(Please write your Exam Roll No.) Exam Roll No. ....

END TERM EXAMINATION

THIRD SEMESTER [B.TECH.] DEC.2014 – JAN.2015

Paper Code: ETCS207 Subject: Foundation of Computer Systems

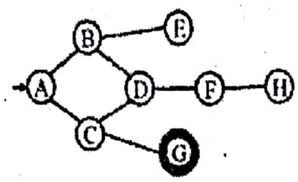
Time : 3 Hours Maximum Marks :75

Note: Attempt any five questions including Q.no.1 which is compulsory.

Q1 Differentiate between the followings (provide examples to support your answer):-

(a) Prepositional Logic and Predicate Logic **(5x5=25)**
(b) Binary and unary operations
(c) Depth-first and breadth first search
(d) Preorder and post order
(e) Direct Proof and Proof by Contra position

Q2 Consider the following graph



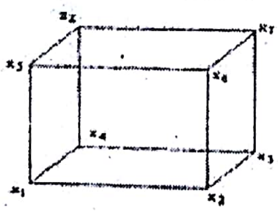
Starting from state A, execute DFS and BFS. The goal node is G. Show the order in which the nodes are expanded. Assume that the alphabetically smaller node is expanded first to break the show dry run ties. **(12.5)**

Q3 Using propositional logic prove the statement (d) from (a, b, c):- **(12.5)**

(a) $P \Rightarrow (Q \Leftrightarrow R)$.
(b) $\neg(Q \Leftrightarrow R)$.
(c) $(S \wedge Q) \Rightarrow P$.
(d) $\neg P \wedge (S \Rightarrow \neg Q)$.

Q4 Write a recursive algorithm to sort a list of following 10 integers using quick sort: 10, 23, 11, 55, 32, 5, 67, 53, 4, 98. Trace the working of your algorithm. **(12.5)**

Q5 Define Hamilton path. Determine if the following graph has a Hamilton circuit. **(12.5)**



Q6 (a) Prove that a simple graph is connected if and only if it has a spanning tree. **(6)**
(b) Show that if R1 and R2 are equivalence relations on A, then $R1 \cap R2$ is an equivalent relation. **(6.5)**

Q7 (a) State and prove Euler's formula for a connected planar graph G=(V, E). Also prove that if $|V| > 2$ then $|E| \leq 3|V| - 6$. **(6)**
(b) State Pigeon Hole principle. Explain using a suitable example. **(6.5)**

Q8 Write short notes on <u>**any two**</u> of the following:- **(6.25x2=12.5)**

(a) Five colour Theorem
(b) Minimization of Boolean function
(c) Pascal's triangles

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END TERM EXAMINATION

THIRD SEMESTER [B.TECH] DECEMBER 2016

Paper Code: ETCS-203	**Subject: Foundation of Computer Science**
Time: 3 Hours	**Maximum Marks: 75**

Note: Attempt any five questions including Q.no.1 which is compulsory.

Q1 (a) Define the connectives conjunction and disjunction and give the truth table for $p \vee q$.

(b) Determine the contrapositive of the statement "If John is a poet, then he is poor."

(c) State and prove the De Morgan's law for a Boolean algebra.

(d) Find DNF for the function $F(x, y, z) = (x + y)z'$.

(e) Define function, domain, Co-domain and range of a function. **(5x5=25)**

Q2 Prove the following:

(a) $n(A \cup B) = n(A) + n(B) - n(A \cap B)$. **(2.5)**

(b) $p \to (q \vee r), (s \wedge t) \to q, (q \vee r) \to (s \wedge t)$ *then* $p \to q$. **(5)**

(c) $(\exists x)(p(x) \wedge Q(x)) \Rightarrow (\exists x)(p(x)) \wedge (\exists x)(Q(x))$. **(5)**

Q3 (a) Explain the principle of mathematical induction. **(4)**

(b) Explain the Partial Ordered Relation with the help of suitable example. **(4)**

(c) What is extended pigeonhole principle, explain with suitable example. **(4.5)**

Q4 (a) Explain Vertex coloring problem and chromatic number of graph using example. **(6)**

(b) Show that the minimum number of edges in a connected graph with n vertices is (n-1). **(6.5)**

Q5 (a) Show that all proper subgroups of groups of order 8 must be abelian. **(4)**

(b) Define cyclic group with example. **(4)**

(c) Prove that the group (G,+6) is a cyclic group where $G = \{0,1,2,3,4,5\}$. **(4.5)**

Q6 (a) Draw the Hasse diagram for the divisibility for the divisibility relation on $\{2, 4, 5, 10, 12, 20, 25\}$ starting from the digraph. **(4)**

(b) Define lattice and give an example. **(4)**

(c) Explain principle of inclusion and exclusion with an example. **(4.5)**

Q7 (a) Explain Lagrange's Theorem with proof. **(8)**

(b) Show that the intersection of 2 normal subgroups of a group G is also normal subgroup G. **(4.5)**

Q8 (a) Define Hamiltonian Circuit with Example. **(2.5)**

(b) Give an example of graph which contains a Hamiltonian circuit, but not a Eulerian Circuit. **(5)**

(c) If all the vertices of an undirected graph are each odd degree k, show that the number of edges of the graph is multiple of k. **(5)**

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END TERM EXAMINATION

THIRD SEMESTER [B.TECH] DECEMBER 2017

Paper Code: ETCS-203	*Subject: Foundation of Computer*
[Batch 2013 onward]	*Science*

Time: 3 Hours *Maximum Marks: 75*

Note: Attempt any five questions including Q.no.1 which is compulsory. Select one question from each Unit.

