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**M.C.A. DEGREE EXAMINATIONS: APRIL / MAY 2009**

Fourth Semester

**P07CA402 RESOURCE MANAGEMENT TECHNIQUES**

**Time: Three Hours** **Maximum Marks: 100**

(Statistics Tables are permitted)

**Answer ALL the Questions:-**

**PART A (20 x 1 = 20 Marks)**

1. Given Max $Z = 3\,x_1 + 2\,x_2$ subject to

$$-2\,x_1 + x_2 \leq 1$$
$$x_1 \leq 2$$
$$x_1 + x_2 \leq 3, \quad x_1, x_2 \geq 0$$

The solution of the LPP is

a) $x_1 = 2$ $x_2 = 1$ b) $x_1 = -1$ $x_2 = 1$

c) $x_1 = -2$ $x_2 = 1$ d) $x_1 = 2$ $x_2 = -1$

2. The constraint involving '≤' sign are reduced to equations by adding _____

a) Surplus variable b) Slack variable

c) Artificial d) degenerate

3. Express the following LPP in standard form:

Min $Z = 2\,x_1 + x_2$ subject to

$x_1 + 2\,x_2 \leq 4$; $x_1 + x_2 \geq -2$; $3\,x_1 + 5\,x_2 \leq 3$

a) Max $Z = -2\,x_1 - x_2$

$x_1 + 2\,x_2 + s_1 = 4$

$-x_1 - x_2 + s_2 = 2$

$3\,x_1 + 5\,x_2 + s_3 = 3$

b) Max $Z = 2\,x_1 - x_2$

$x_1 + 2\,x_2 - s_1 = 4$

$-x_1 - x_2 + s_2 = 2$

$3x_1 + 5\,x_2 + s_3 = 3$

c) Max $Z = 2\,x_1 - x_2$

$x_1 - 2\,x_2 + s_1 = 4$

$-x_1 - x_2 + s_2 = 2$

$3\,x_1 - 5\,x_2 + s_3 = 3$

d) Max $Z = 2\,x_1 + x_2$

$x_1 + 2\,x_2 + s_1 = 4$

$x_1 + x_2 + s_2 = 2$

$3\,x_1 + 5\,x_2 + s_3 = 3$

4. Express the following LPP in canonical form:

Min $Z = 2x_1 + x_2$ subject to

$$x_1 + x_2 \leq 1$$
$$2x_1 + 3\,x_2 = 4$$
$$x_1, x_2 \geq 0.$$

a) Max $Z = -2x_1 - x_2$

$x_1 + x_2 \leq 1$

$2x_1 + 3x_2 \leq -4$

$x_1, x_2 \geq 0$

b) Max $Z = -2x_1 - x_2$

$x_1 - x_2 \leq 1$

$2x_1 + 3x_2 \leq -4$

$x_1, x_2 \geq 0$

c) Max $Z = -2x_1 - x_2$

$x_1 + x_2 \leq 1$

$2x_1 + 3x_2 \leq 4$

$-2x_1 - 3x_2 \leq -4$

$x_1, x_2 \geq 0$

d) Max $Z = -2x_1 - x_2$

$x_1 - x_2 \leq 1$

$2x_1 - 3x_2 \leq -4$

$x_1, x_2 \geq 0$

5. Row wise and column wise difference between two minimum costs is calculated under _____ method

a) NWC method b) Vogel's approximation method

c) MODI method d) Matrix method

6. The number of non – basic variables in the balanced transportation problem with m – rows and n – columns is _____

a) m + n -1 b) m – (m+ n-1) c) mn – (m+n – 1) d) m+n - mn

7. Consider the problem of assigning five jobs to five persons. The assignment costs are given as follow

| | | *Job* | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| *Person* | *A* | 8 | 4 | 2 | 6 | 1 |
| | *B* | 0 | 9 | 5 | 5 | 4 |
| | *C* | 3 | 8 | 9 | 2 | 6 |
| | *D* | 4 | 3 | 1 | 0 | 3 |
| | *E* | 9 | 5 | 8 | 9 | 5 |

