D = Most Pessimistic Time.



II Semester M.B.A. (Day) Degree Examination, June 2008  
(2007-08 Scheme)

2.6 : QUANTITATIVE METHODS AND OPERATIONS RESEARCH

Time: 3 Hours

Max. Marks : 75

SECTION - A

Answer any six questions. Each question carries two marks. (6×2=12)

1. a) Define an OR model.
- b) What is feasibility region ?
- c) What is the difference between pure strategy and mixed strategy ?
- d) What is degeneracy ? How does the problem of degeneracy arise in a transportation problem ?
- e) What is an unbalanced assignment problem ?
- f) Explain free and independent floats.
- g) Discuss the assumptions underlying the EOQ formula.
- h) Define saddle point in game theory.

SECTION - B

Answer any three questions. Each question carries 8 marks. (3×8=24)

2. A company has four sales representatives who are to be assigned to four sales territories. The monthly sales increase estimated for each sales representative for different sales territories (in lakhs of rupees) are shown below :

| Sales Representatives | Sales Territories |     |     |     |
|-----------------------|-------------------|-----|-----|-----|
|                       | 1                 | 2   | 3   | 4   |
| A                     | 200               | 150 | 170 | 220 |
| B                     | 160               | 120 | 150 | 140 |
| C                     | 190               | 195 | 190 | 200 |
| D                     | 180               | 175 | 160 | 190 |

Suggest optimal assignment and the total maximum sales increase per month.

3. A factory requires 1500 units of an item per month, each costing Rs. 27. The cost per order is Rs. 150 and the inventory carrying charges work out to 20% of the average inventory. Find out the EOQ and the number of orders per year.

Would you accept a 2% price discount on a minimum supply quantity of 1200 units? Compare the total cost in both the cases.

4. For a machine the following data are available :

| Year                              | 0      | 1     | 2     | 3     | 4    | 5    | 6    |
|-----------------------------------|--------|-------|-------|-------|------|------|------|
| Cost of spares (Rs.)              | –      | 200   | 400   | 700   | 1000 | 1400 | 1600 |
| Salary of maintenance staff (Rs.) | –      | 1200  | 1200  | 1400  | 1600 | 2000 | 2600 |
| Losses due to breakdown (Rs.)     | –      | 600   | 800   | 700   | 1000 | 1200 | 1600 |
| Resale value (Rs.)                | 12,000 | 6,000 | 3,000 | 1,500 | 800  | 400  | 400  |

Determine the optimum period for replacement of the above machine.

5. Find the sequence and total elapsed time required in performing the following jobs on three machines in the order ABC. Processing times (in hrs) are given in the following table

| Job     |   | 1 | 2  | 3 | 4 | 5  |
|---------|---|---|----|---|---|----|
| Machine | A | 8 | 10 | 6 | 7 | 11 |
|         | B | 5 | 6  | 2 | 3 | 4  |
|         | C | 4 | 9  | 8 | 6 | 5  |

6. Bakery keeps stock of a popular brand of cake. Previous experience indicates the daily demand as given here.

|                     |      |      |      |      |      |      |
|---------------------|------|------|------|------|------|------|
| <b>Daily Demand</b> | 0    | 10   | 20   | 30   | 40   | 50   |
| <b>Probability</b>  | 0.01 | 0.20 | 0.15 | 0.50 | 0.12 | 0.02 |

Consider the following sequence of random members

48, 78, 19, 51, 56, 77, 15, 14, 68, 09

Using this sequence stimulate the demand for the next 10 days. Find out the stock situation if the owner of the bakery decides to make 30 cakes every day. Also estimate the daily average demand for the cakes on the basis of simulated data.



SECTION - C

(2×12=24)

Answer any two questions. Each question carries 12 marks.

7. Define Operation Research. What are the important techniques used in Operation Research ? Explain their limitations.

8. Solve the LPP by Simplex Method

$$\text{Maximize } z = 3x_1 + 5x_2 + 4x_3$$

$$\text{S.t. } 2x_1 + 3x_2 \leq 8$$

$$2x_2 + 5x_3 \leq 10$$

$$3x_1 + 2x_2 + 4x_3 \leq 15$$

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

9. A manufacturer wants to ship 22 loads of his product as shown below. The matrix gives the kilometers from sources of supply to the destinations

|        |                | Destination    |                |                |                |                | Supply |
|--------|----------------|----------------|----------------|----------------|----------------|----------------|--------|
|        |                | D <sub>1</sub> | D <sub>2</sub> | D <sub>3</sub> | D <sub>4</sub> | D <sub>5</sub> |        |
| Source | S <sub>1</sub> | 5              | 8              | 6              | 6              | 3              | 8      |
|        | S <sub>2</sub> | 4              | 7              | 7              | 6              | 5              | 5      |
|        | S <sub>3</sub> | 8              | 4              | 6              | 6              | 4              | 9      |
| Demand |                | 4              | 4              | 5              | 4              | 8              |        |

Shipping cost is Rs. 10 per load per km. What shipping schedule should be used to minimize total transportation cost ?



SECTION - D  
(Compulsory)

## 10. Case Study

(1×15=15)

A project consists of the following activity and different time estimates (in days)

| Activity | Optimistic time ( $t_o$ ) | Pessimistic time ( $t_p$ ) | Most likely time ( $t_m$ ) |
|----------|---------------------------|----------------------------|----------------------------|
| 1-2      | 3                         | 15                         | 6                          |
| 1-3      | 2                         | 14                         | 5                          |
| 1-4      | 6                         | 30                         | 12                         |
| 2-5      | 2                         | 8                          | 5                          |
| 2-6      | 5                         | 17                         | 11                         |
| 3-6      | 3                         | 15                         | 6                          |
| 4-7      | 3                         | 27                         | 9                          |
| 5-7      | 1                         | 7                          | 4                          |
| 6-7      | 2                         | 8                          | 5                          |

- Draw a network.
  - Determine the CP and their variances.
  - Find the earliest and latest expected times to reach each node.
  - What is the probability that the project will be completed by 27<sup>th</sup> day ?
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PG – 601

II Semester M.B.A. (Day) Degree Examination, June 2009  
(2007-08 Scheme)

Paper – 2.6 : QUANTITATIVE METHODS AND OPERATION RESEARCH

Time : 3 Hours

Max. Marks : 75

*Instruction : Calculations must be shown in detail.*

SECTION – A

Answer any six questions.