Q1 (a) What do you mean by Quantifiers? Explain nested quantifiers.

(b) Show that logical expression $\neg(p \rightarrow q) \rightarrow p$ is a tautology.

(c) Prove by contradiction that "If n is an integer and 3n+2 is odd, then n is odd."

(d) Let f and g be the functions from the set of integers defined by $f(x) = 2x + 3$ and $g(x) = 3x + 2$. What is the composition of fog and gof?

(e) Use mathematical induction to prove the inequality $n<2^n$.

(f) How many bit strings of length four do not have two consecutive 1s?

(g) What is the solution of the recurrence relation $a_n = a_{n-1} + 2a_{n-2}$ with $a_0 = 2$ and $a_1 = 7$. $a_n = \alpha_1 (2)^n + \alpha_2 (-1)^n$ $a_n = 3(2)^n - 1(-1)^n$.

(h) Explain the Pascal's Identify and Triangle.

(i) Give the formula for the number of elements in the union of 4 sets A_1, A_2, A_3 & A_4.

(j) Find the value of the Boolean Function represented by $F(x, y, z) = xy + \bar{z}$. **(2.5x10=25)**

Unit-I

Q2 (a) Explain the pigeonhole principle. How many students must be in a class to guarantee that at least two students receive the same score on the final exam, if the exam is graded on a scale from 0 to 100 points? **(4.5)**

$+1 = 101$ (6/6/100) 102

(b) Find the solution to the recurrence relation- **(8)**

(i) $a_n = 6a_{n-1} - 11a_{n-2} + 6a_{n-3}$ $\alpha_1(1)^n + \alpha_2(2)^n + \alpha_3(3)^n$

(ii) $a_n = 5a_{n-1} - 6a_{n-2} + 7^n$. $\frac{1}{2}(2)^n + \frac{1}{2}(3)^n + \frac{49}{20}7^n$

Q3 (a) Let R be the relation on the set A = {0, 1, 2, 3} containing the ordered pairs (0, 1), (1, 1), (1, 2), (2, 0), (2, 2) and (3, 0). Find (i) Reflexive closure of R (ii) Symmetric closure of R. **(4.5)**

(b) Let R be the relation on the set of real numbers such that aRb if and only if a-b an integer. Is R an equivalence relation? **(4)**

(c) Show that $\neg(p \vee (\neg p \wedge q))$ and $\neg p \wedge \neg q$ are logically equivalent by developing a series of logical equivalences. **(4)**

Unit-II

Q4 (a) Explain principle of Inclusion-Exclusion. Find how many positive integers not exceeding 1000 are divisible by 7 or 11. **(4.5)** 232

(b) Obtain: **(8)**

(i) PDNF form of $[(p \wedge q) \vee (\neg p \wedge r) \vee (p \wedge r)]$.

(ii) PCNF form of $[(p \vee q) \wedge (\neg p \rightarrow \neg q)]$.

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ETCS-203 P.1

Q5 (a) Show that the hypothesis "It is not sunny this afternoon and it is colder than yesterday," 'We will go swimming only if it is sunny", "if we do not go swimming, then we will take a canoe trip", and "If we take a canoe trip then we will be home by sunset" lead to the conclusion "we will be home by sunset." **(5.5)**

(b) Let $A = \{x \mid 3x^2 - 7x - 6 = 0\}$ and $B = x \mid 6x^2 - 5x - 6 = 0\}$, then find $A \cap B$. **(3)**

(c) Prove that $\sqrt{2}$ is irrational by giving proof by Contradiction. **(4)**

Unit-III

Q6 (a) Is the poset $(Z^+, |)$ a lattice. **(4)**

(b) Draw the Hasse diagram representing the partial ordering $\{(a, b) \mid$ a divides b$\}$ on $\{1, 2, 3, 4, 6, 8, 12\}$. Also find the minimal and maximal elements of the Hasse diagram. **(4.5)**

(c) What is distributive lattice? Show that in any distributive lattice, the set of all complemented elements is a sublattice. **(4)**

Q7 (a) Use the K-maps and simplify: **(3x2=6)**

(i) $XY + \overline{X}\,Y$

(ii) $X\,\overline{Y} + \overline{X}\,Y$

(iii) $X\,\overline{Y} + \overline{X}\,Y + \overline{X}\,\overline{Y}$

(b) Explain Cayley's theorem by using an example. **(3)**

(c) Explain homomorphism, isomorphism and automorphism? **(3.5)**

Unit-IV

Q8 (a) Give the proof of Euler's formula. Suppose that a connected planar simple graph has 20 vertices, each of degree 3. Into how many regions does a representation of this planar graph split the plane. **(4.5)**

(b) Show that if $a^2 = e$ for all a in a group G (A, *), then G is commutative. **(4)**

(c) Explain the 5 color theorem with suitable example. **(4)**

Q9 Write short notes on:

(a) Lagrange's theorem **(4)**

(b) Normal Subgroups and Ring **(4)**

(c) Euler and Hamiltonian paths **(4.5)**

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