

MATH 130

Study Guide for Exam 2, Chapters 4, 5 and 6

This is a list of topics that could be used to generate questions for Exam 2. Pages and questions from the text are included, but be sure to also study the types of problems from the online material.

- Chapter 4: Apportionment

1. Know the following vocabulary terms: (pages 127 and 128)

– apportionment	method	– upper quota
problem	– standard divisor	– divisor (modified)
– states	– standard quota	– modified quota
– seats	– lower quota	– geometric mean
– apportionment		

2. Apportionment introduction (section 4.1 and questions 1-6 on pages 128 and 129)
 - (a) Calculate the standard divisor.
 - (b) Discuss the standard divisor using units.
 - (c) Calculate the standard quotas, lower quotas and upper quotas.
 - (d) Calculate the number of surplus seats if the lower quotas are allocated.
 - (e) Calculate the number of surplus seats if the upper quotas are allocated.

3. Find the final apportionment using the following methods:
 - (a) Hamilton’s Method (section 4.2, questions 11-20 on page 130)
 - (b) Jefferson’s Method (section 4.3, questions 21-28 on pages 130 and 131)
 - (c) Adams’s Method (page 115, questions 31-34 on page 131)
 - (d) Webster’s Method (page 115-117, questions 35-38 on page 131)
 - (e) Huntington-Hill Method (section 4.5, questions 41-50 on pages 131 and 132)

4. Know the Quota Rule and Paradoxes and recognize when a violation has occurred. (section 4.6, questions 51-65 on pages 132-134)
 - (a) Quota Rule
 - (b) Alabama Paradox
 - (c) Population Paradox
 - (d) New States Paradox

5. For each allocation method, know which paradox may apply and if the method can violate the quota rule. (page 125)

• Chapter 5: Graphs (Euler)

1. Recognize routing problems (section 5.1)

2. Know the following vocabulary terms: (pages 144-149)

- | | | |
|---------------------|--------------------|--------------------------------|
| – graph | – degree | – circuit, Euler circuit |
| – vertex(vertices) | – odd/even vertex | – length of a circuit/path |
| – edge | – clique | – connected/disconnected graph |
| – vertex set | – simple graph | – components |
| – adjacent vertices | – isolated vertex | – bridge |
| – loop | – adjacent edges | |
| – multiple edges | – path, Euler path | |

3. Interpret graphs

(a) Apply vocabulary terms to answer questions about a given graph. (pages 144-149, questions 1-18 on pages 164-166)

(b) Construct a graph to model a given scenario. (pages 150-152, questions 19-28 on pages 166,167)

4. Apply Euler's Theorems to determine if a graph has an Euler Circuit or an Euler Path or neither. (pages 152-154, questions 29-34 on page 168)

5. Apply Fleury's algorithm to find an Euler path or an Euler Circuit. (pages 154-157, questions 35-42 on pages 168-169)

6. Find an eulerization or a semi-eulerization of a graph. (pages 158-162, questions 43-57 on pages 169-170)

(a) Identify the minimum number of edges needed for the eulerization.

(b) Count the number of duplicate edges (deadhead) in an eulerized graph.

(c) Count the total number of edges (including duplicates) in an eulerized graph.

(d) Determine if the eulerization is optimal.

- Chapter 6: Graphs (Hamilton)

1. Recognize TSP problems (section 6.1)
2. Know the following vocabulary terms: (pages 194-195)

– tour	cluding notation, i.e.	– nearest-neighbor
– optimal tour	K_{23})	tour
– TSP	– inefficient algorithm	
– Hamilton Circuit	– approximate algo-	– repetitive nearest
– Hamilton Path	rithm	neighbor tour
– complete graph (in-	– relative error	– cheapest-link tour
3. Find Hamilton Circuits and Paths on a given graph. (pages 179-181, questions 1-16 on pages 195-197)
4. Calculate the weight of a tour. (pages 183-185, questions 17-20 on pages 197 and 198)
5. For complete graphs, employ the the formulas relating the number of vertices to the degree of each vertex, number of edges, number of Hamilton Paths, and the number of Hamilton Circuits. (pages 181 and 182, questions 23-26 on page 198)
6. Name Hamilton Circuits and Paths by listing the vertices in order of travel. Note that one circuit can be named in many ways. (top of page 181)
7. Apply the following algorithms:
 - (a) Brute Force Algorithm (pages 183-186, questions 27-32 on pages 198 and 199)
 - (b) Nearest-Neighbor Algorithm (pages 186-188, questions 35-42 on pages 199 and 200)
 - (c) Repetitive Nearest-Neighbor Algorithm (pages 188-190, questions 43-46 on page 200)
 - (d) Cheapest-Link Algorithm (pages 190-194, questions 49-54 on page 201, question 69 on pages 202,203)
8. Calculate the relative error of a tour. (page 188, questions 55 and 56 on page 201)
9. For K_4 and K_5 , determine if a tour is optimal.