End-sem examination July-Dec 2020

Programme: M.Tech. (CSE-CN)/Ph.D (CSE) **Course**: MFCS **Course code**: CS420102

Full marks: 40 **Time**: 2 hour. **Session**: 2020-2021

Answer *any four* questions

1. Two teams A and B play a 5 match series. In each match A wins with probability p and loses with probability 1-p. Compute the following: 10
   - The probability that the game ends after the third, the fourth or the fifth match.
   - The probability that A wins the series.
2. A gambler has Rs. 3/-. He bets Re. 1/- at a time and wins Re. 1/- with probability 1/2. He stops playing if he loses Rs. 3/- or wins Rs. 4/-. 10
   (a) Show that the process is Markov process.
   (b) Is state 3 ergodic? Verify.
3. a) Prove the following transition probability matrix is irreducible: 5

$$\begin{matrix} 0 & 1 \\ 1/2 & 1/2 \end{matrix}$$

   b) If x is normally distributed with mean 18 and variance 3, and y is normally distributed with mean 24 and variance 2, and x and y are independent, what is
   P(12<= x <14 and 14<= y <20)? 5
4. a) Consider the function, $f(X) = 5x_1^2x_2 + 4x_1x_2^3 - 8x_1x_2$. Does the point (1,1) satisfy the FONC and SONC? 6
   b) Compute the directional derivative of $f(X) = 5x_1^2x_2 + 4x_1x_2^3 - 8x_1x_2$ at X = [1,0] in the direction S=[-1,-1]. 4

5. a) Apply gradient descent with a unit step size to $f(X) = x_1^4x_2 + x_1x_2^4$ from a starting point of your choice. Compute four iterations. 6

b) In conjugate gradient descent, what is the normalized descent direction at the first iteration for the function f $(x, y) = x^2 + xy + y^2 + 5$ when initialized at $(x, y) = (1, 1)$? 4