(6×2=12)

1. a) Define linear programming problem in general terms.
- b) What are the basic assumptions in solving assignment problem ?
- c) What are the two objectives of queuing problem solving ?
- d) State any two advantages and limitations of simulation.
- e) What do you mean by Analogue Model ?
- f) Define operation research.
- g) What is pay off matrix ?
- h) Write the importance of inventory model for management.
- i) What do you mean by unbounded solution ?

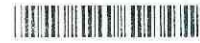
SECTION – B

Answer any three questions.

(3×8=24)

2. "Operation Research replaces management by personality" Comment.
3. Explain the role of linear programming in managerial decision making.

P.T.O.



4. A machine operator processes five types of items on his machine each week and must choose depends on the items prosperity on the machine and set up cost, according to its following table :

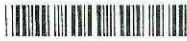
|          |   | To Item  |          |          |          |          |
|----------|---|----------|----------|----------|----------|----------|
|          |   | A        | B        | C        | D        | E        |
| For Item | A | $\infty$ | 4        | 7        | 3        | 4        |
|          | B | 4        | $\infty$ | 6        | 3        | 4        |
|          | C | 7        | 6        | $\infty$ | 7        | 5        |
|          | D | 3        | 3        | 7        | $\infty$ | 7        |
|          | E | 4        | 4        | 5        | 7        | $\infty$ |

If he processes each type of item once and only once each week, how should he sequence the item on his machine in order to minimise the total set up cost ?

5. The cost associated with procurement and holding of an item are given below :

|                                    |   |   |
|------------------------------------|---|---|
| Cost per item                      | = | Rs. 10  |
| Order processing cost              | = | Rs. 200   |
| Insurance for holding              | = | 2% of the value of inventory cost of inspection and approval of |
| Materials of a lot                 | = | Rs. 100   |
| Interest for the locked up capital | = | 15%   |
| Annual Demand                      | = | 1000 units  |
| Other holding cost                 | = | 8%  |
| Order quantity followed            | = | 500 units   |

Find out the total cost incurred due to this item per year and examine the possibility of minimising the total cost and state the savings in %.



6. Gupta Bakery Amritsar, keeps stock of a popular brand cake. Daily demand based on past experience is as given below :

Experience indicates :

|                     |   |      |      |      |      |      |      |
|---------------------|---|------|------|------|------|------|------|
| <b>Daily Demand</b> | : | 0    | 15   | 25   | 35   | 45   | 50   |
| <b>Probability</b>  | : | 0.01 | 0.15 | 0.20 | 0.50 | 0.12 | 0.02 |

Consider the following sequence of random members :

**R.No.** 48, 78, 09, 51, 56, 77, 15, 14, 68, 09 using the sequence simulate the demand for the next 10 days.

Find out the stock situation if the owner of the bakery decides to make 35 cakes every day. Also estimate the daily average demand for the cakes on the basis of simulated data.

SECTION – C

Answer **any two** questions. **Each** question carries **12** marks. **(2×12=24)**

7. a) Why is a computer necessary in conducting a real world simulation ?

b) Write a short note on :

i) Sequencing

ii) Pure and mixed strategy

iii) Replacement

iv) Waiting line

8. Use the Simplex method to solve the following LP problem :

$$\text{Maximize } z = 3x_1 + 5x_2 + 4x_3$$

$$\text{s.t. } 2x_1 + 3x_2 \leq 8$$

$$2x_2 + 5x_3 \leq 10$$

$$3x_1 + 2x_2 + 4x_3 \leq 15$$

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



9. A Project consists of the following activity and different time estimates (in days)

| Activity | Precedence | (in days) |    |    |
|----------|------------|-----------|----|----|
|          |            | a         | m  | b  |
| A        | -          | 4         | 6  | 8  |
| B        | A          | 10        | 12 | 16 |
| C        | A          | 8         | 12 | 16 |
| D        | B          | 4         | 8  | 12 |
| E        | D          | 4         | 6  | 8  |
| F        | C,D        | 4         | 8  | 14 |
| G        | E,F        | 4         | 8  | 12 |
| H        | B          | 2         | 4  | 6  |
| I        | H          | 4         | 8  | 14 |
| J        | G&I        | 4         | 6  | 8  |

a) Draw a network, b) Determine the CP and their variance, c) What is the probability that the project will be completed by 30<sup>th</sup> day ?

SECTION – D

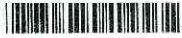
Case study (Compulsory) :

(15×1=15)

10. Maximise for the following transportation problem as the figures inside relates to profit and not the cost of transportation :

|         |                | Warehouse      |                |                | Requirements |
|---------|----------------|----------------|----------------|----------------|--------------|
|         |                | M <sub>1</sub> | M <sub>2</sub> | M <sub>3</sub> |              |
| Factory | F <sub>1</sub> | 7              | 5              | 5              | 100          |
|         | F <sub>2</sub> | 7              | 11             | 9              | 80           |
|         | F <sub>3</sub> | 10             | 9              | 9              | 60           |
| Demand  |                | 110            | 70             | 40             |              |

Determine its feasible and optimal solution.



