University of Mumbai
Examination 2020

Program: Information Technology

Curriculum Scheme: Rev2016

Examination: Second year/ Semester IV

Course Code: 301 and Course Name: Applied Mathematics-IV

Time: 1 hour Max. Marks: 80

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For the students:- All the Questions are compulsory and carry equal marks .

Q1.	Consider a dice with the property that that probability of a face with n dots showing up is proportional to n. The probability of face showing 4 dots is?
Option A:	1/7
Option B:	5/42
Option C:	1/21
Option D:	4/21
Q2.	X is a variate between 0 and 3. The value of E(X2) is
Option A:	8
Option B:	7
Option C:	9
Option D:	27
Q3.	A T-test sample has 7 pairs of samples. The distribution should contain
Option A:	5
Option B:	9
Option C:	6
Option D:	0
Q4.	Find the population proportion p for an IPL team having total 30 players with 10 overseas players.
Option A:	½
Option B:	1/3
Option C:	2/3
Option D:	1/4
Q5.	If 40% of boys opted for math's and 60% of girls opted for maths, then what is the probability that math's is chosen if half of the class's population is girls?
Option A:	0.5
Option B:	0.6
Option C:	0.7
Option D:	0.4
Q6.	If E(x) = 2 and E(z) = 4, then E(z – x) =?
Option A:	2
Option B:	6
Option C:	0
Option D:	-2
Q7.	For a Poisson Distribution, if mean(m) = 1, then P(1) is?

Option A:	e
Option B:	1/e
Option C:	e/2
Option D:	0
Q8.	Which of the following is not a necessary condition for a matrix, say A, to be diagonalizable?
Option A:	A must have n linearly independent eigen vectors
Option B:	All the eigen values of A must be distinct
Option C:	A can be an idempotent matrix
Option D:	A must have n linearly dependent eigen vectors
Q9.	The determinant of the matrix whose eigen values are 4, 2, 3 is given by
Option A:	19
Option B:	24
Option C:	15
Option D:	23
Q10.	Find the trace of the matrix A= $\begin{bmatrix} 1 & 0 & 6 \\ 0 & 5 & 0 \\ 0 & 4 & 4 \end{bmatrix}$
Option A:	0
Option B:	14
Option C:	10
Option D:	11
Q11.	Find the Value of A^3 where A= $\begin{bmatrix} -1 & -1 & 2 \\ 0 & 1 & -1 \\ 2 & 2 & 1 \end{bmatrix}$
Option A:	$\begin{bmatrix} 3 & 5 & -1 \\ -2 & -9 & 2 \\ -2 & -4 & -5 \end{bmatrix}$
Option B:	$\left[\begin{bmatrix} 3 & 5 & -1 \\ 1 & -9 & 1 \\ -2 & -4 & -5 \end{bmatrix}\right]$
Option C:	$\left[\begin{bmatrix} 3 & 5 & -1 \\ -2 & -9 & 1 \\ -2 & -4 & -5 \end{bmatrix}\right]$
Option D:	$\begin{bmatrix} 3 & 5 & -1 \\ -1 & -9 & 1 \\ -2 & -4 & -5 \end{bmatrix}$
Q12.	Find the Eigenvalues and type of the given matrix $\begin{bmatrix} 3 & 10 & 5 \\ -2 & -3 & -4 \\ 3 & 5 & 7 \end{bmatrix}$
Option A:	3, 1, 3 Non Derogatory
Option B:	2, 2, 2 Derogatory
Option C:	3, 2, 2 Derogatory

