22MIB211N

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MCom(IB) DEGREE EXAMINATION DECEMBER 2025
(Second Semester)

Branch - **INTERNATIONAL BUSINESS**

BUSINESS STATISTICS AND OPTIMIZATION TECHNIQUES

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	Which measure is most affected by extreme values? a) Mean b) Median c) Mode d) Quartile	K1	CO1
	2	If all values in a data set increase by 5, which of the following is true about the standard deviation? a) Increases by 5 b) Decreases by 5 c) Remains unchanged d) Becomes zero	K2	CO1
2	3	The regression line of Y on X minimizes the sum of: a) products of deviations b) squares of horizontal deviations c) squares of vertical deviations d) absolute deviations	K1	CO2
	4	When the correlation coefficient between X and Y is negative, the regression slope of Y on X will: a) be negative b) be positive c) be zero d) be undefined	K2	CO2
3	5	When applying the F-test for the comparison of two variances, which of the following is true about the distribution of the test statistic under the null hypothesis? a) Normal distribution b) Positively skewed (right-skewed) distribution c) Uniform distribution d) Binomial distribution	K1	CO3
	6	In one-way ANOVA, which of the following best describes the null hypothesis? a) The two samples have equal means b) All group varainces means are equal c) All group means are equal d) The ratio of between-group to within-group variance is less than 1	K2	CO3
4	7	Which of the following methods is generally preferred for obtaining the initial feasible solution when minimum transportation cost is the priority? a) North West Corner Rule b) MODI Method c) Vogel's Approximation Method d) Least Cost Method	K1	CO4
	8	The Hungarian method is specifically designed to solve which type of problem? a) Transportation problem b) Linear programming problem c) Assignment problem d) Game theory problem	K2	CO4
5	9	The Expected Monetary Value (EMV) criterion is primarily used in decision making under: a) Certainty b) Risk c) Uncertainty d) Both risk and uncertainty	K1	CO5

Cont...

5	10	When constructing payoff matrices in game theory, the phrase 'zero sum' implies that: a) Players cooperate to maximize joint payoff b) The gain of one player exactly equals the loss of the other c) Both players get zero payoff in equilibrium d) Payoffs sum to zero across all strategies	K2	CO5

SECTION - B (35 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks $(5 \times 7 = 35)$

