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22STU518N

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 2026
(Fifth Semester)

Branch - **STATISTICS**

OPERATIONS RESEARCH

Time: Three Hours Maximum: 75 Marks

SECTION-A (10 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** marks (10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	The feasible region for an LPP defined by linear inequalities is represented geometrically as: a) Circle b) Polygon c) Parabola d) Hyperbola	K1	CO1
	2	In simplex tableau, the entering variable is the one which: a) Has the smallest positive coefficient in the objective row b) Has the largest positive coefficient in the objective row c) Has the smallest negative coefficient in the objective row (for maximization) d) Has the largest negative coefficient in the objective row (for maximization)	K2	CO1
2	3	In a transportation table with m origins and n destinations, the number of basic variables in a feasible solution is a) $m + n$ b) $m + n - 1$ c) $m \times n$ d) $m \times n - 1$	K1	CO2
	4	In Vogel's Approximation Method, the penalty for a row or column is a) The sum of all costs in that row or column b) The difference between the lowest and next lowest cost in that row or column c) The highest cost in that row or column d) The lowest cost in that row or column	K2	CO1
3	5	In a sequencing problem, the main objective is to a) Determine the best order of performing jobs to minimize total elapsed time b) Assign jobs to machines c) Find the shortest path d) Determine inventory levels	K1	CO1
	6	The Hungarian method is used to solve a) Transportation problems b) Assignment problems c) Sequencing problems d) Travelling salesman problems	K2	CO1
4	7	In a saddle point, the value of the game is: a) Minimum of row maxima = Maximum of column minima b) Maximum of row minima = Minimum of column maxima c) Average of all payoffs d) Equal to zero	K1	CO2
	8	The dominance property in game theory is used to: a) Find the saddle point directly b) Eliminate inferior strategies c) Determine payoffs d) Increase the value of the game	K2	CO1
5	9	Slack or float in a network represents a) Delay allowed without affecting total project duration b) Extra cost incurred c) Time saved on an activity d) Duration of critical activities	K1	CO1
	10	Dummy activities in a network are used to a) Represent real work and consume time b) Maintain logical relationships between activities c) Increase total duration d) Represent slack time	K2	CO2

Cont...

SECTION - B (35 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 × 7 = 35)

<table>
<tr><th>Module No.</th><th>Question No.</th><th>Question</th><th>K Level</th><th>CO</th></tr>
<tr><td rowspan="3">1</td><td>11.a.</td><td>A nutritionist must prepare a daily diet containing at least 50 g protein, 60 g carbohydrates and 20 g fat. Three foods are available: Food A (per 100 g: 10 g protein, 20 g carbs, 5 g fat) costing ₹30; Food B (per 100 g: 5 g protein, 25 g carbs, 10 g fat) costing ₹25; Food C (per 100 g: 15 g protein, 10 g carbs, 2 g fat) costing ₹40. Determine the quantities of each food (in 100 g units) to meet the nutrient requirements at minimum cost. Formulate the LPP.</td><td rowspan="3">K2</td><td rowspan="3">CO3</td></tr>
<tr><td colspan="2">(OR)</td></tr>
<tr><td>11.b.</td><td>Describe simplex method to solve the LPP.</td></tr>
<tr><td rowspan="3">2</td><td>12.a.</td><td>Explain the procedure of Vogel's approximation method.</td><td rowspan="3">K3</td><td rowspan="3">CO3</td></tr>
<tr><td colspan="2">(OR)</td></tr>
<tr><td>12.b.</td><td><table><tr><th></th><th>D1</th><th>D2</th><th>D3</th><th>D4</th><th>Supply</th></tr><tr><td>S1</td><td>3</td><td>5</td><td>2</td><td>7</td><td>90</td></tr><tr><td>S2</td><td>4</td><td>1</td><td>3</td><td>6</td><td>140</td></tr><tr><td>S3</td><td>8</td><td>6</td><td>4</td><td>2</td><td>120</td></tr><tr><td>S4</td><td>5</td><td>9</td><td>7</td><td>3</td><td>100</td></tr><tr><td>Demand</td><td>110</td><td>120</td><td>150</td><td>70</td><td></td></tr></table>Solve by least cost method.</td></tr>
<tr><td rowspan="3">3</td><td>13.a.</td><td>Explain the sequential problem of n jobs 2 machines.</td><td rowspan="3">K3</td><td rowspan="3">CO3</td></tr>
<tr><td colspan="2">(OR)</td></tr>
<tr><td>13.b.</td><td>Solve the following assignment problem.<table><tr><th></th><th>J1</th><th>J2</th><th>J3</th><th>J4</th></tr><tr><td>W1</td><td>4</td><td>1</td><td>3</td><td>2</td></tr><tr><td>W2</td><td>2</td><td>0</td><td>5</td><td>3</td></tr><tr><td>W3</td><td>3</td><td>2</td><td>2</td><td>3</td></tr><tr><td>W4</td><td>4</td><td>3</td><td>1</td><td>2</td></tr></table></td></tr>
<tr><td rowspan="3">4</td><td>14.a.</td><td>Write a note on :
i) Two person zero - sum game ii) Pure Strategy
iii) Mixed Strategy iv) Saddle Point</td><td rowspan="3">K3</td><td rowspan="3">CO4</td></tr>
<tr><td colspan="2">(OR)</td></tr>
<tr><td>14.b.</td><td>Payoff matrix (Player A rows, Player B columns). A's payoffs (zero-sum):<table><tr><th></th><th>Column 1</th><th>Column 2</th></tr><tr><td>Row 1</td><td>3</td><td>1</td></tr><tr><td>Row 2</td><td>0</td><td>2</td></tr></table>Find optimal mixed strategies (graphical method) and value of the game.</td></tr>
<tr><td rowspan="3">5</td><td>15.a.</td><td>What is network analysis? Briefly explain
i) Optimistic Time
ii) Most Likely Time
iii) Pessimistic Time</td><td rowspan="3">K2</td><td rowspan="3">CO5</td></tr>
<tr><td colspan="2">(OR)</td></tr>
<tr><td>15.b.</td><td>Describe the procedure of CPM.</td></tr>
</table>

