K. J. SOMAIYA INSTITUTE OF MANAGEMENT STUDIES AND RESEARCH,
Vidyavihar, Mumbai- 400077

Program: ***MCA, Sem-I (2016-19Batch)***
Subject: Mathematical Foundation in Computer Science
(End Term Exam)

Maximum Marks: 50
Duration: 3 hrs. **Date: 21st November 2016**

Instructions

1. Attempt any five questions

QUESTION 1
(10)

a. Prove that for any positive integer 'n' the number '$n(n^2 + 5)$ is an integer multiple of 6 by mathematical induction
b. If I be the set of integers and if R be defined over I by "a R b" iff "a-b is an even integer" ,a, b∈ I, then show that the relation R is an equivalence relation

QUESTION 2
(10)

a. Determine whether the set of even integers with binary operation defined as a*b=(ab)/2 is a semigroup, a monoid or neither. If it is a monoid, specify the identity. If it is a semigroup or a monoid determine whether it is commutative.
b. Check the validity of the following arguments.
   If I play football, I cannot study.
   Either I study or I pass DBMS
   I played football.
   Therefore, I passed DBMS.

QUESTION 3
(10)

a. Define degree of a vertex in an undirected graph. How many edges are there in a graph with ten vertices each of degree six?

b. State the Tower of Hanoi problem. Obtain its recurrence relation with suitable initial conditions. Solve the recurrence relation.

QUESTION 4
(10)

a. Draw the graph for following Adjacency list & write Euler Circuit and Hamilton Circuit if exists.

A	B	C	E
B	A	D	F
C	A	D	G
D	B	C	H
E	A	F	G
F	B	E	H
G	C	E	H
H	D	F	G

b. Let the state transition table for a finite state machine be

	0	1
S_0	S_0	S_1
S_1	S_1	S_2
S_2	S_3	S_2
S_3	S_3	S_4
S4	S4	S2

List values of the transition function f_w for (i) w = 01011, (ii) w = 10101.

QUESTION 5
(10)

a. Let $H = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ be a parity check matrix.
Determine the (3, 6) encoding function $e_H: B^3 \rightarrow B^6$. Decode the word 001111 relative to a maximum likelihood decoding function associated with e_H.

b. Find the solution of the recurrence relation $a_n = 4a_{n-1} + 1$ with $a_1 = 4$ as initial condition.

QUESTION 6

(10) by laws of logic

$(p \vee q) \leftrightarrow (p \wedge q)$.

a. Obtain the following

Principal conjunctive normal form of $(p \leftrightarrow q) \vee \sim r$

(i) Conjunctive normal form of

Disjunctive normal form of $\sim(p \vee q) \leftrightarrow (p \wedge q)$

(ii)

(iii)

b. Let $V = \{ v_0, v_1, v_2, a, b, c\}$, $S = \{ a, b, c\}$ and let $\mapsto$ be the relation on V^* given by
1. $v_0 \mapsto vov_1$ 2. $Vov_1 \mapsto bbwv_2v_0$ 3. $v_2 \mapsto a$, $v_2v_0 \mapsto ab$, $v_1 \mapsto c$
Consider the phase structure grammar $G = (V, S, v_0, \mapsto)$.

(i) Derive the sentence xyz. Also draw the derivation tree.

****