<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>Explain the difference between range and standard deviation. Calculate the range and standard deviation for the data: 3, 7, 10, 5, 8.</td><td rowspan="3">K2</td><td rowspan="3">CO1</td></tr>
<tr><td colspan="2">(OR)</td></tr>
<tr><td>11.b.</td><td>Define the measures of central tendency. Explain the conditions under which mean, median, and mode are appropriate measures to use.</td></tr>
<tr><td rowspan="3">2</td><td>12.a.</td><td>Interpret the meaning of a correlation coefficient of $r = -0.85$. What does it imply about the relationship between two variables?</td><td rowspan="3">K3</td><td rowspan="3">CO2</td></tr>
<tr><td colspan="2">(OR)</td></tr>
<tr><td>12.b.</td><td>Construct the regression coefficients b_{yx} and b_{xy} given the following summary statistics: $\bar{X} = 20, \bar{Y} = 30, SD_x = 5, SD_y = 10, r = 0.6$.</td></tr>
<tr><td rowspan="3">3</td><td>13.a.</td><td>Explain the concept of null and alternative hypothesis with examples.</td><td rowspan="3">K5</td><td rowspan="3">CO3</td></tr>
<tr><td colspan="2">(OR)</td></tr>
<tr><td>13.b.</td><td>Two samples of size 15 and 20 have variances 25 and 36 respectively. Test the equality of variances using F-test at 5% significance level.</td></tr>
<tr><td rowspan="3">4</td><td>14.a.</td><td>Given the transportation cost matrix below, apply the Least Cost Method to obtain the initial feasible solution:
<table>
<tr><th></th><th>D1</th><th>D2</th><th>D3</th></tr>
<tr><td>S1</td><td>8</td><td>6</td><td>10</td></tr>
<tr><td>S2</td><td>9</td><td>12</td><td>13</td></tr>
<tr><td>S3</td><td>14</td><td>9</td><td>16</td></tr>
</table></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>Apply the Hungarian method to solve the following assignment problem with next cost matrix:
<table>
<tr><th></th><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>A</td><td>10</td><td>19</td><td>8</td><td>15</td></tr>
<tr><td>B</td><td>10</td><td>18</td><td>7</td><td>17</td></tr>
<tr><td>C</td><td>13</td><td>16</td><td>9</td><td>14</td></tr>
<tr><td>D</td><td>12</td><td>19</td><td>8</td><td>18</td></tr>
</table></td></tr>
<tr><td rowspan="3">5</td><td>15.a.</td><td>Evaluate the Expected Monetary Value (EMV) and Expected Opportunity Loss (EOL) for the decisions from question 1, assuming probabilities for State 1, 2, and 3 are 0.3, 0.4, and 0.3 respectively, and recommend the best decision.</td><td rowspan="3">K5</td><td rowspan="3">CO5</td></tr>
<tr><td colspan="2">(OR)</td></tr>
<tr><td>15.b.</td><td>Given the following payoff matrix for a two-person zero-sum game, analyze and find the saddle point if it exists. If not, determine the mixed strategy solution:
<table>
<tr><th></th><th colspan="3">Player B</th></tr>
<tr><td rowspan="3">Player A</td><td></td><td>B1</td><td>B2</td></tr>
<tr><td>A1</td><td>6</td><td>2</td></tr>
<tr><td>A2</td><td>4</td><td>8</td></tr>
</table></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>Apply mean and mode for the following data.
Class: 0-7 7-14 14-21 21-28 28-35 35-42
Frequency: 7 11 24 19 12 9</td><td>K3</td><td>CO1</td></tr>
<tr><td>2</td><td>17</td><td>Analyze the Karl Pearson's correlation coefficient for the following bivariate data:
<table><tr><td>X</td><td>12</td><td>15</td><td>18</td><td>22</td><td>25</td></tr><tr><td>Y</td><td>30</td><td>28</td><td>35</td><td>40</td><td>42</td></tr></table></td><td>K4</td><td>CO2</td></tr>
<tr><td>3</td><td>18</td><td>A researcher wants to examine whether a special training program improves the scores of students in a statistics exam. Eight students took a pre-training test and a post-training test. The scores are as follows:
<table><tr><td>Pre Test</td><td>65</td><td>72</td><td>78</td><td>62</td><td>75</td><td>70</td><td>68</td><td>74</td></tr><tr><td>Post Test</td><td>70</td><td>76</td><td>80</td><td>68</td><td>78</td><td>74</td><td>70</td><td>79</td></tr></table>Determine whether the training program has a significant effect on the students' scores.</td><td>K5</td><td>CO3</td></tr>
<tr><td>4</td><td>19</td><td>Analyze the optimality of the given basic feasible solution using the MODI method for the transportation problem below. Suggest improvements if the solution is not optimal:
<table><tr><td></td><td>D1</td><td>D2</td><td>D3</td></tr><tr><td>S1</td><td>3</td><td>1</td><td>7</td></tr><tr><td>S2</td><td>2</td><td>6</td><td>5</td></tr></table>Supply: 20, 25 and Demand: 15, 10, 20</td><td>K4</td><td>CO4</td></tr>
<tr><td>5</td><td>20</td><td>Estimate the following payoff matrix under uncertainty, and determine the best decision using the Maximin and Minimax Regret criteria. Show all calculations and justify your choice.
<table><tr><td>Decision</td><td>State 1</td><td>State 2</td><td>State 3</td></tr><tr><td>D1</td><td>30</td><td>10</td><td>20</td></tr><tr><td>D2</td><td>40</td><td>25</td><td>15</td></tr><tr><td>D3</td><td>20</td><td>30</td><td>25</td></tr></table></td><td>K5</td><td>CO4</td></tr>
</table>

Z-Z-Z END