Model Question Paper-I with effect from 2023-24 (CBCS Scheme)

USN | | | | | | | | | | |

Third Semester B.E. Degree Examination

Mathematics for Computer Science

TIME: 03 Hours **Max. Marks: 100**

Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.
02. Statistical tables and Mathematics formulae handbooks are allowed

<table>
<tr><th colspan="3">Module -1</th><th>Bloom's Taxonomy Level</th><th>Marks</th></tr>
<tr><td>Q.01</td><td>a</td><td>The probability distribution function of variate X is given by the following table;
<table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr><tr><td>P(x)</td><td>k</td><td>3k</td><td>5k</td><td>7k</td><td>9k</td><td>11k</td><td>13k</td></tr></table>i) Find the value of k, ii) $P(x \geq 5)$ & iii) $P(3 < x \leq 6)$.</td><td>L2</td><td>6</td></tr>
<tr><td></td><td>b</td><td>If the probability of a bad reaction from a certain injection is 0.001, determine the chance that more than two of 2000 individuals will have a bad reaction.</td><td>L3</td><td>7</td></tr>
<tr><td></td><td>c</td><td>Find the mean and standard deviation of Poisson's distribution.</td><td>L2</td><td>7</td></tr>
<tr><td colspan="3">OR</td><td></td><td></td></tr>
<tr><td>Q.02</td><td>a</td><td>The probability of a pen manufactured by a factory be defective is $1/10$. If 12 such pens are manufactured, what is the probability that i) exactly 2 are defective, ii) at least 2 are defective, iii) none of them are defective.</td><td>L3</td><td>6</td></tr>
<tr><td></td><td>b</td><td>Determine the value of k, so that the function $f(x) = k(x^2 + 4)$ for x = 0, 1, 2, 3 can serve as a probability distribution of the discrete random variable X: Also find i) $P(0 < x \leq 2)$ and ii) $P(x \geq 1)$.</td><td>L2</td><td>7</td></tr>
<tr><td></td><td>c</td><td>Find the mean and standard deviation of Binomial distribution.</td><td>L2</td><td>7</td></tr>
<tr><td colspan="3">Module-2</td><td></td><td></td></tr>
<tr><td>Q.03</td><td>a</td><td>The joint probability distribution of discrete random variables X & Y are as follows;
<table><tr><td>X\Y</td><td>-3</td><td>2</td><td>4</td></tr><tr><td>1</td><td>0.1</td><td>0.2</td><td>0.2</td></tr><tr><td>2</td><td>0.3</td><td>0.1</td><td>0.1</td></tr></table>Then i) determine marginal distribution of X & Y, ii) show that X & Y are dependent.</td><td>L2</td><td>6</td></tr>
<tr><td></td><td>b</td><td>Determine the value of k so that the function $f(x, y) = k|x - y|$, for $x = -2, 0, 2$; $y = -2, 3$ represents joint probability distribution of the random variables X and Y. Also determine $\text{cov}(X, Y)$.</td><td>L2</td><td>7</td></tr>
<tr><td></td><td>c</td><td>Three boys X, Y, Z are throwing a ball to each other. X always throws the ball to Y & Y always throws the ball to Z. But Z is just as likely to throw the ball to Y or as to X. Write TPM if Z is the first person to throw the ball, find the probability that X has the ball after fourth throw.</td><td>L3</td><td>7</td></tr>
<tr><td colspan="3">OR</td><td></td><td></td></tr>
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<table>
<tr><td>Q.04</td><td>a</td><td>Given the following joint distribution of the random variable X & Y,
<table>
<tr><td>X\Y</td><td>−2</td><td>−1</td><td>4</td><td>5</td></tr>
<tr><td>1</td><td>0.1</td><td>0.2</td><td>0</td><td>0.3</td></tr>
<tr><td>2</td><td>0.2</td><td>0.1</td><td>0.1</td><td>0</td></tr>
</table>
Determine the marginal probability distributions of X & Y. Also compute i) Expectations of X, Y & XY, ii) Covariance of X & Y, iii) Correlation of X & Y.</td><td>L2</td><td>6</td></tr>
<tr><td></td><td>b</td><td>The joint probability distribution of random variables X & Y are as follows.
<table>
<tr><td>x\y</td><td>−4</td><td>2</td><td>7</td></tr>
<tr><td>1</td><td>1/8</td><td>¼</td><td>1/8</td></tr>
<tr><td>5</td><td>¼</td><td>1/8</td><td>1/8</td></tr>
</table>
then determine i) marginal distribution of X & Y, ii) E(X), E(Y) & E(XY), iii) COV(X, Y), iv) ρ(X, Y).</td><td>L2</td><td>7</td></tr>
<tr><td></td><td>c</td><td>The students study habits are as follows; If he studies on one night, he is 60% sure not to study on next night. On the other hand, if he does not study on to night, he is 80% sure to study next night. Write the transition probability matrix for his chain of study. In the long run how often does he study? Suppose he studies on Monday night, what is the probability that he does not study on Friday night?</td><td>L3</td><td>7</td></tr>
<tr><td colspan="3">Module-3</td><td></td><td></td></tr>
<tr><td>Q.05</td><td>a</td><td>A die was thrown 9000 times and throw of 5 or 6 was obtained 3240 times on the assumption of random throwing do the data indicate an unbiased die?</td><td>L3</td><td>6</td></tr>
<tr><td></td><td>b</td><td>Before an increase in excise duty on tea 400 people out of a sample 500 persons were found to be tea drinkers. After an increase in duty 400 people were tea drinkers in a sample of 600 people. Using standard error of proportion, state whether there is a significant decrease in the consumption of tea for 95% and 99% level of significance?</td><td>L3</td><td>7</td></tr>