**II Semester M.B.A. (Day) Examination, June/July 2010**  
**(2007-08 Scheme)**  
**MANAGEMENT**

**Paper – 2.6 : Quantitative Methods and Operations Research**

Time : 3 Hours

Max. Marks : 75

*Instructions : Graph sheets and Statistical tables will be supplied on request.*

SECTION – A

- I. Answer **any six** of the following. Each question carries **two** marks. (6×2=12)
- a) What are the basic assumptions in solving assignment problem ?
  - b) What is a dummy activity ? Why do we need it ?
  - c) Define an OR Model.
  - d) Differentiate between pure strategy and mixed strategy.
  - e) Define feasible region.
  - f) Discuss the assumptions underlying the EOQ formula.
  - g) What are the assumptions of sequencing ?
  - h) State one merit and one demerit of simulation technique.

SECTION – B

Answer **any three** questions. Each question carries **8** marks. (3×8=24)

2. Explain the need and importance of operation research.
3. A furniture manufacturing company plans to make two products – chairs and tables from its available resources, which consists of 400 board feet of timber and 450 man hours of labour. To make a chair one requires 5 board feet of timber and 10 man hours which will yield a profit of Rs. 45. To produce a table one would require 20 board feet of timber and 15 man hours and it will give a profit of Rs. 80. The problem is to determine how many chairs and tables the company should produce if its objective is to maximise the profits. Formulate this as a linear programming problem and solve it graphically.

P.T.O.



4. Using min. max and max. min principle, solve the game theory.

|          |                         | Player B       |                |                |
|----------|-------------------------|----------------|----------------|----------------|
|          |                         | B <sub>1</sub> | B <sub>2</sub> | B <sub>3</sub> |
| Player A | Strategy A <sub>1</sub> | 3              | -2             | 4              |
|          | A <sub>2</sub>          | -1             | 4              | 2              |
|          | A <sub>3</sub>          | 2              | 2              | 6              |

5. The production department for a company requires 3600 kg of raw material for manufacturing a particular item per year. It has been estimated that the cost of placing an order is Rs. 40 and the cost of carrying inventory is 25% of the investment in the inventories. The price is Rs. 10 per kg. The purchasing manager wishes to determine an ordering policy for raw material.
6. What is replacement ? Why it is necessary ?

#### SECTION - C

Answer **any two** questions.

(12×2=24)

7. Explain the different models of operation research.
8. A project consists of the following activity and different time estimates (in days).

| Activity | t <sub>o</sub> | t <sub>p</sub> | t <sub>m</sub> |
|----------|----------------|----------------|----------------|
| 1-2      | 3              | 15             | 6              |
| 1-3      | 2              | 14             | 5              |
| 1-4      | 6              | 30             | 12             |
| 2-5      | 2              | 8              | 5              |
| 2-6      | 5              | 17             | 11             |
| 3-6      | 3              | 15             | 6              |
| 4-7      | 3              | 27             | 9              |
| 5-7      | 1              | 7              | 4              |
| 6-7      | 2              | 8              | 5              |



- a) Draw a network.
- b) Determine the CP and their variances.
- c) Find the earliest and latest expected times to reach each node.
- d) What is the probability that the project will be completed by 27<sup>th</sup> day and 30<sup>th</sup> day ?

9. Solve the following LPP by simplex method

Maximise  $z = 5x_1 + 10x_2 + 8x_3$

s.t.  $3x_1 + 5x_2 + 2x_3 \leq 60$

$4x_1 + 4x_2 + 4x_3 \leq 72$

$2x_1 + 4x_2 + 5x_3 \leq 100$

$x_1, x_2, x_3 \geq 0.$

SECTION – D

10. Case study (Compulsory).

(1×15=15)

A Co. has three plants in which it produces a standard product. It has four agencies in different parts of the country where this product is sold. The relevant data are given in the following table.

| a) Plant       | Weekly production Capacity (Units) | Unit production Costs (Rs.) |
|----------------|------------------------------------|-----------------------------|
| P <sub>1</sub> | 400                                | 18                          |
| P <sub>2</sub> | 300                                | 24                          |
| P <sub>3</sub> | 800                                | 20                          |



b) Transportation cost (in Rs.) per unit.

|            |                | Agency         |                |                |                |
|------------|----------------|----------------|----------------|----------------|----------------|
|            |                | A <sub>1</sub> | A <sub>2</sub> | A <sub>3</sub> | A <sub>4</sub> |
| From Plant | P <sub>1</sub> | 2              | 5              | 7              | 3              |
|            | P <sub>2</sub> | 8              | 4              | 6              | 2              |
|            | P <sub>3</sub> | 3              | 4              | 4              | 5              |

c) Agency Demand (Units) Selling Price (Rs.)

|                |     |    |
|----------------|-----|----|
| A <sub>1</sub> | 300 | 32 |
| A <sub>2</sub> | 400 | 35 |
| A <sub>3</sub> | 300 | 31 |
| A <sub>4</sub> | 500 | 36 |

Determine the optimal plan so as to maximise the profits.

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PG – 006

II Semester M.B.A. (Day) Degree Examination, July 2011

(2007-08 Scheme)

Management

Paper – 2.6 : QUANTITATIVE METHODS AND OPERATIONS

RESEARCH

Time : 3 Hours

Max. Marks : 75

*Instruction : Calculators are allowed.*

SECTION – A

Answer **any six** questions. **Each** question carries **two** marks.

(6×2=12)

1. a) Define linear programming.
- b) What is Iconic model ?
- c) What are two person zero-sum games ?
- d) What are concurrent activities ?
- e) What is group replacement ?
- f) Define critical path.
- g) What do you mean by initial basic feasible solution ?
- h) What is simulation ?
- i) What do you mean by slack variables ?

P.T.O.



## SECTION – B

Answer **any three** questions. Each question carries **8** marks.

