2021

COMPUTER SCIENCE — HONOURS

Paper : CC-6

Full Marks : 50

The figures in the margin indicate full marks.

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

Answer **question no. 1** and **any four** questions from the rest.

1. Answer **any five** questions of the following : 2×5

   (a) Let A = {1, 2, 3}. Find all one to one functions f : A $\rightarrow$ A.

   (b) How many spanning trees can you form using S nodes?

   (c) State the principle of inclusion and exclusion for n number of sets.

   (d) Given a group of 6 Samurai, 7 Lords and 8 Ninjas. How many teams of 5 members can be formed?

   (e) What do you mean by Arbitrarily traceable graph?

   (f) Show that $f(n) = n^2 + 2^n$ is of $O(2^n)$.

   (g) If y = $4x^6 - 5x$, find the percentage error in y at $x = 1$, if the error in $n = 0.04$.

   (h) There are two boxes of balls. The first contains 1 red and 4 blue balls and the second contains 2 red and 3 blue balls. A ball is picked at random. If the picked ball is red, what is the probability that it comes from the first box?

2. (a) A simple graph with n vertices and k components can have atmost $(n-k)(n-k+1)/2$ edges.

   (b) If $f(n)$ is in $O(g(n))$ and $g(n)$ is in $O(h(n))$, prove that $f(n)$ is $O(h(n))$.

   (c) Solve the following recurrence relation :

   $x_n - 5x_{n-1} + 6_{n-2} = 0$,
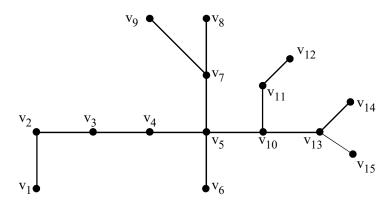
   where $x_1 = x_2 = 1$, for $n \geq 3$. 3+3+4

3. (a) There are 100 people in a certain room. In this group, 60 are men 30 are young and 10 are young men. It is known further that 40 are republicans, 20 are republican men, 15 are young republicans and 5 are young republican men. Assume that each person is either a republican or a democrat,

   (i) How many are old women?

   (ii) How many are old democratic women?

   (b) If h is very small, prove that $\Delta^{n+1} f(x_0) \approx h^{n+1} f^{n+1}(x_0)$. (3+3)+4

Please Turn Over

4. (a) For the following graph find its center and diameter.

   (b) In a sequence of eight Bernoulli trials, compute the probability of 0, 1, ..., 8 successes.

   (2+2)+6

5. (a) Find y (4.4), by Euler's method, taking $h = 0.2$, from the differential equation

   $$\frac{dy}{dx} = \frac{2 - y^2}{5x}, \quad y = 1 \quad \text{when} \quad x = 4.$$

   (b) Define big - O and big - θ. Explain their geometrical interpretations.   6+4

6. (a) State Bayes' theorem on conditional probability.

   (b) A simple connected graph has 7 vertices and 14 edges. Find the rank and nullify of the graph.

   (c) An unbiased coin is tossed five times. Find the probability of getting more than two heads.   4+2+4

7. (a) State the condition when a system of linear equations is said to be strictly diagonally dominant. Solve the following simultaneous equations by Gauss-Elimination method.

   $$3x + 4y + 2z = 15$$
   $$2x + 3y + 2z = 10$$
   $$5x + 2y + z = 18.$$

   (b) What do you mean by ill conditioned matrix?   (2+6)+2

8. (a) A given connected graph G is an Euler graph if and only if all vertices of G are of even degree.

   (b) Find the number of nodes with degree one in a binary tree with 101 nodes.

   (c) How many bit strings of length 4 either start with a 0 bit or end with two bits 11?   4+2+4

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