

MAT 1060. Mathematics of Decision Making. 3 hours.

Applications of modern mathematics to management and decision making, including the solution of optimization problems using network theory, methods for optimal scheduling, voting methods, game theory, and related strategies. Applications include planning of postal delivery routes, placement of cable television lines, United States Congressional apportionment, and dispute resolution.

Text: *For All Practical Purposes: Mathematical Literacy in Today's World* (6th ed.), by J. Malkevich et al., Freeman 2003.

- I. Management (chapters 1, 2, 3) (4 weeks)
 - A. Highway inspector problem (2 weeks)
Euler's algorithm
Optional topic: Chinese Postman Problem (unsimplified)
Suppl. text: *The Chinese Postman Problem*, by V. K. Balakrishnan, COMAP 1986
 - B. Travelling salesman problem (1 week)
Heuristic algorithms: nearest neighbor, sorted edges
Optional topic: minimum cost spanning trees
 - C. List processing algorithm (1 week)
Scheduling paradoxes, bin packing
Optional topic: Critical path schedules
- II. Codes (chapters 9, 10) (2 weeks)
 - A. Check digits and bar codes (1 week)
 - B. Hamming codes (1 week)
- III. Voting (chapters 12, 13, 14, 15) (5 weeks)
 - A. Voting methods (1 week)
Majority, plurality, elimination, Borda, Condorcet
 - B. Weighted voting (2 weeks)
Banzhaf power index
 - C. Congressional apportionment (2 weeks)
Methods of Hamilton, Jefferson, Adams, Webster, Hill-Huntington
Optional topic: Fair division
- IV. Games (chapter 16) (2 weeks)
 - A. Two-person zero-sum games (1 week)
Game matrix, saddles, dominant strategy, expected value, mixed strategy
 - B. Non zero-sum games (1 week)
Prisoner's dilemma, chicken
Suppl. text: *Game Theory, A Nontechnical Introduction*, by M. Davis, Dover 1997

The total of 13 weeks leaves an extra two weeks for optional topics, projects, and review.

Note that the four units are independent, and so they can be done in any order.