(3×8=24)

2. Define OR. Explain the importance of OR in business activities.
3. Explain the different methods of Inventory under Inventory Management.
4. A company, for one of the A-class items, placed 6 orders each of size 200 in a year. Given ordering cost Rs. 600, holding cost 40%, cost per unit Rs. 40, find out the loss to the company in not operating scientific inventory policy. What are your recommendations for the future ?
5. Solve the problem of assignment for the given table to maximise the sales.

|      |   | Machines |    |    |    |    |
|------|---|----------|----|----|----|----|
|      |   | A        | B  | C  | D  | E  |
| Jobs | 1 | 32       | 38 | 40 | 28 | 40 |
|      | 2 | 40       | 24 | 28 | 21 | 36 |
|      | 3 | 41       | 27 | 33 | 30 | 37 |
|      | 4 | 22       | 38 | 41 | 36 | 36 |
|      | 5 | 29       | 33 | 40 | 35 | 39 |

The five Jobs are to be processed and five machines are available. Any machine can process any job with reducing profit (in rupees) is given above.

6. There are 6 jobs each of which must go through machines A, B and C in the order ABC processing time (in hours) given in the (table) following table :

| Job \ Machine | 1 | 2 | 3 | 4 | 5  | 6 |
|---------------|---|---|---|---|----|---|
|               | A | 8 | 3 | 7 | 2  | 5 |
| B             | 3 | 4 | 5 | 2 | 1  | 6 |
| C             | 8 | 7 | 6 | 9 | 10 | 9 |

Determine the optimal sequence and total elapsed time.



SECTION – C

Answer **any two** of the following :

(2×12=24)

7. Explain the different models of OR. How these models are useful in day to day operation ?

8. Use Simplex method to solve the following LP model.

$$\text{Maximise } z = 32x_1 + 35x_2 + 45x_3$$

$$\text{S.t. } 2x_1 + 3x_2 + 2x_3 \leq 120$$

$$4x_1 + 3x_2 + x_3 \leq 160$$

$$3x_1 + 2x_2 + 4x_3 \leq 100$$

$$x_1 + x_2 + x_3 \leq 40$$

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

9. A Co. has 4 different factories in 4 different locations in the country and for sales agencies in four other locations in the country. The cost of production the sale price, shipping cost in the cells of matrix monthly capacities and monthly requirements are given below :

| Factory              | Sales Agency |    |    |    | Capacity | Cost of production |
|----------------------|--------------|----|----|----|----------|--------------------|
|                      | 1            | 2  | 3  | 4  |          |                    |
| A                    | 7            | 5  | 6  | 4  | 10       | 10                 |
| B                    | 3            | 5  | 4  | 2  | 15       | 15                 |
| C                    | 4            | 6  | 4  | 5  | 20       | 16                 |
| D                    | 8            | 7  | 6  | 5  | 15       | 15                 |
| Monthly Requirements | 8            | 12 | 18 | 22 |          |                    |
| Selling price        | 20           | 22 | 25 | 18 |          |                    |



## SECTION – D

10. Case study :

Below given table has a list of activities and time estimates : (1×15=15)

| Activity | Time (weeks) |    |    |
|----------|--------------|----|----|
|          | To           | Em | Tp |
| 1 – 2 A  | 6            | 7  | 8  |
| 1 – 3 B  | 7            | 9  | 12 |
| 2 – 3 C  | 2            | 4  | 6  |
| 2 – 4 D  | 8            | 12 | 18 |
| 3 – 4 E  | 0            | 0  | 0  |
| 3 – 5 F  | 12           | 14 | 18 |
| 4 – 6 G  | 3            | 4  | 5  |
| 5 – 7 H  | 10           | 13 | 17 |
| 5 – 8 I  | 6            | 8  | 12 |
| 6 – 8 J  | 5            | 9  | 13 |
| 7 – 9 K  | 4            | 7  | 10 |
| 8 – 9 L  | 6            | 9  | 15 |
| 9 – 10 M | 8            | 13 | 19 |

**Required :**

- 1) Construct a PERT network and determine the critical path.
  - 2) Prepare a time-chart.
  - 3) What is the variance and standard deviation of the project ?
  - 4) What is the probability that the project will be completed within 62 weeks ?
-



PG – 118

**II Semester M.B.A. (Day) Degree Examination, June/July 2012  
(2007-08 Scheme)**

**Management**

**Paper – 2.6 : QUANTITATIVE METHODS AND OPERATION RESEARCH**

Time : 3 Hours

Max. Marks : 75

**Instruction :** Answer all the Sections. Calculators are allowed.

**SECTION – A**

1. Answer **any six** questions :

**(6×2=12)**

- What is degeneracy ?
- What is unbalanced assignment ?
- Distinguish between static and dynamic model.
- What is simulation ?
- Mention the assumptions of EOQ model.
- What are the significance of VAM ?
- What do you mean by decoupling inventory ?
- What is a float ?

**SECTION – B**

Answer **any three** questions :

**(3×8=24)**

- "Operation Research replaces management by personality" Discuss.
- What is a game in game theory ? What are the properties of a game ? Explain the 'best strategy' on the basis of minimax criterion of optimality.
- A transportation equipment manufacturer uses rivets at an approximately constant rate of 2500 kgs. per year. The cost of rivets is Rs. 40 per kg. The company purchase manager estimates that it costs Rs. 200 to place an order and that the carrying cost of inventory is 10% p.a.
  - How frequently should orders for rivets be placed and what quantities should be ordered ?
  - If the ordering cost is Rs. 470 per order and 15% for carrying cost, how would the optimal policy change ? How much is the company losing per year because of imperfect cost information ?

P.T.O.



