

AMIETE – CS (OLD SCHEME)

Code: AC10
Time: 3 Hours

JUNE 2011

Subject: DISCRETE STRUCTURES
Max. Marks: 100

NOTE: There are 9 Questions in all.

- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 Minutes of the commencement of the examination.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

Q.1 Choose the correct or the best alternative in the following: (2×10)

a. Let $S = \{a, b, \phi\}$ then number of elements in power set $P(P(S))$ is

- (A) 8 (B) 16
(C) 256 (D) 512

b. Number of reflexive relations that can be defined on a set A with 4 elements is

- (A) 1024 (B) 4096
(C) 16 (D) 2048

c. How many nodes of degree two you can find in a complete binary tree T having 20 leaf nodes?

- (A) 8 (B) 18
(C) 19 (D) 20

d. Which of the following production rule generates a language in $\{0, 1\}$ that terminates in substring "01".

- (A) $P = \{S \rightarrow 0S, S \rightarrow 1S, S \rightarrow 01\}$ (B) $P = \{S \rightarrow 01S, S \rightarrow 10S, S \rightarrow 1\}$
(C) $P = \{S \rightarrow 0A, A \rightarrow 1S, S \rightarrow 01\}$ (D) $P = \{S \rightarrow 00S, S \rightarrow 11S, S \rightarrow 01\}$

e. In how many ways can a party of 7 persons arrange themselves around a circular table?

- (A) 7! (B) 8!
(C) 6! (D) 7

f. A bounded Poset has

- (A) Only least element (B) Only greatest element
(C) Both least and greatest element (D) Only minimal element

g. The proposition $(p \vee (p \rightarrow q))$ is equivalent to which of the following?

- (A) $\neg p \vee (p \rightarrow q)$ (B) q
(C) F (D) T

h. Converse of the statement 'I stay only if you go' is

- (A) I shall not stay if you don't go. (B) I stay if you don't go.
(C) I shall not stay if you go. (D) If you go then I shall not stay.

i. A regular language is produced by

- (A) Type I grammar (B) Type II grammar
(C) Type III grammar (D) Type 0 grammar

j. Two matrices A and B of order $m \times n$ and $p \times q$ respectively, are said to be conformal for multiplication if

- (A) m is equal to p (B) n is equal to p
(C) n is equal to q (D) m is equal to q

Answer any FIVE Questions out of EIGHT Questions.

Each question carries 16 marks.

Q.2 a. Let $A = \{a, b, c, d, e\}$ and $R = \{(a, a), (a, b), (b, c), (c, e), (c, d), (d, e)\}$ then compute (i) R^2 and (ii) R^∞ (8)

b. Prove that the relation "congruence modulo 3" is an equivalence relation in the set of integers. (8)

Q.3 a. Show that $n^3 + 2n$ is divisible by 3. (8)

b. Prove that the sum of two rational numbers is a rational number. Using the proof show that the sum of a rational number and an irrational number is an irrational number. (8)

Q.4 a. Let L be a distributive Lattice. For any $a, b, c \in L$, show that if $a \wedge b = a \wedge c$ and $a \vee b = a \vee c$ then $b = c$ (8)

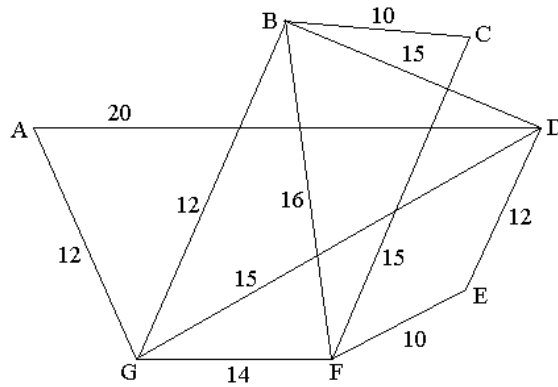
b. Simplify the Boolean function: $F(x, y, z) = \sum (0, 1, 2, 3, 4, 6)$ (8)

Q.5 a. Without using truth table, prove De Morgan's law of addition and multiplication of Boolean variables x and y i.e.

- (i) $(x + y)' = x' \cdot y'$
(ii) $(x \cdot y)' = x' + y'$ (8)

b. Prove that $p \rightarrow q \equiv \neg p \vee q$ (8)

- Q.6** a. Find minimum spanning tree using Krushkal's algorithm of the following graph. (10)



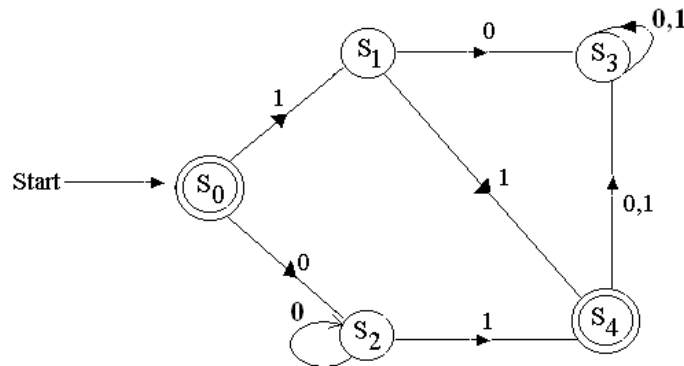
- b. Define the following terms: Quotient graph, Bipartite graph, Regular graph. (6)

- Q.7** a. State and prove Pigeonhole principle. (8)

- b. In a class there are 35 girls and 25 boys. 5 students are selected at random from the class. What is the probability that out of five at least two are girl? (8)

- Q.8** a. State and prove pumping lemma for regular language. (8)

- b. Simplify the following FSM. (8)



- Q.9** Write a short note on the following:

- (i) Transitive Closure
- (ii) Principle of Mathematical Induction
- (iii) Isomorphic graph
- (iv) Types of Grammar

(4×4)