S. NO.: 463 BATCH: 97-2015 Reg. No.: 12

**END OF SEMESTER EXAMINATIONS, NOVEMBER - 2017**
**OPERATIONS RESEARCH**
**SUBJECT CODE : 08UAMA08**

**MAJOR : B.Sc (MATHEMATICS)** **SEMESTER : IV**
**TIME : 3 HOURS** **MAX. MARKS: 75**

## SECTION A – ( 5 X 2 = 10 )

**Answer All the Questions:**

1. Define Linear Programming Problem.

**[OR]**

2. Define optimum solution.
3. Form the dual to the linear programming problem.
   Minimize $Z = 10x_1 + 6x_2 + 2x_3$
   Subject to the constraints:
   $-x_1 + 5x_2 + x_3 \geq 1$
   $3x_1 + x_2 - x_3 \geq 2$
   $x_1, x_2, x_3 \geq 0$

**[OR]**

4. Define Dual problem.
5. Define Transportation problem.

**[OR]**

6. Define unbalanced Transportation problem.
7. Define the problem of sequencing.

**[OR]**

8. What are the types of sequencing problem?
9. What is a critical path?

**[OR]**

10. What are the time estimations in a PERT?

## SECTION B – ( 5 X 4 = 20 )

**Answer All the Questions:**

11. Solve the following L.P.P by Graphical method.
    Maximize $Z = 20x_1 + 30x_2$
    Subject to the constraints:
    $3x_1 + 3x_2 \leq 36$
    $5x_1 + 2x_2 \leq 50$
    $2x_1 + 6x_2 \leq 60$
    $x_1, x_2 \geq 0$

**[OR]**

12. A Company makes two kinds of leather belts. Belt A is a high quality belt and belt B is a lower quality. The respective profits are Rs. 4.00 & Rs. 3.00 per belt. Each belt of type A requires twice as much time as a belt of type B and if all belts were of type B, the company could make 1000 per day. The supply of leather is sufficient for only 800 belts per day (Both A & B combined). Belt A requires a fancy buckle and only 400 per day are available. There are only 700 buckles a day available for belt B. Determine the optimal product mix.
13. Explain duality Simplex Algorithm.

**[OR]**

14. Explain Formulation of a dual problem.
15. Explain Vogel's Approximation method.

**[OR]**

16. Use North West Corner method to obtain initial basic feasible solution of the transportation problem.

| | D | E | F | G | Available |
|---|---|---|---|---|---|
| A | 11 | 13 | 17 | 14 | 250 |
| B | 16 | 18 | 14 | 10 | 300 |
| C | 21 | 24 | 13 | 10 | 400 |
| Demand | 200 | 225 | 275 | 250 | |

...2...

17. Six jobs go first over machine I & and then over machine II. The order of the completion of jobs has no significance. The following table gives the machine time in hours for six jobs and the two machines.

| Jobs No: | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Time on Machine I: | 5 | 9 | 4 | 7 | 8 | 6 |
| Time on Machine II: | 7 | 4 | 8 | 3 | 9 | 5 |

Find the sequence of jobs that minimizes the total elapsed time to complete the jobs.

**[OR]**

18. Explain 'n' jobs and m machines.
19. Construct the arrow diagram comprising activities A,B,... and L such that the following relationship are satisfied.
    - i) A,B and C the first activities of the project, can start simultaneously.
    - ii) A and B precede D
    - iii) B precedes E, F and H
    - iv) F and C precede G
    - v) E and H precede I and J
    - vi) C,D,F and J precede K
    - vii) K precede L
    - viii) I,G and L are the terminal activities of the project.