5. A salesman travels from one place to another the tour that will minimize the total distance of visiting all cities and returning home. The distance (in km) between pairs of cities are given below :

|           |   | To city  |          |          |          |
|-----------|---|----------|----------|----------|----------|
|           |   | P        | Q        | R        | S        |
| From city | P | $\infty$ | 15       | 25       | 20       |
|           | Q | 22       | $\infty$ | 45       | 55       |
|           | R | 40       | 30       | $\infty$ | 25       |
|           | S | 20       | 26       | 38       | $\infty$ |

Use the assignment method to determine the tour that will minimize the total distance of visiting all cities and returning home.

6. A book store wishes to carry a particular book in stock. Demand is not certain and there is a lead time of 2 days for stock replenishment. The probabilities of demand are given below :

|                             |      |      |      |      |      |
|-----------------------------|------|------|------|------|------|
| <b>Demand (units/day) :</b> | 0    | 1    | 2    | 3    | 4    |
| <b>Probability :</b>        | 0.05 | 0.10 | 0.30 | 0.45 | 0.10 |

Each time an order is placed, the store incurs an ordering cost of Rs. 10 per order. The store also incurs a carrying cost of Re. 0.5 per book per day. The inventory carrying cost is calculated on the basis of stock at the end of each day. Orders 5 books when present inventory plus any outstanding order falls below 8 books. Currently (beginning of 1<sup>st</sup> day) the store has a stock of 8 books plus 6 books ordered two days ago and are expected to arrive next day. Carryout simulation for 10 days. Random numbers for 10 days are given below :

89 34 78 63 61 81 39 16 13 73



SECTION - C

Answer any two questions :

(2x12=24)

- 7. a) Explain the principal assumptions made while dealing with sequencing problem.
- b) What is replacement ? Describe some important replacement situations.
- 8. Use the simplex method to solve the following LPP.

Maximize  $Z = 3x_1 + 5x_2 + 4x_3$

S.T  $2x_1 + 3x_2 \leq 8$

$2x_2 + 5x_3 \leq 10$

$3x_1 + 2x_2 + 4x_3 \leq 15$

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

9. Consider the following table :

| Activity | Predecessor Activity | $t_o$ | $t_m$ | $t_p$ |
|----------|----------------------|-------|-------|-------|
| A        | -                    | 2     | 3     | 10    |
| B        | -                    | 2     | 3     | 4     |
| C        | A                    | 1     | 2     | 3     |
| D        | A                    | 4     | 6     | 14    |
| E        | B                    | 4     | 5     | 12    |
| F        | C                    | 3     | 4     | 5     |
| G        | D,E                  | 1     | 1     | 7     |

- 1) What is the probability that the project shall be complete within a period of 13 weeks.
- 2) What is the probability that the project is completed within 11 and 16 weeks ?



## SECTION - D

## 10. Case study (Compulsory) :

(1×15=15)

A company has four factories  $F_1, F_2, F_3$  and  $F_4$  manufacturing the same product. Production and raw material costs differ from factory to factory and are given in the following table in the first two rows. The transportation costs from the factories to sales depots  $S_1, S_2, S_3$  are also given. The last two columns in the table give the sales price and the total requirement at each depot. The production capacity of each factory is given in the last row.

|                          | $F_1$ | $F_2$ | $F_3$ | $F_4$ | Sales Price/unit | Requirement |
|--------------------------|-------|-------|-------|-------|------------------|-------------|
| Production cost/unit     | 15    | 18    | 14    | 13    |                  |             |
| Raw material cost/unit   | 10    | 9     | 12    | 9     |                  |             |
| Transportation cost/unit | -     |       |       |       |                  |             |
| $S_1$                    | 3     | 9     | 5     | 4     | 34               | 80          |
| $S_2$                    | 1     | 7     | 4     | 5     | 32               | 120         |
| $S_3$                    | 5     | 8     | 3     | 6     | 31               | 150         |
| Production Capacity      | 10    | 150   | 50    | 100   |                  |             |

Determine the most profitable production and distribution schedule and the corresponding profit. The surplus production should be taken to yield zero profit.



II Semester M.B.A. (Day) Degree Examination, June/July 2013  
(2007-08 Scheme)  
MANAGEMENT

Paper 2.6 : Quantitative Methods and Operation Research

Time : 3 Hours

Max. Marks : 75

- Instructions :* 1) Calculators are *allowed*.  
2) Answer *all* the Sections.

SECTION – A

Answer **any six** sub questions, **each** question carries **two** marks. (6×2=12)

1. a) What is saddle point ?
- b) Mention any four models used in OR.
- c) What is LPP ?
- d) What is degeneracy ?
- e) What is prescriptive model ?
- f) Define inventory.
- g) What is prohibited assignment ?
- h) Distinguish between event and activity.

SECTION – B

Answer **any three** questions : (3×8=24)

2. Explain the concept, scope and tools of OR as applicable to business and industry.
3. Explain the EOQ model. What are its assumptions ? What are the practical limitations in using this formula ?
4. Six jobs have to be processed at three machines A, B and C in the order ACB the time taken by each job on each machine is indicated below. Each machine can process any one job at a time.

|         |     | Processing Time in Hours |                |                |                |                |                |   |
|---------|-----|--------------------------|----------------|----------------|----------------|----------------|----------------|---|
|         |     | J <sub>1</sub>           | J <sub>2</sub> | J <sub>3</sub> | J <sub>4</sub> | J <sub>5</sub> | J <sub>6</sub> |   |
| Machine | Job | A                        | 12             | 8              | 7              | 11             | 10             | 5 |
|         |     | B                        | 7              | 10             | 9              | 6              | 10             | 5 |
|         |     | C                        | 3              | 4              | 2              | 5              | 1.5            | 4 |

Determine the sequence so as to minimize the processing time.

P.T.O.