The optimum assignment schedule is

a) 7 units b) 10 units c) 5 units d) 9 units

8. The initial basic feasible solution for the following transportation problem by least cost method.

| | | To | | | | Supply |
|---|---|---|---|---|---|---|
| From | | 1 | 2 | 1 | 4 | 30 |
| | | 3 | 3 | 2 | 1 | 50 |
| | | 4 | 2 | 5 | 9 | 20 |
| Demand | | 20 | 40 | 30 | 10 | |

a) Rs 180 b) Rs 150 c) Rs 120 d) Rs 170

9. In PERT analysis the variance of a job having optimistic time 5, most likely time 8 and pessimistic time 17 is_____.

a) 2 b) 6 c) 5 d) 4

10. If the standard deviation of the critical activities in a project are 2, 3 and 6 the standard deviation of the critical path is _____

a) 7 b) 5 c) 6 d) 3

11. Express the expected duration of an activity of a project in terms of $t_0$ , $t_m$ and $t_p$ is

a) $t_e = \left(\frac{t_0 + 4t_m - t_p}{6}\right)$ b) $t_e = \left(\frac{t_0 + 4t_m + t_p}{6}\right)$

c) $t_e = \left(\frac{t_0 - 4t_m + t_p}{6}\right)$ d) $t_e = \left(\frac{t_0 - 4t_m - t_p}{6}\right)$

12. In critical activities, the total float is

a) equal b) one c) non zero d) zero

13. Given the numbers 2,6,1,5,3,7,2; write down the weighted moving average of period 3, the weights being 1, 4, 1 is;

a)4.5, 2.5, 4 b)5, 2, 3 c) 3, 5.5, 6 d)4.5, 2.5, 5.5

14. The values of two constants 'a' and 'b' are estimated by solving the following two normal equations are

a) $\Sigma Y = Na - b\Sigma X$, $\Sigma XY = a\Sigma X + b\Sigma X^2$

b) $\Sigma Y = Na + b\Sigma X$, $\Sigma XY = a\Sigma X + b\Sigma X^2$

c) $\Sigma Y = Na + b\Sigma X$, $\Sigma XY = a\Sigma X - b\Sigma X^2$

d) $\Sigma Y = Na + b\Sigma X$, $\Sigma X = a\Sigma X + b\Sigma X^2$

15. Link Relatives (L.R) = _____

a) $\frac{\text{Current Season's figure}}{\text{Previous season's figures}}$ X 200

b) $\frac{\text{Current Season's figure}}{\text{Previous season's figures}}$ X 100

c) $\frac{\text{Previous season's figures}}{\text{Current Season's figure}}$ X 100

d) $\frac{\text{Current Season's figure}}{\text{Previous season's figures}}$ X 400

16. Seasonal indices = _____

a) $\frac{\text{Monthly Average}}{\text{Average of monthly averages}}$ X 200

b) $\frac{\text{Monthly Average}}{\text{Average of monthly averages}}$ X 100

c) $\frac{\text{Average of monthly averages}}{\text{Monthly Average}}$ X 100

d) $\frac{\text{Monthly Average}}{\text{Average of monthly averages}}$ X 400

17. Laspeyres method = _____

a) $P_{01} = \frac{\Sigma P_1 q_0}{\Sigma p_0 q_0} \times 200$ b) $P_{01} = \frac{\Sigma p_0 q_0}{\Sigma P_1 q_0} \times 100$

c) $P_{01} = \frac{\Sigma P_1 q_0}{\Sigma p_0 q_0} \times 100$ d) $P_{01} = \frac{\Sigma P_1 q_0}{\Sigma p_0 q_0} \times 150$

18. Simple aggregative Index = _____

a) $P_0 = \frac{\Sigma P_1}{\Sigma p_0} \times 200$ b) $P_0 = \frac{\Sigma P_1}{\Sigma p_0}$

c) $P_0 = \frac{\Sigma p_0}{\Sigma P_1} \times 100$ d) $P_0 = \frac{\Sigma P_1}{\Sigma p_0} x100$

19. Weighted average of price Relative method = _____

a) $P_{01} = \frac{\Sigma pv}{\Sigma v}$ b) $P_{01} = \frac{\Sigma pv}{\Sigma v}$

c) $P_{01} = \frac{\Sigma v}{\Sigma pv}$ d) $P_{01} = \frac{\Sigma v}{\Sigma pv}$

20. Marshall – Edgeworth's Index = _____

a) $P_{01} = \frac{\Sigma P_1 (q_0 + q_1)}{\Sigma p_0 q_1} \times 200$ b) $p_{01} = \frac{\Sigma P_1 (q_0 + q_1)}{\Sigma p_0 q_1} \times 100$

c) $P_{01} = \frac{\Sigma P_1 (q_0 - q_1)}{\Sigma p_0 q_1} \times 100$ d) $P_{01} = \frac{\Sigma P_1 (q_0 + q_1)}{\Sigma p_0 (q_0 + q_1)} \times 100$

**PART B (5 x 16 = 80 Marks)**

21. a) Find the non – negative values of $x_1$ $x_2$ and $x_3$ which (16)

