

NEPAL COLLEGE OF INFORMATION TECHNOLOGY

Model Set: II

Program : BE SE
Semester : I
Subject : DS

Time : 3 hrs
FM: 100
PM: 45

- ✓ Candidates are requested to give their answer as far as practicable in their own words.
- ✓ Attempt all questions
- ✓ Figure on the margin indicates full marks

1. (a) Explain the Hamiltonian path and Hamiltonian circuit with the help of a diagram. State the necessary and sufficient conditions for Euler circuits and paths. How is Euler circuit different from the Hamiltonian circuit? [8]
- (b) What is chromatic number of a complete graph and bipartite graph? Explain real world application of graph theory. [7]

OR

Explain different techniques of Graph Representation.

2. (a) Define the terms Tautology, Contradiction and Logical Equivalences. Show that Implication and Contrapositive are Logically Equivalent. State the converse, contrapositive and Inverse of the statement: "A positive integer is prime only if it has no divisors other than 1 and itself. [8]
- (b) Using rules of inferences, show that the hypotheses "if you send me an e-mail message, then I will finish writing the program," "if you do not send me an e-mail message, then I will go to sleep early," and "If I go to sleep early, then I will wake up feeling refreshed" lead to the conclusion "If I do not finish writing the program, then I will wake up feeling refreshed." [7]
3. (a) Translate the following statement using quantifiers and logical connectives: [8]
- i. Some student in your class has voted for Balen.
 - ii. Everyone who sees Mary loves Mary.
 - iii. A goal without plan is just a dream.
 - iv. Behind every successful man there is a women.

OR

Use Mathematical induction to show that:

$2 - 2.7 + 2.72 + \dots + 2.(-7)^n = [1 - (-7)^{n+1}]/4$ whenever n is positive integer.

- (b) Solve Tower of Hanoi puzzle using iterative approach. [8]
4. (a) Solve: $a_n - 6a_{n-1} + 8a_{n-2} = 3$ with initial condition $a_0 = 10$, $a_1 = 25$. [7]
- (b) What is an Equivalence relation. Let 'm' be an integer with $m > 1$. Show that the relation $R = \{(a, b) \mid a \equiv b \pmod{m}\}$ is an equivalence relation on the set of integers. [8]

5. (a) What are key differences between DFA and NFA? Design a Deterministic finite automata that accepts all those strings that starts and ends with different symbol over (a, b). [8]
- (b) Define grammar with an example. Write regular expression for following languages and convert it into equivalent Automata. [7]
- i. $L = \{w: w \text{ starts with 'a' and ends with 'b' over } (a, b)\}$
 - ii. $L = \{w: \text{second symbol of } w \text{ is '0' and fourth symbol is '1' over } (0, 1)\}$
6. (a) What is pigeonhole principle? How many cards must be selected from a standard deck of 52 cards to guarantee that: [5]
- a) At least three cards of the same suit are chosen?
 - b) At least three cards of same value are selected?
- (b) Define injective and surjective function. Determine whether a function $f(x) = 2x + 3$ from the set of real numbers to the set of real numbers is bijective? [5]
- (c) Explain computer representation of sets and set operations. [5]
7. Write short notes on (any two): [2*5]
- (a) Indirect proof
 - (b) Transport Network
 - (c) Predicate Logic