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Roll No..

MCSE/MSE-101

M.E./M.Tech., I Semester

Examination, November 2018

Advanced Computational Mathematics

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.

ii) All questions carry equal marks.

1. If $f : R^3 \to R^3$ is the linear mapping defined by

$f(x, y, z) = (x + 2y - z, y + z, x + y - 2z),$

Find a basis and dimension of

i)   The image of f

ii) The kernel of f

2. a) Determine whether $(1,1,1,1),(1,2,3,2,),(2,5,6,4),(2,6,8,5)$ form a basis of R^4. If not, find the dimension of the subspace they span.

b) Compute the DFT of the four point sequence $S(n)=\{1, 2, 3, 4\}$, using DFT transformation matrix.

3. Solve the parabolic equation $\frac{\partial u}{\partial t} = 4\frac{\partial^2 u}{\partial x^2}$ with boundary

conditions $u(0,t) = 0, u(8,t) = 0$ and $u(x,0) = 4x - \frac{1}{2}x^2$ at

the points $x = i : i = 0,1,2,3,4,5,6,7$ and $t = \frac{1}{8}j, j = 0,1,2,3,4,5.$

4. a) The probability that an injection manufactured by a company will be defective is 0.1. If 12 such injection are manufactured, find the probability that
    i)   Exactly two will be defective
    ii) Atleast two will be defective
    iii) None will be defective.

b) Find λ-cut relations for λ = 0.1, 0.4, 0.5, 0.9, 1, for the following fuzzy relation

matrix $R = \begin{bmatrix} 0.2 & 0.7 & 0.4 & 1 \\ 1 & 0.9 & 0.5 & 0.1 \\ 0 & 0.8 & 1 & 0.6 \\ 0.2 & 0.5 & 1 & 0.3 \end{bmatrix}$

5. a) A research worker wishes to estimate mean of population by using sufficiently large sample. The probability is 95% that sample mean will not differ from the true mean by more than 25% of the standard deviation. How large a sample should be taken?

b) The nine items of a sample have the following values: 45,47,50,52,48,47,49,53,51. Does the mean of these differ significantly from the assumed mean of 47.5? (given t = 2.31 for 8 d.f. at 5% level of significance)

6. Derive the steady state difference equations of the queuing model $(M / M / 1 : \infty / \infty / FCFS)$. Also prove that

$L_s = \frac{\rho}{1 - \rho}.$

7. a) Define the following :
    i)   Markov Process
    ii) Queuing System

b) Solve the Poisson differential equation $u_{xx} + u_{yy} = 8x^2 y^2$ for the square mesh of the following figure with $u(x, y) = 0$ on the boundary and mesh length = 1.
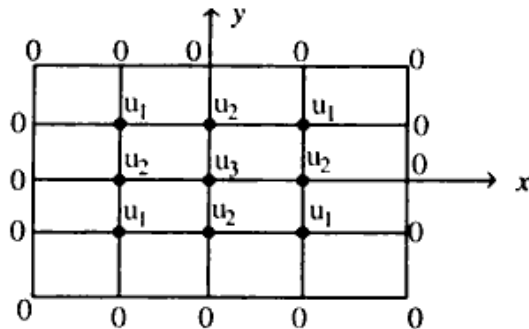
8. a) Find union, intersection, complements and differences of the following fuzzy sets. Also verify DeMorgan's laws for these fuzzy sets: http://www.rgpvonline.com

$$A = \left\{ \frac{0.5}{1} + \frac{0.6}{2} + \frac{0.8}{3} + \frac{1}{4} + \frac{1}{5} \right\},$$

$$B = \left\{ \frac{0.2}{1} + \frac{0.4}{2} + \frac{0.7}{3} + \frac{0.9}{4} + \frac{1}{5} \right\}$$

b) What is MATLAB Programming? Explain Command window, edit window and graphics window in MATLAB Programming.

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