

Math 412 Introduction to Graph Theory  
Fall 2004 — Sections G1U and G1G — University of Illinois

Tentative Schedule of Classes

| Lec. | Sec.  | Topics  |
|------|-------|---|
| 1    | 1.1   | course introduction, graph models, definitions                  |
| 2    | 1.1   | isomorphism, decomposition                                      |
| 3    | 1.2   | walks, connection, bipartite characterization                   |
| 4    | 1.2   | airline application, Eulerian characterization                  |
| 5    | 1.2/3 | Eulerian graphs, decomposition, vertex degrees, counting        |
| 6    | 1.3   | extremal problems, large bipartite subgraph                     |
| 7    | 1.3   | Mantel, induction trap, graphic sequences                       |
| 8    | 1.4   | digraphs, De Bruijn, kings                                      |
| 9    | 2.1   | tree characterization, properties                               |
| 10   | 2.1   | distance, diameter, center, distance-sum                        |
| 11   | 2.1/2 | Bridg-It, Cayley's Formula                                      |
| 12   | 2.2   | spanning trees  |
| 13   | 2.3   | graceful labelings, Kruskal's Algorithm                         |
| 14   | 2.3   | Dijkstra's Algorithm, Chinese Postman problem, maximum matching |
| 15   | 3.1   | Hall's Theorem, König-Egervary Theorem                          |
| 16   | 3.1   | Gallai's Theorem, König's Theorem                               |
| 17   | 3.2   | augmenting path, weighted bipartite matching                    |
| 18   | 3.2/3 | stable matching, 1-factors                                      |
| 19   | 3.3   | factors in graphs, applications                                 |
| 20   | 4.1   | connectivity  |
| 21   | 4.1   | edge-connectivity, bonds, blocks                                |
| 22   | 4.1/2 | Whitney, ear decomposition, digraphs, Robbins                   |
| 23   | 4.2   | Menger's Theorems   |
| 24   | 4.2/3 | Menger applications, network flow to aug path or duality        |
| 25   | 4.3   | duality, max-min, integral flows, applications                  |
| 26   | 5.1   | coloring definitions, examples, greedy coloring                 |
| 27   | 5.1   | interval graphs, Gallai/Roy, Brooks                             |
| 28   | 5.2   | Mycielski, Turán  |
| 29   | 5.2   | color-critical, edge-connectivity, $K_4$ -subdivision           |
| 30   | 5.3   | chromatic polynomial  |
| 31   | 5.3   | chordal graphs, perfect graphs                                  |
| 32   | 6.1   | planar duals  |
| 33   | 6.1   | outerplanar, Euler's formula, Platonic solids                   |
| 34   | 6.2   | Kuratowski's Theorem  |
| 35   | 6.2/3 | planarity testing, 4 color theorem                              |
| 36   | 6.3   | crossing number, genus  |
| 37   | 7.1   | edge-coloring   |
| 38   | 7.1   | Vizing's Theorem  |
| 39   | 7.2   | Hamiltonian cycles up to closure                                |
| 40   | 7.2   | Chvátal, Chvátal-Erdős  |
| 41   | 7.3   | Tait, Grinberg  |