Maximize $Z = 3x_1 + 2x_2 + 5x_3$ subject to

$$x_1 + 4x_2 \leq 420$$
$$3x_1 + 2x_3 \leq 460$$
$$x_1 + 2x_2 + x_3 \leq 430, \quad x_1, x_2, x_3 \geq 0$$

**(OR)**

b) Use penalty method to Minimize $Z = 4x_1 + x_2$ subject to (16)

$$3x_1 + x_2 = 3$$
$$4x_1 + 3x_2 \geq 6$$
$$x_1 + 2x_2 \leq 3, \quad x_1, x_2 \geq 0$$

22. a) Suggest the optimal solution to the following assignment problem and also the minimum cost. (16)

Job

| Workers | I | II | III | IV |
|---|---|---|---|---|
| A | 24 | 27 | 18 | 20 |
| B | 26 | 23 | 20 | 31 |
| C | 24 | 22 | 34 | 26 |
| D | 19 | 21 | 21 | 22 |
| E | 30 | 25 | 28 | 27 |

**(OR)**

b) Solve the following transportation problem to maximize profit (16)

Profits (Rs)/Unit

Destination

| Source | A | B | C | D | Supply |
|---|---|---|---|---|---|
| 1 | 40 | 25 | 22 | 33 | 100 |
| 2 | 44 | 35 | 30 | 30 | 30 |
| 3 | 38 | 38 | 28 | 30 | 70 |
| Demand | 40 | 20 | 60 | 30 | |

23. a) The following table shows the jobs of a network along with their time estimates.

| Job | 1 – 2 | 1 – 6 | 2 – 3 | 2 – 4 | 3 – 5 | 4 – 5 | 6 – 7 | 5 – 8 | 7 – 8 |
|---|---|---|---|---|---|---|---|---|---|
| $t_0$(days) | 1 | 2 | 2 | 2 | 7 | 5 | 5 | 3 | 8 |
| $t_m$ (days) | 7 | 5 | 14 | 5 | 10 | 5 | 8 | 3 | 17 |
| $t_p$ (days) | 13 | 14 | 26 | 8 | 19 | 17 | 29 | 9 | 32 |

(i) Draw the project network

(16) (ii) Calculate the project length

(iii) Find the probability that the project is completed in 40 days and 35 days.

(iv) Find the earliest and latest event times for all the activities

(v) Find the expected variance of the project length (16)

**(OR)**

b). Construct a network for the project whose activities and their precedence relationship are given below:

(16) A – Initial activity A < B, C, D; B < E; C < F; D <G; E < F; F < G and G – Terminal activity

| Activity | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| Time in Days | 3 | 6 | 16 | 10 | 8 | 5 | 3 |

Also compute

(i) The earliest event time and latest event time.

(ii) The total project duration and the critical path.

(iii) Total, free and independent float for each activity. (16)

24. a).From the following data calculate seasonal indices by the ratio to Moving average method.

| Year | 1st Quarter | 2nd Quarter | 3rd Quarter | 4th Quarter |
|---|---|---|---|---|
| 1981 | 68 | 62 | 61 | 63 |
| 1982 | 65 | 58 | 56 | 61 |
| 1983 | 68 | 63 | 63 | 67 |
| 1984 | 70 | 59 | 56 | 62 |
| 1985 | 60 | 55 | 51 | 58 |

**(OR)**

b) i). Fit a straight line trend equation by the method of least squares and estimate the trend values. (8)

| Year: | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 |
|---|---|---|---|---|---|---|---|---|
| Values: | 80 | 90 | 92 | 83 | 94 | 99 | 92 | 104 |

ii). Explain the components of time series. (8)

25 a). Construct index numbers of price from the following data.

(i) Laspeyres method

(ii) Paasche method

(iii) Fisher's Index method

(iv) Marshall – Edgeworth method

| Commodity | 1994 | | 1995 | |
|---|---|---|---|---|
| | Price | Quantity | Price | Quantity |
| A | 2 | 8 | 4 | 6 |
| B | 5 | 10 | 6 | 5 |
| C | 4 | 14 | 5 | 10 |
| D | 2 | 19 | 2 | 13 |

(16)

**(OR)**

b i) What are the uses of Index numbers? (8)

ii) For the data given below, calculate the Index numbers by taking

(1) 1979 as the base year

(2) 1986 as the base year (8)

| Year | Price of commodity |
|---|---|
| 1979 | 4 |
| 1980 | 5 |
| 1981 | 6 |
| 1982 | 7 |
| 1983 | 8 |
| 1984 | 10 |
| 1985 | 9 |
| 1986 | 10 |
| 1987 | 11 |

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