2007

APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING

PAPER-III

Full Marks: 100

Time: 4 hours

The figures in the right-hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

Write the answers to Questions of each Group in separate books

GROUP-A

(Probability and Statistics)

[*Marks*: 30)

Answer any two questions

(Tum Over)

- (a) What do you mean by.Markov chain and order 1. of a Markov chain in stochastic process? 3+2
 - (b) State and prove First Entrance theorem.
 - (c) Prove that in an irreducible chain, all the states are of the same type. They are either all transient, all persistent null, or all persistent non-null. All the states are aperiodic and in the latter case they all have the same period.
- 2. (a) What do you mean by Galton-Watson **Branching Process? Prove that**

space S = (1,2,3,4)

transition probability matrix

$$Pn(s)$$
 $Pn_I(P(s))$
 $and P. (s)$ $P(Pn_I(s))$,

the symbols have their usual meanings.

(b) Let $(X_{\cdot,\cdot}, n \mid 0)$ be a Markov chain having state and corresponding

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$$P = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 1/3 & 2/3 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1/2 & 0 & 1/2 & 0 \\ 0 & 0 & 1/2 & 1/2 \end{bmatrix}$$

(Continued)

Show that. the state three and four are transient,
the state two is persistent, and the state one is
ergodic.

- (c) State Chapman-Kolinogorav equation.
- (a) Describe the Pure Birth process and deduce the corresponding Yule-Furry process. What will be the probability generating function for this process?
 - (b) What do you mean by partial correlation and multiple correlation coefficient of the three variables?
 - (c) Define the terms:
 - (i) Transition Probability
 - (ii) Doubly Stochastic Matrix.

GROUP-B

(Numerical Analysis)

[Marks: 401

Answer Q. No. 4 and any three from the rest

4. Prove the 'following relations where the **operators** have their **usual meanings**:

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(Tum Over)

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(ii)	μ=cosh 12J	where	и	hL).		
	·						

S. (a) Describe power method to obtain numerically the largest eigenvalue and the corresponding eigenvector of a matrix. When does the method fail?

(b) Define orthogonal polynomials and its sequences with example.

6. (a) Describe Milne's method for numerical solution of the equation dy = f(x, y) in the interval dx
[a, b], subject to the initial condition y = yo at x = x0. Explain how you obtain the starting values.

(b) Deduce the three-point Gauss-Legendre quadrature formula. Show that the formula gives exact result for f(x) xs.

7. Describe LU-decomposition method to solve a system of linear equations A,,= b. Write the limitations of this method. Also give an idea to find the value of A I -

(Continued)

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(a) Describe a finite difference method to solve the wave equation defined below:

$$a^{2}$$
 - a^{2} - a^{2

where **initial conditions** u(x, 0) = f(x) and

$$u1(x,0) = g(x), 0 < x < l$$

and boundary conditions

$$U_{\cdot}(Ort) = (p(t); and u(irt) = (t), tO.$$

(b) Economize the power series

$$\cos x = 1 \frac{x^2}{2!} - \frac{x^4}{4!} - \frac{x^6}{6!} \frac{x^8}{8!} \dots$$

correct to four significant figures, using Chebyshev polynomial.

- 9. (a) Define a cubic spline. Derive the governing,equations for the spline function.
 - (b) Find the **Natural cubic splines** for the data given below and **estimate** f(1.5).

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(Turn Over)

GROUP--C

[Computer Science)

[Marks: 30]

- **10.** Answer any six from the following:
 - (i) Explain `floating point representation' of a real number with the help of a register with a capacity of six digits and a sign bit. Pictorially, represent 0-004825 x 10-7 by the said register. Evaluate 0.01439x 104-0.1025x 102.
 - (ii) Using Karnaugh map, simplify the following function

$$f(A, B, C, D) = I(1,3,5,8,9,11,15)$$

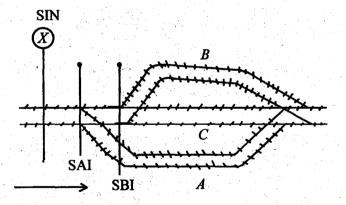
+1 (2,13)

and draw the circuit.

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(if). A railway station with three platforms
A, B, Cis illustrated below. A train coming to the station in the direction of arrow is to be routed to platform A, B or C. Normally the train is to be routed to platform A if that platform is empty.

Only if both A and B platforms are occupied, the train is routed to platform C. A switching, system is to be designed which will set the points SAI, SBI and the control the, signal SIN. Each platform has a switch which is turned ON if a train is standing in that platform. A switch is also turned ON if a train is approaching the signal SIN. [In this design, the condition of, `no train is approaching the - station' and ' a train is approaching the station' is to be taken into account].



Railway Lines

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(Turn Over)

- (iv) How do we initialize structures during declaration? Give an example. Explain the difference between the two member access operators '.' and '-*'. What is a union? How is it different from a structure?
- (v) Write a program to find out the value of sum of all prime numbers between two specified numbers in C.
- (vi) Explain the role of the initialization, test and update expressions in a for loop. What is the output of the following statements: 4+1

for U = 0; i < 10; i++)
printf("%d\",
$$l$$
", l

- (vii) Write a C program to test whether an integer is a prime or not.
- (viii) Write down the general form of a function subprogram in C and discuss the different parts of it.
- (ix) Write program segments that will read the value of x and evaluate the following function:

using (i) nested if statements, (ii) conditional operator.

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(x) Write a program to find the average of n numbers (i) not using array (ii) using array, with the help of two functions in C.