<tr><td></td><td>c</td><td>A survey was conducted in a slum locality of 2000 families by selecting a sample of size 800 families. It was revealed that 180 families were illiterate. Find the probable limits of the illiterate families in the population of 2000.</td><td>L3</td><td>7</td></tr>
<tr><td colspan="3">OR</td><td></td><td></td></tr>
<tr><td>Q.06</td><td>a</td><td>In 324 throws a die an odd number turned up 181 times. Is it reasonable to think that the die is an unbiased one?</td><td>L3</td><td>6</td></tr>
<tr><td></td><td>b</td><td>The mean weight obtained from a random sample of size 100 is 64gms. The standard deviation of the weight distribution of the population is 3gms. Test the statement that the mean weight of the population is 67gms at 5% level of significance. Also set up 99% confidence limits of the mean weight of the population.</td><td>L3</td><td>7</td></tr>
<tr><td></td><td>c</td><td>In a sample of 100 people in this city, the average income was Rs. 210, with a standard deviation of Rs. 10. For another sample of 150 persons, the average income was Rs. 220, with a standard deviation of Rs. 12. The standard deviation of the incomes of the people of the city was Rs. 11. Test whether there is any significant difference between the average incomes of the localities.</td><td>L3</td><td>7</td></tr>
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<table>
<tr><td colspan="3">Module-4</td><td></td><td></td></tr>
<tr><td>Q.07</td><td>a</td><td>An experiment on Pea breading the following frequency of seeds were obtained
<table>
<tr><td>Round & Yellow</td><td>Wrinkled & Yellow</td><td>Round & Green</td><td>Wrinkled & Green</td><td>Total</td></tr>
<tr><td>315</td><td>101</td><td>108</td><td>32</td><td>556</td></tr>
</table>
Theory predicts that the frequences should be in the proportions 9:3:3:1. Examine the correspondence between theory and experiment ($\chi^2_{0.05}$= 7.815).</td><td>L3</td><td>6</td></tr>
<tr><td></td><td>b</td><td>Use the Central Limit theorem to evaluate $P[50 < \bar{X} < 56]$ where $\bar{X}$ represents the mean of a random sample of size 100 from an infinite population with mean $\mu = 53$ and variance $\sigma^2 = 400$ (Given, A(1.5) = 0.4332).</td><td>L2</td><td>7</td></tr>
<tr><td></td><td>c</td><td>Ten individuals are chosen at random from a population and their heights in inches found to be 63, 63, 66, 67, 68, 69, 70, 70, 71 and 71. Test the hypothesis that the mean height of the universe is 66 inches. ($t_{0.05}$ = 2.262 for 9 d.f.).</td><td>L3</td><td>7</td></tr>
<tr><td colspan="3">OR</td><td></td><td></td></tr>
<tr><td>Q.08</td><td>a</td><td>The following table shows the runs scored by two batsmen can it be said that the performance of batsman A is more consistent than the performance of batsman B? Use 1% level of significance ($F_{0.01}$,4,7 = 7.85).
<table>
<tr><td>Batsman-A</td><td>40</td><td>50</td><td>35</td><td>25</td><td>60</td><td>70</td><td>65</td><td>55</td></tr>
<tr><td>Batsman-B</td><td>60</td><td>70</td><td>40</td><td>30</td><td>50</td><td></td><td></td><td></td></tr>
</table></td><td>L3</td><td>6</td></tr>
<tr><td></td><td>b</td><td>The following table gives the number of aircraft accidents that occurred during the various days of the week. Find whether the accidents are uniformly distributed over the week?
<table>
<tr><td>Days</td><td>Sun</td><td>Mon</td><td>Tue</td><td>Wed</td><td>Thu</td><td>Fri</td><td>Sat</td><td>Total</td></tr>
<tr><td>Accidents</td><td>14</td><td>16</td><td>8</td><td>12</td><td>11</td><td>9</td><td>14</td><td>84</td></tr>
</table>
Given that $\chi^2_{0.05}$= 12.59.</td><td>L3</td><td>7</td></tr>
<tr><td></td><td>c</td><td>Consider the sample consisting of nine numbers 45, 47, 50, 52, 48, 47, 49, 53, 51. The sample is drawn from a population whose mean is 47.5. Find whether the sample mean differs significantly from the population mean at 5% level of significance ($t_{0.05}$ for 8 d.f. = 2.31).</td><td>L2</td><td>7</td></tr>
<tr><td colspan="3">Module-5</td><td></td><td></td></tr>
<tr><td>Q.09</td><td>a</td><td>A manufacturing company has purchase three new machines of different brands and wishes to determine whether one of them is faster than the others in producing a certain output, 5 hourly production figures are obtained at random from each other machine and the results are given below;
<table>
<tr><td>Observation</td><td>A</td><td>B</td><td>C</td></tr>
<tr><td>1</td><td>25</td><td>31</td><td>24</td></tr>
<tr><td>2</td><td>30</td><td>39</td><td>30</td></tr>
<tr><td>3</td><td>36</td><td>38</td><td>28</td></tr>
<tr><td>4</td><td>38</td><td>42</td><td>25</td></tr>
<tr><td>5</td><td>31</td><td>35</td><td>28</td></tr>
</table>
Use ANOVA and determine whether the machines are significantly</td><td>L3</td><td>10</td></tr>
</table>

