2019

B.Sc.

2nd Semester Examination

COMPUTER SCIENCE (Honours)

Paper - C4T

(Discrete Structure)

Full Marks : 60 Time : 3 Hours

The figures in the margin indicate full marks. Candidates are required to give their answers in their own words as far as practicable.

1. Answer any *ten* questions. 10×2

(a) Define master theorem. 2

(b) Define Planar Graphs. 2

(c) Define De Morgan's law. 2

(d) Write, principle of inclusion and exclusion. 2

(e) Prove that $3n^2 + 2n + 5 = 0(n^2)$. 2

[Turn Over]

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(f) Define Ω (Big-omega) notation in complexity. 2

(g) Define generating function. 2

(h) Write down basic characteristics of an Algorithm.

(i) Define cut set and cut vertex. 2

(j) Define Euler graph. 2

(k) Give an example of a relation which a Reflexive and Transitive but not symmetric. 2

(l) Define Adjacency matrix of a graph. 2

(m) Define symmetric difference between two sets with an example. 2

(n) Prove that number of odd degree vertices in a graph is always even. 2

(o) Define Bijective mapping with an example. 2

2. Answer any *four* questions. 4×5

(a) Define Tautology and Contradiction. Using Truth table prove that,

$$(p \rightarrow q) \wedge (r \rightarrow q) \equiv (p \vee r) \rightarrow q$$ 2+3

(b) Using Mathematical induction prove that :

$2^n < \lfloor n$ for $n \geq 4$. 5

(c) For any three arbitrary sets A, B, C, prove that

(i) $A-(B \cup C)=(A-B) \cap (A-C)$

(ii) $(A \cap B) \cap (A-B)=\phi$ 2½+2½

(d) If R be a relation in the set of integers Z defined by

$$R=\{(x, y): x \in z, y \in z, (x-y) \text{ is divisible by } 6\}$$

Prove that R is an equivalence relation. 5

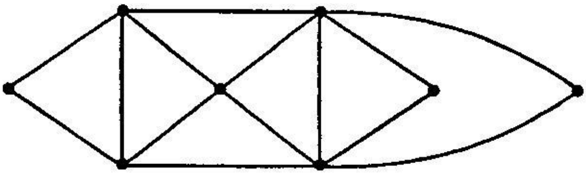
(e) Solve the following recurrence relation.

$a_r - 3a_{r-1} + 3a_{r-2} - a_{r-3} = 0$ 5

given that, $a_0 = 2, a_1 = 1, a_2 = 1$.

[Turn Over]

(f) Colour the following graph : 5



Answer any *two* questions : 2×10

3. (a) Prove that in a simple graph with n vertices and K components can not have more than $(n-k)(n-k+1)/2$ edges. Prove that $E = I + 2n$, where E is the external path length, I is the internal path length and n is the nodes having two children. 7+3

(b) (i) Find asymptotic relation for the recurrence relation using Master theorem

$$T(n) = 2T(n/2) + n^2$$

(ii) Find the asymptotic using substitution method :

$$T(n) = 6T(n/3) + 2n - 1,$$

$$T(n) = 2 \text{ for } n = 1$$

5+5

(c) (i) Prove that a tree with n vertices contains $(n-1)$ edges.

(ii) Define graph isomorphism with an example.

(iii) Prove that a connected graph contains an Eulerian trail, but not an Eulerian circuit, if and only if it has exactly two vertices of odd degree. 5+2+3

(d) (i) Solve the recurrence realtion using generating function :

$$a_r - 5a_{r-1} + 6a_{r-2} = 2^r + r\,;\, a_\circ = 1,\ a_1 = 1$$

(ii) 900 students appeared for two papers in Mathematics. 740 students passed in paper-I and 650 students in paper-II. If 625 students passed in both, find the number of students who failed in both.
