

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE

(UGC-AUTONOMOUS)

MCA(2Yrs) I Year II Semester (R16) Supplementary End Semester Examinations – Dec' 2019

(Regulations: R16)

OPERATIONS RESEARCH

Time: 3Hrs

Max Marks: 50

Attempt all the questions. All parts of the question must be answered in one place only.

In Q.no 1 to 5 answer either Part-A or B only

- Q.1(A) A company sells two different products A and B making a profit of Rs. 40 and Rs. 30 per unit respectively. They are both produce with the help of a common production process and are sold in two different markets. The production process has a total capacity of 30,000 man-hours. It takes 3 hours to produce a unit of A and one hour to produce a unit of B. The market has been surveyed and company officials feel that the maximum number of units of A that can be sold is 8,000 units and that of B is 12,000 units. Subject to these limitations, formulate LP model and determine the optimal product mix that maximizes the profit using Graphical method. 10M

OR

- Q.1(B) Solve the following LPP by using Simplex method 10M
Max. $Z = 5x_1 + 7x_2$
Subject to constraints $x_1 + x_2 \leq 4$, $3x_1 + 8x_2 \leq 24$, $10x_1 + 7x_2 \leq 35$, and $x_1, x_2 \geq 0$

- Q.2(A) A manufacturer wants to ship 22 loads of his product as shown below. The matrix gives the kilometers from source to destinations. 10M

| | D_1 | D_2 | D_3 | D_4 | D_5 | Supply |
|--------|-------|-------|-------|-------|-------|--------|
| S_1 | 5 | 8 | 6 | 6 | 3 | 8 |
| S_2 | 4 | 7 | 7 | 6 | 5 | 5 |
| S_3 | 8 | 4 | 6 | 6 | 4 | 9 |
| Demand | 4 | 4 | 5 | 4 | 8 | |

The shipping cost is Rs. 10 per load per kilometer. What is shipping schedule should be used in order to minimize the total transportation cost?

OR

- Q.2(B) What are the differences between assignment and transportation problems and also explain the Hungarian method. 10M

- Q.3(A) Briefly explain the following terms:

- (i) Payoff matrix (ii) two person zero sum game (iii) Saddle point 10M
(iv) maximini and (v) Dominance rule

OR

- Q.3(B) Determine a sequence of the jobs that minimizes the total elapsed time required to complete all jobs on machines M_1 , M_2 and M_3 in the order M_1 - M_2 - M_3 . 10M

| Job | 1 | 2 | 3 | 4 | 5 | 6 |
|-------|---|---|---|---|----|---|
| M_1 | 8 | 3 | 7 | 2 | 5 | 1 |
| M_2 | 3 | 4 | 5 | 2 | 1 | 6 |
| M_3 | 8 | 7 | 6 | 9 | 10 | 9 |

Q.4(A) What is Simulation? Explain the types of simulation used in OR with examples. 10M

OR

Q.4(B) The following mortality rates have been observed for a certain type of fuse: 10M

| | | | | | |
|-------------------------------|---|----|----|----|-----|
| Week | 1 | 2 | 3 | 4 | 5 |
| % fail by the end of the week | 5 | 15 | 35 | 57 | 100 |

There are 1000 fuses in use and it costs Rs 5 to replace an individual fuse. If all fuses were replaced simultaneously it would cost Rs 1.25 per fuse. It is proposed to replace all fuses at fixed intervals of time, whether or not they have burnt out, and to continue replacing burnt out fuses as they fail. At what time intervals should the group replacement be made? Also prove that this optimum policy is superior to the straight forward policy of replacing each fuse only when it fails.

Q.5(A) Consider the following details of a project, 10M

| Activity | Predecessor | Duration | | |
|----------|-------------|------------|-------------|-------------|
| | | Optimistic | Most likely | Pessimistic |
| A | - | 6 | 7 | 8 |
| B | - | 1 | 2 | 9 |
| C | - | 1 | 4 | 7 |
| D | A | 1 | 2 | 3 |
| E | A, B | 1 | 2 | 9 |
| F | C | 1 | 5 | 9 |
| G | C | 2 | 2 | 8 |
| H | E, F | 4 | 4 | 4 |
| I | E, F | 4 | 4 | 10 |
| J | D, H | 2 | 5 | 14 |
| K | I, G | 2 | 2 | 8 |

(i) Construct the network, (ii) determine the critical path and expected project completion time and (iii) find the probability of completing the project on or before 25 weeks.

OR

Q.5(B) Workers come to a tool store room to enquire about the special tools required by them. The average time between the arrivals is 60 seconds and the arrivals are distributed in Poisson fashion. The average service time is 40 seconds. Determine 10M

- (i) Average queue length.
- (ii) Average length of non-empty queue.
- (iii) Average number of workers in the system including the workers being attended.
- (iv) Mean waiting time of an arrival.

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