Option D:	1, 2, 3 Non Derogatory
Q13.	A sample size is considered large in which of the following cases?
Option A:	n > or = 30
Option B:	n > or = 50
Option C:	n < or = 30
Option D:	n < or = 50
Q14.	Rank correlation coefficient was discovered by
Option A:	Fisher
Option B:	Spearman
Option C:	Karl Pearson
Option D:	Bowley
Q15.	A random variable X may have no moments although its M.G.F is
Option A:	Not exist
Option B:	Exist
Option C:	1
Option D:	0
Q16.	In a Simplex table, the pivot row is computed by
Option A:	dividing every number in the profit row by the pivot number.
Option B:	dividing every number in the pivot row by the corresponding number in the profit row.
Option C:	dividing every number in the pivot row by the pivot number.
Option D:	dividing every number in the net profit row by the corresponding number in the gross profit row.
Q17.	A bag contains 80 chocolates. This bag has 4 different colors of chocolates in it. If all four colors of chocolates were equally likely to be put in the bag, what would be the expected number of chocolates of each color?
Option A:	12
Option B:	11
Option C:	20
Option D:	19
Q18.	Find the Eigen values of matrix $\begin{bmatrix} 4 & 1 \\ 1 & 4 \end{bmatrix}$
Option A:	3,-3
Option B:	-3,-5
Option C:	3,5
Option D:	5, 0
Q19.	In a Binomial Distribution, if 'n' is the number of trials and 'p' is the probability of success, then the mean value is given by
Option A:	np(1-p)
Option B:	np
Option C:	n
Option D:	p

Q20.	A vector field which has a vanishing divergence is called as
Option A:	Solenoidal field
Option B:	Rotational field
Option C:	Hemispheroidal field
Option D:	Irrotational field

Q2. **(20 Marks)**	**Solve any Four out of Six 5 marks each**
A	Find Eigen value and Eigen vector of matrix $\begin{bmatrix} 2 & -1 & 1 \\ 1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$
B	Show that $F = (x^2 - yz)i + (y^2 - zx)j + (z^2 - xy)k$. is conservative field. Find its scalar potential
C	Determine all basic solutions to the following problem. $$\text{maximise } z = x_1 + 3x_2 + 3x_3$$ $$\text{subject to } x_1 + 2x_2 + 3x_3 = 4$$ $$2x_1 + 3x_2 + 5x_3 = 7$$
D	Solve the following NLPP $$\text{maximise } z = 10x_1 + 4x_2 - 2x_1^2 - x_2^2$$ $$\text{subject to } 2x_1 + x_2 \leq 5$$ $$x_1, x_2 \geq 0$$
E	For a special security in a certain protected area it was decided to put three lighting bulbs on each pole. If each bulb has a probability p of burning out in the first 100 hours of service, calculate the probability that atleast one of them is still good after 100 hours, given $p = 0.3$. How many bulbs would be needed on each pole to ensure 99% safety that atleast one is good after 100 hours?
F	The average marks scored by 32 boys is 72 with standard deviation 8 while that of 36 girls is 70 with standard deviation is 6 test at 1% level of significance whether the boys perform better than the girls. ($\lvert z_\alpha \rvert = 2.58$)

Q3. **(20 Marks)**	**Solve any Four out of Six 5 marks each**

A	Find Eigen value and Eigen vector of matrix $\begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -5 & -2 \end{bmatrix}$
B	Show that $f = y e^{xy} \cos z\, i + x e^{xy} \cos z\, i - e^{xy} \sin z\, k$ is irrotational and find the scalar potential for f and also find $\int f.dr$ along the curve joining the points $(0,0,0)$ and $(-1,2,\pi)$
C	Solve the following linear programming problem by simplex method $\max. z = 5x_1 + 4x_2$ subject to $6x_1 + 4x_2 \le 24$ $x_1 + 2x_2 \le 6$ $-x_1 + x_2 \le 1$ $x_2 \le 2$ $x_1, x_2 \ge 0$
D	Solve the following NLPP using Kuhn Tucker condition maximise $z = 12x_1x_2 + 2x_1^2 - 7x_2^2$ subject to $2x_1 + 5x_2 \le 98$ $x_1, x_2 \ge 0$
E	7 dice are thrown 729 times, how many times do you expect at least 4 dice to show 3 or 5?
F	The means of two random samples of size 9 and 7 are 196.42 and 198.82 respectively. The sum of square of the deviation from the means are 26.94 and 18.73 respectively. Can sample be considered to have been drawn from the same populations ($\lvert t_\alpha \rvert = 2.145$)