M.Sc. DEGREE EXAMINATION, OCTOBER/NOVEMBER 2015.

FIRST SEMESTER

Computer Science

Paper I — DISCRETE MATHEMATICAL STRUCTURES

Time : Three hours   Maximum : 75 marks

(No additional sheet will be supplied)

PART A — (5 × 3 = 15 marks)

Answer any FIVE questions.

Each question carries 3 marks.

Each answer should not exceed 1 page.

1. State the generalized pigeonhole principle.

2. Find the truth value of the proposition $(p \to q) \vee (\sim p \to r)$ if p and r are true q is false.

3. Define equivalence relation.

4. Define Euler path.

5. Determine whether usual multiplication on the set $A = \{1, -1\}$ is a binary operation.

6. Define primitive recursive function.

7. Using truth table verify that the proposition $(P \wedge Q) \wedge \neg(P \vee Q)$ is a contradiction.

8. What are free and bound variables in predicate logic?

PART B — (4 × 15 = 60 marks)

Answer ALL questions.

Each question carries 15 marks.

Each answer should not exceed 6 pages.

9. (a) Define Normal form. Explain the conversion between Normal forms.

    (b) Show that $(\exists x)(A(x) \wedge B(x)) \Rightarrow (\exists x) A(x) \wedge (\exists x) B(x)$.

Or

10. Let $U = \{1, 2, 3, 4, 5\}$, $A = \{1, 5\}$, $B = \{1, 2, 3, 4\}$ and $C = \{2, 5\}$. Determine the following sets.

    (a) $(A \cup B) \cap (A \cup C)$

    (b) $(A \cap B) \cup (B \cup C)$.

11. (a) What is well-ordering principle? Example.

    (b) Find the gcd of 380 and 68.

Or

12. (a) A computer password consists of a letter followed by 3 characters and 2 digits. Find the total number of possible passwords.

    (b) Solve the recurrence relation $a_n - 9a_{n-1} + 26a_{n-2} - 24a_{n-3} = 0$ for $n \geq 3$ by generating functions.

13. (a) If n is a positive integer then, prove that $C(n,0) + C(n,2) + \ldots = C(n,1) + C(n,3) + \ldots = 2^{n-1}$.

    (b) State the principle of inclusion-exclusion.

Or

14. (a) How many numbers can be formed using the digits 1, 3, 4, 5, 6, 8 and 9 if no repetitions are allowed?

    (b) Prove that $C(n,r) = C(n-1, r) + C(n-1, r-1)$.

15. Define a planar graph. State and prove the Euler's formula for planar graph.

Or

16. (a) Show that the number of vertices of a graph with odd degree is even.

    (b) Show that a simple connected planar graph with 8 vertices and 13 edges cannot be 2 colored.

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