

# INTRODUCTION TO GRAPH THEORY

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## Ch.0 Preliminaries

1. Sets, relations, functions, & multi-sets
2. Inductive definitions & proofs by induction
3. Cardinality of sets.

## Ch.1 Basic concepts of Graph Theory (21 pages)

1. Digraphs, graphs & other similar objects
2. Representations of digraphs & graphs
3. Operations on graphs, degree sequence & isomorphism

## Ch.2 Connectedness and Distance (17 pages)

1. Walks, trails, circuits, cycles, and paths
2. Connected digraphs and graphs
3. Weighted graphs & digraphs and distance

## Ch.3 Trees and their applications (20 pages)

1. Basic properties of trees & forests
2. Minimum-weight spanning trees
3. Enumeration of labelled trees
4. Rooted trees & uniquely decipherable codings
5. Tree traversals & parentheses-free notations.

Ch.4 Networks and flows (10 pages)

1. Legal flows & capacities of cuts
2. The Ford-Fulkerson Algorithm & Maxflow-Mincut theorem

Ch.5 Edge and Vertex traversal problems (12 pages)

1. Euler circuits & Euler trails
2. Fleury's algorithm & the Chinese Postman problem
3. Hamilton cycles & the Travelling Salesman problem.

Ch.6 Planar embeddings of graphs (19 pages)

1. Basic properties of planar graphs
2. Kuratowski's theorem & non-planar graphs
3. The DMP planarity algorithm
4. Polyhedral graphs & the geometric dual

Ch.7 Colorings & Matchings in graphs (12 pages)

1. Legal colorings & k-colorable graphs
2. Chromatic Polynomial & Four-color theorem
3. Matchings in graphs & Stable marriage algorithm.

Ch.8 Infinite graphs & digraphs (not for the F1U course)