COURSE NUMBER/TITLE: MSCS-280 [354-344] GRAPH THEORY WITH APPLICATIONS IN COMPUTER SCIENCE

CREDITS: 3


TEXTBOOK: Graph Theory & Applications, 1st Ed., by Fournier (adopted Fall 2011)
Previous:
Applied Algorithmic Graph Theory, 1st Ed., by Chartrand (adopted S95)

COURSE OBJECTIVES:
Upon completion of this course, students will be able to:

1. Demonstrate understanding of the basic definitions, computer representations, and properties of a graph.
2. Demonstrate understanding of the fundamental theorems of graph theory.
3. Identify different kinds of special graphs and describe the basic properties of each kind.
4. Show certain characteristics of a graph under its given description.
5. Demonstrate understanding of the basic principles of important graph algorithms such as finding shortest path, directed or undirected cycle, minimum spanning tree, maximum flow and minimum cut, etc. and be able to implement programs for them.
6. Demonstrate understanding of the basic techniques and strategies of applying graph theory to solve advanced data structures and other real world problems on a computer system.

COURSE OUTLINE:
I. Introduction to Graph Theory (objectives 1, 2, 3, 4)
   - Graphs and Data Structures for Representing Graphs
   - Basic Properties of Graphs
   - Isomorphic Graphs
   - Special Graphs
II. Trees (objectives 2, 3, 5, 6)
   - Properties of Trees and Forests
   - Binary Tree, Balanced Binary Tree
   - Rooted Tree, Directed Tree, and Undirected Tree
   - Minimum Spanning Tree of a Graph, Algorithms and Implementation
III. Paths and Distance in Graphs (objectives 2, 3, 5, 6)
   - Shortest Path, Algorithms and Implementation
   - Cycle and Distance in Weighted Graphs and Digraphs
   - Distance Algorithms and Implementation
- Eulerian Graphs and Hamiltonian Graphs with Applications

IV. Flow Networks (objectives 2, 5, 6)
   - Introduction to Flow Networks
   - Max-Flow Min-Cut Theorem, Application, Algorithms and Implementation

V. Graph Colorings (objectives 2, 3, 4)
   - Edge-Coloring, Vertex-Coloring
   - Planar Graphs and Face-Coloring with Applications
   - Four Color Theorem

VI. Other Topics (optional) (objectives 5, 6)
   - Deadlock of Computer System
   - Matching Algorithms
   - Dominance
   - Ramsey Theory