5. The quotations (Rs. in lakhs) received for 4 project from four contractors are :

| Contractor | Project |   |   |    |
|------------|---------|---|---|----|
|            | A       | B | C | D  |
| I          | 7       | 5 | 9 | 10 |
| II         | 3       | 7 | 5 | 8  |
| III        | 7       | 4 | 8 | 9  |
| IV         | 8       | 7 | 5 | 2  |

- i) If only one project is to be awarded to one contractor, find out the assignment of projects to contractors in order to minimise the total cost.
- ii) If due to certain reasons, it has been decided to award project B to contractor I. How will you assign the remaining projects to each of the remaining 3 contractors ? So that the total cost is minimum.
6. Gupta Bakery Amritsar keeps stock of a popular brand of cake. Daily demand based on past experience is as given below :

Experience indicates :

|                |      |      |      |      |      |      |
|----------------|------|------|------|------|------|------|
| Daily Demand : | 0    | 15   | 25   | 35   | 45   | 50   |
| Probability :  | 0.01 | 0.15 | 0.20 | 0.50 | 0.12 | 0.02 |

Consider the following sequence of random numbers :

R. No. 48, 78, 09, 51, 56, 77, 15, 14, 68, 09

Using the sequence, simulate the demand for the next 10 days.

### SECTION – C

Answer **any two** questions, **each** question carries **twelve** marks. **(2x12=24)**

7. a) Explain the situations which make the replacement of items necessary.
- b) Write short note on :
- Optimal solution
  - Critical path
  - Pure and mixed strategies.



8. Solve the following problem and test its optimality :

| Plant               | Project |    |    | Plant Availability |
|---------------------|---------|----|----|--------------------|
|                     | A       | B  | C  |                    |
| W                   | 4       | 8  | 8  | 56                 |
| X                   | 16      | 24 | 16 | 82                 |
| Y                   | 8       | 16 | 24 | 77                 |
| Project Requirement | 72      | 92 | 41 |                    |

9. A company produces 3 types of product X, Y and Z where use three raw materials  $R_1$ ,  $R_2$  and  $R_3$ . The following information is available :

| Material        | Requirement to produce 1 ton |      |      | Max. quantity available |
|-----------------|------------------------------|------|------|-------------------------|
|                 | X                            | Y    | Z    |                         |
| $R_1$           | 3                            | 0    | 3    | 22                      |
| $R_2$           | 1                            | 2    | 3    | 14                      |
| $R_3$           | 3                            | 2    | 0    | 14                      |
| Project per ton | 1000                         | 4000 | 5000 |                         |

Company wants to maximize profit. Formulate this as a LPP and solve it under simple method.



## SECTION – D

10. Case study (Compulsory) :

(1×15=15)

The activities involved in a PERT project are detailed below :

| Activity | Duration (in weeks) |    |    |
|----------|---------------------|----|----|
|          | a                   | m  | b  |
| 1 - 2    | 3                   | 6  | 15 |
| 2 - 3    | 6                   | 12 | 30 |
| 3 - 5    | 5                   | 11 | 17 |
| 7 - 8    | 4                   | 19 | 28 |
| 5 - 8    | 1                   | 4  | 7  |
| 6 - 7    | 3                   | 9  | 27 |
| 4 - 5    | 3                   | 6  | 15 |
| 1 - 6    | 2                   | 5  | 14 |
| 2 - 4    | 2                   | 5  | 8  |

- i) Draw a network diagram.
- ii) Find the critical path.
- iii) Find the probability of completing the project before 31 weeks.
- iv) What is the chance of project duration exceeding 46 weeks ?



**II Semester M.B.A. Degree Examination, July/August 2014**  
**(2007-08 Scheme)**  
**Management**  
**Paper – 2.6 : QUANTITATIVE METHODS AND OPERATIONS**  
**RESEARCH**

Time : 3 Hours

Max. Marks : 75

*Instruction : Answer all Sections.*

**SECTION – A**

1. Answer **any six** questions. **Each** carries **2** marks. **(6×2=12)**
- a) What are non-negativity constraints ?
  - b) Bring out the merits of simulation.
  - c) Define transient and steady state in queuing system.
  - d) Mention any four differences between PERT and CPM.
  - e) Write a short note on two person zero sums game.
  - f) What is an unbalanced assignment problem ?
  - g) What is EOQ ?
  - h) What is dummy destination ?

**SECTION – B**

- Answer **any three** questions. **Each** carries **8** marks. **(3×8=24)**
2. A salesman has to visit five cities A, B, C, D and E. The distances (in hundred miles) between the five cities are as follows :

|    |   | From |   |   |   |   |
|----|---|------|---|---|---|---|
|    |   | A    | B | C | D | E |
| To | A | ∞    | 7 | 6 | 8 | 4 |
|    | B | 7    | ∞ | 8 | 5 | 6 |
|    | C | 6    | 8 | ∞ | 9 | 7 |
|    | D | 8    | 5 | 9 | ∞ | 8 |
|    | E | 4    | 6 | 7 | 8 | ∞ |

If the salesman starts from City A and has to come back to City A which route he should select so that the total distance travelled is minimum.

P.T.O.



3. A company has six jobs on hand coded A to F. All the jobs have to go through 2 machines M1 and M2. The time required for the jobs on each machine in hours is given below :

|    | A | B | C | D | E | F |
|----|---|---|---|---|---|---|
| M1 | 1 | 4 | 6 | 3 | 5 | 2 |
| M2 | 3 | 6 | 8 | 8 | 1 | 5 |

Draw a sequence table scheduling the six jobs on two machines.

4. Consider the following data for the activities of a project :

| Activity               | A | B | C | D    | E | F |
|------------------------|---|---|---|------|---|---|
| Immediate Predecessors | - | A | A | B, C | - | E |
| Duration (days)        | 2 | 3 | 4 | 6    | 2 | 8 |

Draw the network and find the critical path and various floats.

