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Question Paper Code : 11141

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2014.

Fifth Semester

Computer Science and Engineering

080230017 — DISCRETE MATHEMATICS

(Regulation 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define tautology.

2. Construct the truth table for $P \to Q$.

3. Define existential quantifier

4. Give the symbolic form of the expression : Some men are giant.

5. Let $A = \{a, b, c\}$ and $B = \{1, 2, 3\}$. Then find $A \times B$.

6. Define a relation on a set and give an example.

7. If $f : A \to B$, where $A = \{1, 2, 3, 4\}$ and $B = \{a, b, c, d\}$ is defined by $f = \{(1, a), (2, a)\ (3, c), (4, d)\}$. Show that f is a function, but f^{-1} is not.

8. If A is a subset of a universal set U, prove that $\psi_A(x) = 0$ if and only if $A = \phi$.

9. Give any two properties of a group.

10. Define a semigroup.

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Show that the following premises are inconsistence.

(1) If jack misses many classes through illness, then he fails high school.

(2) If Jack fails high school, then he is uneducated

(3) If Jack reads a lot of books, then he is not uneducated.

(4) Jack misses many classes through illness and reads a lot of books. (8)

(ii) P.T. $P \to S$ is a valued conclusion of the premise.

$\neg P \vee Q, \neg Q \vee R, R \to S$. (8)

Or

(b) (i) Obtain the principle conjunctive normal form of $(\neg P \to R) \wedge (Q \leftrightarrow P)$. Hence find its pdnf. (8)

(ii) Show that $(\neg P \wedge (\neg Q \wedge R) \vee (Q \wedge R) \vee (P \wedge R) \Leftrightarrow R$, without using truth table. (8)

12. (a) (i) Prove that $(\exists x)[P(x) \wedge Q(x)] \Rightarrow (\exists x) P(x) \wedge (\exists x) Q(x)$. Is the converse true? (8)

(ii) Show that the premises "one student in the class knows how to write programs in JAVA" and "Everyone who knows how to write program in JAVA can get a high-paying job" imply the conclusion "Someone in this class can get a high-paying job". (8)

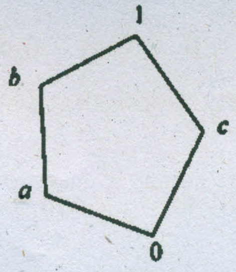
Or

(b) (i) Show that $\exists(x)\ M(x)$ follows logically from the premises (x) $[H(x) \to M(x)]$ and $\exists(x)\, H(x)$. (8)

(ii) Show that $\neg P(A, B)$ follows logically from $(x)(y)[P(x, y) \to W(x, y)]$ and $\neg W(a, b)$. (8)

13. (a) (i) In a complemented and distributive lattice, prove that complement of each element is unique. (8)

(ii) Prove that the lattice whose Hasse diagram given below is not modular. (8)



Or

(b) (i) Let $A = \{1, 2, 3, 4, 5, 6, 7\}$. Define R on A by xRy if and only if $x - y$ is divisible by 3. Prove that R is an equivalence relation. (8)

(ii) State and prove De Morgan's laws in Boolean algebra. (8)

14. (a) (i) Let $A = \{1, 2, 3\}$ and f, g, h and s be function from A to A given by

$f = \{(1, 2)\ (2, 3)\ (3, 1)\}$; $g = \{(1, 2)\ (2, 1)\ (3, 3)\}$

$h = \{(1, 1)\ (2, 2)\ (3, 1)\}$; $s = \{(1, 1)\ (2, 2)\ (3, 3)\}$.

Find $f \circ g$, $g \circ f$, $f \circ h \circ g$, $g \circ s$, $s \circ s$, $f \circ s$. (8)

(ii) Show that the function $f(x, y) = x + y$ is primitive recursive function. Hence compute the value of $f(2, 3)$. (8)

Or

(b) (i) Let f, g be $f : N \to N$ defined by $f(n) = n + 1$, $g(n) = 2n$.

Find $f \circ f, f \circ g, g \circ f, f \circ g$. (8)

(ii) Let $A = \{1, 2, 3\}$.

(1) List all the permutations from A to A

(2) Find square all the permutation

(3) Find inverse all the permutations

(4) Prove that product of permutation is again a permutations. (8)

15. (a) State and prove Lagrange's theorem. Is the converse true. (16)

Or

(b) Find the code words generated by the parity check matrix $H = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

when the encoding function is $e : B^3 \to B^6$. (16)