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Introduction to Contemporary Math
MATH 160
Exam 1 – Summer 1998

You must show all relevant work to receive full credit. The point value of each problem is shown in the left-hand margin.

(8 pts.) 1. Describe all of the symmetries of the following figures.

(a)

(b)

(c)

(d)

(8 pts) 2. The box plot below represents a comparison of the starting salaries for mathematicians and statisticians.

(a) What was the minimum starting salary for a mathematician?

(b) What was the interquartile range for the statisticians?

(c) What was the range for mathematicians?

(d) True or False? The average starting salary for a mathematician was less than what $\frac{3}{4}$ of the statisticians started at.

(9 pts) 3. An urn contains 5 red marbles and 2 white marbles. Three marbles are randomly chosen from the urn. Compute the following probabilities.

(a) Pr (all 3 are white):

(b) Pr (all 3 are red):

(c) Pr (at least 2 are red):

(10 pts) 4. In an election there are four candidates: A, B, C, and D. The voter preference schedule is given below.

Number of voters	8	6	5	3
1st choice	A	B	C	B
2nd choice	C	D	A	C
3rd choice	B	C	D	D
4th choice	D	A	B	A

(a) Use the plurality-with-elimination method to determine the winner of the election.

(b) Use the recursive plurality method to rank the candidates.

(8 pts) 5. Five people A, B, C, D, and E agree to divide a pie using the last diminisher method. The players play in the order A, B, C, D, and E.

Suppose there are no diminishers in round 1 and C and D are the only diminishers in round 2.

(a) Which player gets her fair share at the end of round 1?

(b) Which player is the first to cut the pie at the beginning of round 2?

(c) Which player gets her fair share at the end of round 2?

(d) Which player is the first to cut the pie at the beginning of round 3?

(10 pts) 6. A country has four states and 250 seats in its legislature. The population of each state is given below (in millions).

State	P	Q	R	S
Population (in millions)	2.25	3.15	1.95	2.65

(a) Find the apportionment using Hamilton's Method.

(b) Find the apportionment using Webster's Method.

(8 pts) 7. A country has four states: A, B, C, and D. Each state's standard quota is given in the chart below, and the population of state C is 7,091.

State	A	B	C	D
Standard Quota	3.71	2.59	10.13	5.57

Find the total population of the country.

(9 pts) 8. Consider the graph given below.

(a) List the vertices and their corresponding degrees.

(b) List all of the bridges in the graph.

(c) Determine if this graph contains an Euler path. Explain why or why not. (You do not actually have to find an Euler path if there is one.)

(10 pts) 9.(a) Find an optimal Eulerization for the graph below.

(b) Find an Euler circuit in the graph below.

(10 pts) 10.(a) Find a Hamilton circuit in the graph given below.

(b) In each of the following graphs, determine which are complete and which are not.

(i)

(ii)

(iii)

(10 pts) 11. Consider the weighted graph below.

(a) Use the nearest neighbor algorithm to find a Hamilton circuit, starting at C .

(b) Find the optimal Hamilton circuit using the brute force algorithm.