5. The production department for a company requires 3600 kg of raw material for manufacturing a particular item per year. It has been estimated that the cost of placing an order is Rs. 36 and the cost of carrying inventory is 25 percent of the investment in the inventories. The price is Rs. 10 per kg. The purchase manager wishes to determine an ordering policy for the raw material.
6. Explain the various types of simulation.

SECTION - C

Answer any two questions. Each carries 12 marks.

(2x12=24)

7. A company makes three products X, Y, Z out of three raw materials A, B and C. The number of units of raw materials required to produce one unit of products x, y, z is given in the following table :

|   | X | Y | Z |
|---|---|---|---|
| A | 1 | 2 | 1 |
| B | 2 | 1 | 4 |
| C | 2 | 5 | 1 |

The profit per unit on the products X, Y and Z are Rs. 40, 25 and 50 respectively. The number of units of raw materials available are 36, 60 and 45 respectively.

- a) Determine the product mix that will maximize the total profit. Through the final simplex table, write the solution to the dual problem and give the economic interpretation.
- b) Through the final simplex table, write the solution to the dual problem and give the economic interpretation.



- 8. Briefly discuss the application of queuing theory in industrial management.
- 9. The original cost of the machine ₹ 5,000 operating costs varies as follows.

|                              |   |     |     |     |      |      |      |      |
|------------------------------|---|-----|-----|-----|------|------|------|------|
| <b>Year</b>                  | : | 1   | 2   | 3   | 4    | 5    | 6    | 7    |
| <b>Operating cost (in ₹)</b> | : | 400 | 500 | 700 | 1000 | 1300 | 1700 | 2100 |

at 9% is the discount rate of money. What should be the optimum replacement interval?

**SECTION – D**

- 10. **Compulsory :**

**(1×15=15)**

Solve the following transportation problem by using the :

- a) NWCR
- b) MMM
- c) VAM

| <b>Wholesaler</b>  |          | <b>A</b> | <b>B</b> | <b>C</b> | <b>D</b> | <b>E</b> | <b>Available units</b> |
|--------------------|----------|----------|----------|----------|----------|----------|------------------------|
| <b>Factories</b>   | <b>a</b> | 5        | 7        | 10       | 5        | 3        | 5                      |
|                    | <b>b</b> | 8        | 6        | 9        | 12       | 4        | 10                     |
|                    | <b>c</b> | 10       | 9        | 8        | 10       | 15       | 10                     |
| <b>Requirement</b> |          | 3        | 3        | 10       | 5        | 4        | 25                     |



**II Semester M.B.A. Degree Examination, June/July 2015  
(2007-08 Scheme)**

**Management**

**2.6 : QUANTITATIVE METHODS AND OPERATIONS RESEARCH**

Time : 3 Hours

Max. Marks : 75

**Instruction : Scientific calculators are allowed.**

**SECTION – A**

Answer **any six** questions. **Each** question carries **two** marks.

**(6x2=12)**

1. a) Define linear programming problem.
- b) What is unbalanced assignment ?
- c) What is group replacement ?
- d) What are the significance of VAM ?
- e) Define critical path.
- f) What is simulation ?
- g) What do you mean by degeneracy ?
- h) Mention the assumptions of EOQ model.

**SECTION – B**

Answer **any three** questions. **Each** question carries **8** marks.

**(3x8=24)**

2. "Operation research replaces management by personality". Discuss.
3. What is sequencing problem ? Give its essential characteristics.
4. A company for one of the z-class items, placed 10 orders each of size 300 in a year. Given ordering cost Rs. 750, holding cost 45%, cost per unit Rs. 35. Find out the loss to the company in not operating scientific inventory policy.

P.T.O.



5. There are 6 jobs each of which must go through machines A, B and C in the order ABC processing time (in hours) given in the following table.

| Job \ Machine | 1 | 2 | 3 | 4  | 5  | 6 |
|---------------|---|---|---|----|----|---|
| A             | 8 | 3 | 7 | 10 | 5  | 4 |
| B             | 6 | 4 | 8 | 2  | 1  | 7 |
| C             | 8 | 7 | 6 | 9  | 10 | 9 |

Determine the optimal sequence and total elapsed time.

6. Solve the problem of assignment for the given table to maximise the sales.

|      |   | Machines |    |    |    |    |
|------|---|----------|----|----|----|----|
|      |   | A        | B  | C  | D  | E  |
| Jobs | 1 | 32       | 38 | 40 | 28 | 40 |
|      | 2 | 40       | 24 | 28 | 21 | 36 |
|      | 3 | 41       | 27 | 33 | 30 | 37 |
|      | 4 | 22       | 38 | 41 | 36 | 36 |
|      | 5 | 29       | 33 | 40 | 35 | 39 |

#### SECTION - C

Answer any two of the following :

(2x12=24)

7. Explain the different models of O.R. How are these models useful in day to day operation ?
8. Use the simplex method to solve the following L.P.P.

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

$$\text{S.T. } 2x_1 + 3x_2 \leq 8$$

$$2x_2 + 5x_3 \leq 10$$

$$3x_1 + 2x_2 + 4x_3 \leq 15$$

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



9. Simulation of demand forecasting.

A dealer sells a particular model of washing machine for which the probability distribution of daily demand is as given below.

**Demand/Week :** 20 30 35 40 45 50

**Probability :** 0.05 0.25 0.20 0.25 0.10 0.15

Find average demand of washing machine for 10 weeks. Random numbers for 10 weeks are given below.

89 34 78 63 61 81 39 16 13 73.

