D 51033 (Pages 2) Name.........................

Reg. No.........................

THIRD SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, NOVEMBER 2013

CS/IT 09 304—DISCRETE COMPUTATIONAL STRUCTURES

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *questions.*
Each question carries 2 *marks.*

1. Distinguish between universal and existential quantifiers.
2. What do you mean by equivalence relation ?
3. Explain inverse function with an example.
4. Define Group codes.
5. What do you mean by hamming matrix ?

($5 \times 2 = 10$ marks)

Part B

Answer any **four** *questions.*
Each question carries 5 *marks.*

6. Using truth table verify that the proposition $(P \wedge Q) \wedge \neg (P \vee Q)$ is a contradiction.
7. By using truth table verify whether the following specifications are consistent: "Whenever the system software is being upgraded users cannot access the file system. If users can access the file system, then they can save new files. If users cannot save new files then the system software is not being upgraded".
8. If $f : A \to B$ and $g : B \to C$ are mappings and $g \circ f : A \to C$ is one-to-one (Injection), prove that f is one-to-one.
9. Prove that monoid homomorphism preserves invertibility and monoid epimorphism preserves zero element (if it exists).
10. Show that group homomorphism preserves, identity, inverse and subgroup.
11. Is the lattice of divisors of 32 a Boolean algebra ?

($4 \times 5 = 20$ marks)

Turn over

Part C

Answer section (a) **or** *section (b) of each question.*
Each question carries 10 *marks.*

12. (a) Prove that any proposition e can be transformed into CNF.

Or

(b) (i) Translate the following predicate calculus formula into English sentence $\forall x\, [C(x) \vee \exists y\, (C(y) \wedge F(x, y)]$. Here $C(x)$: x has a computer, $F(x, y)$: x and y are friends. The universe for both x and y is the set of all students of your college.

(ii) Check whether 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".

13. (a) (i) $f: X \to Y$

(1) How many different functions are possible ?

(2) How many different one-to-one functions are possible ?

(ii) Define equivalence class. Find all equivalence classes of a congruence relation mod 5 on the sets of integer.

Or

(b) Let G be a (p, q) graph. Let M be the maximum degree of the vertices of G and let m be the minimum degree of the vertices of G. Show that $m \leq \frac{2q}{p} \leq M$.

14. (a) Let S be the set of real numbers except -1. Define * on S by $a*B = a + b + ab$. Show that (S,*) is abelian group.

Or

(b) State and prove Fundamental theorem on homomorphism of groups Let (G , *) be a finite cyclic group generated by an element $a \in G$. If G is of order n prove that $a^n = e$ and $G = \{a, a^2, ..., a^n = e\}$ where n is the least positive integer for which $a^n = e$.

15. (a) Using generating function, solve $f(n) = f(n-1) + f(n-2)$; $f(0) = 1, f(1) = 1$.

Or

(b) Solve $s(k) - 10\, s(k-1) + 9\, s(k-2) = 0$ with $s(0) = 3$, $s(1) = 11$.

($4 \times 10 = 40$ marks)