SECTION -C (30 Marks)

Answer **ANY THREE** questions

ALL questions carry **EQUAL** Marks (3 × 10 = 30)

<table>
<tr><th>Module No.</th><th>Question No.</th><th>Question</th><th>K Level</th><th>CO</th></tr>
<tr><td>1</td><td>16</td><td>What is LPP? Discuss its scope and limitations.</td><td>K2</td><td>CO1</td></tr>
<tr><td>2</td><td>17</td><td>A company has three factories F1, F2, F3 and three warehouses W1, W2, W3. The supply from factories is 20, 30, and 25 units respectively. The demand at warehouses is 10, 25, and 40 units respectively. The transportation cost per unit is given below:
<table><tr><th></th><th>W1</th><th>W2</th><th>W3</th><th>Supply</th></tr><tr><td>F1</td><td>8</td><td>6</td><td>10</td><td>20</td></tr><tr><td>F2</td><td>9</td><td>12</td><td>13</td><td>30</td></tr><tr><td>F3</td><td>14</td><td>9</td><td>16</td><td>25</td></tr><tr><td>Demand</td><td>10</td><td>25</td><td>40</td><td></td></tr></table>Use the MODI method to find the optimal solution for minimum transportation cost.</td><td>K3</td><td>CO2</td></tr>
<tr><td>3</td><td>18</td><td>Five jobs are to be processed through two machines M_1 and M_2 in the order $M_1 \rightarrow M_2$. The processing times(in hours) are given below:
<table><tr><td>Job</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>M_1</td><td>3</td><td>12</td><td>5</td><td>2</td><td>10</td></tr><tr><td>M_2</td><td>8</td><td>4</td><td>6</td><td>7</td><td>3</td></tr></table>i) Determine the optimal sequence of jobs
(ii) Find the minimum elapsed time
(iii) Calculate the idle time for each machine.</td><td>K3</td><td>CO3</td></tr>
<tr><td>4</td><td>19</td><td>Describe Minimax and Maxmin criterion in game theory.</td><td>K4</td><td>CO4</td></tr>
<tr><td>5</td><td>20</td><td>A project is represented by the network shown below and has the following data:
<table><tr><td>Task</td><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td><td>G</td><td>H</td><td>I</td></tr><tr><td>Least time</td><td>5</td><td>18</td><td>26</td><td>16</td><td>15</td><td>6</td><td>7</td><td>7</td><td>3</td></tr><tr><td>Greatest Time</td><td>10</td><td>22</td><td>40</td><td>20</td><td>25</td><td>12</td><td>12</td><td>9</td><td>5</td></tr><tr><td>Most Likely Time</td><td>8</td><td>20</td><td>33</td><td>18</td><td>20</td><td>9</td><td>10</td><td>8</td><td>4</td></tr></table>Determine
i) Expected task and their variances
ii) The earliest and latest expected time
iii) The critical path</td><td>K4</td><td>CO5</td></tr>
</table>

Z-Z-Z END