SECTION - D

10. Case study **compulsory** :

(1×15=15)

Below given table has a list of activities and time estimates.

| Activity | Predecessor Activity | $t_o$ | $t_m$ | $t_p$ |
|----------|----------------------|-------|-------|-------|
| A        | -                    | 2     | 4     | 10    |
| B        | -                    | 3     | 4     | 5     |
| C        | A                    | 1     | 2     | 3     |
| D        | A                    | 4     | 6     | 14    |
| E        | B                    | 4     | 5     | 12    |
| F        | C                    | 3     | 4     | 6     |
| G        | D, E                 | 1     | 1     | 8     |

- 1) Construct a PERT network and determine the critical path.
- 2) What is the probability that the project shall be complete within a period of 15 weeks ?
- 3) What is the probability that the project is completed within 10 and 18 weeks ?



PG – 948

**II Semester M.B.A. Degree Examination, July 2016  
(2007-08 Scheme)  
Management**

**2.6 : QUANTITATIVE METHODS AND OPERATIONS RESEARCH**

Time : 3 Hours

Max. Marks : 75

**SECTION – A**

1. Answer **any six** questions. **Each** question carries **two** marks. **(2×6=12)**
- What is objective function ?
  - What is unbalanced assignment model ?
  - Mention the assumptions made in sequencing problem.
  - Distinguish between pure and mixed strategies.
  - State any four limitations of operation research.
  - What are the important techniques used in operation research ?
  - Distinguish between initial feasible solution and feasible solution in the context of transportation problem.
  - What are the assumptions of EOQ model ?

**SECTION – B**

Answer **any three** of the following. **Each** question carries **eight** marks. **(3×8=24)**

- What is simulation ? What are the advantages and limitations of simulation ? Also specify the areas where simulations can be used.
- Explain the following terms :
  - Balking
  - Traffic intensity
  - Saddle point
  - Replacement model.

P.T.O.



4. The following information is provided :

Annual usage is 30000 units, ordering cost are Rs. 150 per order, carrying cost are 22% price of each item is Rs. 22, lead time is 10 days. There are 250 working days per year. Determine the EOQ and orders per year. In the past two years, the usage rate has gone as high as 150 units per day for a recording system, based on inventory level. What safety stock is required to protect against this higher usage rate ? What should be the reorder point at this safety stock level ?

5. Determine the optimal sequence of jobs that minimizes total elapsed time. Jobs are to be processed on three machines  $M_1$ ,  $M_2$  and  $M_3$  in the order  $M_1 M_3 M_2$  (time in hrs.)

| Job   | A | B | C | D  | E | F | G  |
|-------|---|---|---|----|---|---|----|
| $M_1$ | 3 | 8 | 7 | 4  | 9 | 8 | 7  |
| $M_2$ | 4 | 3 | 2 | 5  | 1 | 4 | 3  |
| $M_3$ | 6 | 7 | 5 | 11 | 5 | 6 | 12 |

6. Suggest optimum assignment to sales territories, where the estimates of sales to be made by each salesman in different territories are given below :

|          |   | Territories |    |     |    |    |
|----------|---|-------------|----|-----|----|----|
|          |   | I           | II | III | IV | V  |
| Salesman | A | 10          | 15 | 17  | 14 | 14 |
|          | B | 6           | 18 | 10  | 12 | 16 |
|          | C | 12          | 5  | 13  | 13 | 6  |
|          | D | 8           | 11 | 16  | 10 | 12 |

If salesman B cannot be assigned to territory II for certain reasons, will the optimum assignment change. If so, what will be the new assignment schedule and the total sales ?



SECTION – C

Answer **any two** of the following questions. **Each** question carries **twelve** marks.  
(2×12=24)

- 7. In constructing any OR model, it is essential to realize that the most important purpose of the modelling process is 'to help manager better', keeping this purpose in mind, state the OR models that can be of help to chartered accountants in advising their clients.
- 8. Solve the following transportation problem for maximum profit :

**Per unit profit (Rs.)**

| Warehouse | A  | B  | C  | D  |
|-----------|----|----|----|----|
| X         | 12 | 18 | 6  | 25 |
| Y         | 8  | 7  | 10 | 18 |
| Z         | 14 | 3  | 11 | 20 |

| Availability at warehouses (units) | X   | Y   | Z   |
|------------------------------------|-----|-----|-----|
|                                    | 200 | 500 | 300 |

| Demand in the market (units) | A   | B   | C   | D   |
|------------------------------|-----|-----|-----|-----|
|                              | 180 | 320 | 100 | 400 |

- 9. A project consists of the following activity and different time estimates :

| Activity | $t_o$ | $t_m$ | $t_p$ |
|----------|-------|-------|-------|
| 1-2      | 3     | 6     | 15    |
| 1-3      | 2     | 5     | 14    |
| 1-4      | 6     | 12    | 30    |
| 2-5      | 2     | 5     | 8     |
| 2-6      | 5     | 11    | 17    |
| 3-6      | 3     | 6     | 15    |
| 4-7      | 3     | 9     | 27    |
| 5-7      | 1     | 4     | 7     |
| 6-7      | 2     | 5     | 8     |

- a) Draw a network.
- b) Determine the critical path and their variances.
- c) Find the earliest and latest expected times to reach each node.
- d) What is the probability that the project will be completed by 27<sup>th</sup> day ?



## SECTION - D

## 10. Compulsory (Case Study) :

(15x1=15)

A company manufactures 3 type of parts which use precious metals platinum and gold. Due to shortage of these precious metals, the government regulates the amount that may be used per day. The relevant data with respect to supply requirements and profit are summarised in the table shown below :

| Product | Platinum<br>per unit (gm) | Gold<br>per unit (gm) | Profit<br>per unit (Rs.) |
|---------|---------------------------|-----------------------|--------------------------|
| A       | 2                         | 3                     | 500                      |
| B       | 4                         | 2                     | 600                      |
| C       | 6                         | 4                     | 1200                     |

Daily allotments of platinum and gold are 160 gm and 120 gm respectively. How should the company decide the supply of scarce precious metals ? What is the optimum profit ? Solve by simplex method.

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