Tribhuwan University
Institute of Science and Technology
2078

Bachelor Level / second-semester / Science Full marks: 60 **Computer Science and Information Technology(CSC160)** Pass marks: 24
(Discrete Structures) Time: 3 hours Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.

Group A

Long answer questions:

Attempt any Two questions:

1. Prove that for all integers x and y, if x^2+y^2 is even then x+y is even. Using induction prove that $1^3+2^3+.....+n^3 = n^2(n+1)^2/4$. [5+5]

2. State division and remainder algorithm. Suppose that the domain of the propositional function P(x) consists of the integers 0, 1, 2, 3 and 4. Write out each of following propositions using disjunctions, conjunctions and negations. [4+6]

a. ∃x P(x)

b. ∀x P(x)

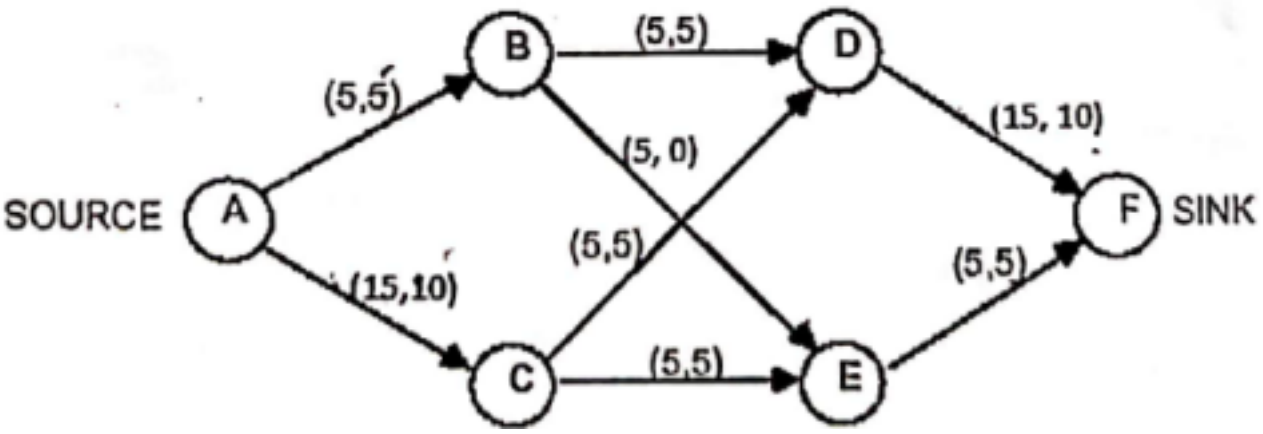
c. ∃x ¬P(x)

d. ∀x ¬P(x)

e. ¬∃x P(x)

f. ¬∀x P(x)

3. List the necessary conditions for the graphs to be isomorphic with an example. Find the maximal flow from the node SOURCE to SINK in the following network flow. [5+5]



Group B

Short answer questions:

Attempt any Eight questions:

4. What is the coefficient of x^7 in $(1+x)^{11}$? Describe how correlation can be represented using matrices.

[2+3] 5. Solve the recurrence relation $a_n = 5n_{n-1} - 6n_{n-2}$ with initial conditions $a_0 = 1$, $a_1 = 4$. [5]

6. Prove that if n is a positive integer, then n is odd if and only if 5n+6 is odd. [5]

7. Define propositions. Consider the argument "John, a student in this class knows how to write programs in C. Everyone who knows how to write a program in C can get a high paying job. Therefore, someone in this class can get a high paying job." Now, explain which rules of inferences are used for each step. [1+4]

8. Show that if there are 30 students in a class, then at least two have the same names that begin with the same letter. Explain Pascal's triangle. [2.5+2.5]

9. Illustrate the Dijkstra's Algorithm to find the shortest path from source node to destination node with an example. [5] (c) -

10. What is the significance of Minimal Spanning Tree? Describe how Kruskal's algorithm can be used to find the MST. [2+3] 11.

Define zero-one matrix. Explain the types of function. [1+4]

12. Represent any three set operations using Venn diagrams. Give a recursive defined function to find the factorial of any given positive integer. [3+2]