**[OR]**

20. Explain Critical path method.

**SECTION C – ( 5 X 9 = 45 )**

**Answer All the Questions:**

21. Use Simplex method to solve the following L.P.P.

Maximize $Z = x_1 + 2x_2$

Subject to constraints:

$$-x_1 + 2x_2 \le 8$$
$$x_1 + 2x_2 \le 12$$
$$x_1 - 2x_2 \le 3$$
$$x_1, x_2 \ge 0$$

**[OR]**

22. Solve the following L.P.P by Big 'M' Method.

Minimize $Z = 4x_1 + 3x_2$

Subject to the constraints:

$$2x_1 + x_2 \ge 10$$
$$-3x_1 + 2x_2 \le 6$$
$$x_1 + x_2 \ge 6$$
$$x_1, x_2 \ge 0$$

23. Explain Dual Simplex Algorithm.

**[OR]**

24. Use duality to solve the following L.P.P.

Maximize $Z = 2x_1 + x_2$

Subject to the constraints:

$$x_1 + 2x_2 \le 10$$
$$x_1 + x_2 \le 6$$
$$x_1 - x_2 \le 2$$
$$x_1 - 2x_2 \le 1,$$
$$x_1, x_2 \ge 0$$

25. Obtain an optimum basic feasible solution to the following Transportation problem.

| | *A* | *B* | *C* | *D* | *Supply* |
|---|---|---|---|---|---|
| *E* | 19 | 30 | 50 | 10 | 7 |
| *F* | 70 | 30 | 40 | 60 | 9 |
| *G* | 40 | 8 | 70 | 20 | 18 |
| *Demand* | 5 | 8 | 7 | 14 | |

**[OR]**

26. Solve the following Assignment problem to find maximum total expected sale.

| | Area | I | II | III | IV | V |
|---|---|---|---|---|---|---|
| | A | 32 | 38 | 40 | 28 | 40 |
| | B | 40 | 24 | 28 | 21 | 36 |
| Sasesman | C | 41 | 27 | 33 | 30 | 37 |
| | D | 22 | 38 | 41 | 36 | 36 |
| | E | 29 | 33 | 40 | 35 | 39 |

27. We have 4 jobs each of which has to go through the machines $M_j$. $j = 1, 2....6$ in the order $M_1, M_2....., M_6$ processing time (in hours) is given below.

| | Machines | | | | | |
|---|---|---|---|---|---|---|
| | $M_1$ | $M_2$ | $M_3$ | $M_4$ | $M_5$ | $M_6$ |
| job A | 18 | 8 | 7 | 2 | 10 | 25 |
| job B | 17 | 6 | 9 | 6 | 8 | 19 |
| job C | 11 | 5 | 8 | 5 | 7 | 15 |
| job D | 20 | 4 | 3 | 4 | 8 | 12 |

Determine a sequence of these four jobs that minimizes the total elapsed time T.

**[OR]**

28. Use Graphical method to find the minimum elapsed total time sequence of 2 jobs and 5 machines, when we are given the following information?

| | machines | | | | | |
|---|---|---|---|---|---|---|
| Job I | Sequence | A | B | C | D | E |
| | Time | 2 | 3 | 4 | 6 | 2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Job II | Sequence | C | A | D | E | B |
| | Time | 4 | 5 | 3 | 2 | 6 |

29. A project consists of a series of tasks labelled A,B,….. H,I with the following relationships (W<X, Y means X and Y cannot start until W is completed. X,Y<W means W cannot start until both X and Y are completed) with this notation construct the network diagram having the following constraints:

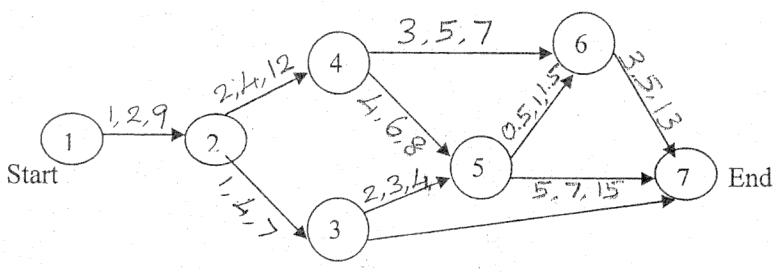
$A < D, E$; $B, D < F$; $C < G$; $B < H$; $F, G < I$

find also the minimum time of completion of the project, when the time (in days) of completion of each task is as follows.

| Task | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| Time | 23 | 8 | 20 | 16 | 24 | 18 | 19 | 4 | 10 |

**[OR]**

30. Consider the network shown in the figure given below. The estimates of $t_o$, $t_m$ and $t_p$ are shown in this order for each of the activities on the top of the arcs denoting the respective activities.




Find the probability of completing the project in 25 days.

*********