8. (a) The failure rate of a certain component is $h(t) = \lambda_0 t$, where $y_0 > 0$ is a given constant. Determine the reliability $R(t)$ of the component. Repeat for $h(t) = \lambda_0 t^{1/2}$.

(b) Write short notes on the following :
  (i) Decision theory
  (ii) Goal programming.

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MEMT/MEDC/MEPE/MEVD–101

M. Tech. (First Semester)

EXAMINATION, July/August, 2008

(Common for MEMT/MEDC/MEPE/MEVD Engg.)

### ADVANCED COMPUTATIONAL MATHEMATICS

(MCSE–101)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : Attempt any *five* questions. All questions carry equal marks.

1. (a) Find the the deflection $u(x, t)$ of the vibrating string of length π and ends fixed corresponding to zero initial velocity and initial deflection $f(x) = k \,(\sin x - \sin 2x)$, given $c^2 = 1$.

(b) Solve Laplace equation in rectangle with $u(0, y) = u(a, y) = u(x, b) = 0$ and $u(x, 0) = f(x)$, see figure :
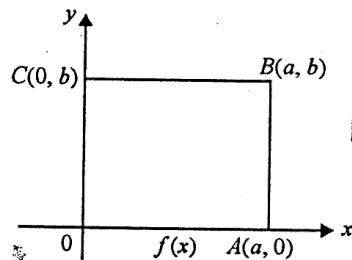
2. (a) Solve $\dfrac{\partial u}{\partial t} = \dfrac{\partial^2 u}{\partial x^2}$ subject to initial condition $u = \sin \pi x$ at $t = 0$ for $0 \le x \le 1$ and $0 \le x \le 1$ and $u = 0$ at $x = 0$ and $x = 1$ for $t > 0$, by the Gauss-Seidel iterative method.

(b) Write the properties of DFT, WFT and Haar transform.

3. (a) Out of 800 families with 4 children each, how many families would be expected to have (i) 2 boys and 2 girls (ii) at least one boy (iii) no girl (iv) at most two girls ? Assume equal probabilities for boys and girls.

(b) A random variable X has the probability function :

x	$P(X = x) = P(x)$
0	a
1	$3a$
2	$5a$
3	$7a$
4	$9a$
5	$11a$
6	$13a$
7	$15a$
8	$17a$

  (i) Determine the value of a.
  (ii) Find $P(X > 2)$, $P(X \ge 6)$, $P(3 < X < 5)$.

4. (a) Explain the meaning and importance of sampling distribution.

(b) Define stochastic processes and explain classification of stochastic process.

5. (a) Let :

$$S = \begin{array}{c} \\ A \\ B \\ C \end{array} \begin{array}{ccc} A & B & C \\ \begin{bmatrix} 0.2 & 0.3 & 0.5 \\ 0.4 & 0.3 & 0.2 \\ 0.4 & 0.6 & 0 \end{bmatrix} \end{array}$$

is a transition matrix. Give the transition matrix for three steps and four steps.

(b) Obtain the steady state difference equations for the queuing model (M/M/1 : N/FCFS) in usual notation and solve them for p_0 and p_1.

6. (a) Obtain the distribution of the number in the system in steady state for M/M/S model by considering it as a birth and death process.

(b) What are the roles of α-cuts and strong α-cuts in fuzzy set theory ? What is the difference between them ?

7. (a) Let A, B be two fuzzy numbers whose membership functions are given by :

$$A(x) = \begin{cases} (x + 2)/2 & \text{for } -2 < x \le 0 \\ (2 - x)/2 & \text{for } 0 < x < 2 \\ 0 & \text{otherwise} \end{cases}$$

$$B(x) = \begin{cases} (x - 2)/2 & \text{for } 2 < x \le a \\ (6 - x)/2 & \text{for } 0 < x < 6 \\ 0 & \text{otherwise} \end{cases}$$

Calculate the fuzzy numbers $A + B, A - B, B - A, A \cdot B, A/B$, Min. (A, B) and Max. (A, B).

(b) Define the basic functions of MATLAB.