<table>
<tr><td></td><td></td><td>different in their mean speed. Given at 5% level $F_{2,12}$= 3.89.</td><td></td><td></td></tr>
<tr><td></td><td>b</td><td>Set up ana analysis of variance table for the following per acre production data for three varieties of wheat, each grown on 4 plots and state if the variety differences are significant.
<table>
<tr><td rowspan="2">Plot of Land</td><td colspan="3">Per acre production data</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>1</td><td>6</td><td>5</td><td>5</td></tr>
<tr><td>2</td><td>7</td><td>5</td><td>4</td></tr>
<tr><td>3</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>4</td><td>8</td><td>7</td><td>4</td></tr>
</table>
Use ANOVA, given at 5% level $F_{2,9}$ = 4.26.</td><td>L3</td><td>10</td></tr>
<tr><td colspan="3">OR</td><td></td><td></td></tr>
<tr><td>Q.10</td><td>a</td><td>Set up an analysis of variance table for the following two-way design results: per acre production data of wheat in metric tons;
<table>
<tr><td rowspan="2">Varieties of fertilizers</td><td colspan="3">Varieties of seeds</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>W</td><td>6</td><td>5</td><td>5</td></tr>
<tr><td>X</td><td>7</td><td>5</td><td>4</td></tr>
<tr><td>Y</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Z</td><td>8</td><td>7</td><td>4</td></tr>
</table>
Also state whether variety differences are significant at 5% level. Given that $F_{2,6}$ = 5.14 and $F_{3,6}$ = 4.76.</td><td>L3</td><td>10</td></tr>
<tr><td></td><td>b</td><td>Analyze the variance in the following table Latin square of yields in kgs of Paddy where A, B, C, D denotes the different methods of cultivation.
<table>
<tr><td>D-122</td><td>A-121</td><td>C-123</td><td>B-122</td></tr>
<tr><td>B-124</td><td>C-123</td><td>A-122</td><td>D-125</td></tr>
<tr><td>A-120</td><td>B-119</td><td>D-120</td><td>C-121</td></tr>
<tr><td>C-122</td><td>D-123</td><td>B-121</td><td>A-122</td></tr>
</table>
Examine whether the different methods of cultivation have given significantly different is given that F_3 = 4.76.</td><td>L3</td><td>10</td></tr>
</table>