Problems for Section 4.1

Sharpen Your Skills: (Answers in back of text.)

1. The Math Club is electing its president by choosing among three candidates, Ruth, Sue, and Tom (denoted R, S, and T below). The other 9 members of the club turn in these preference ballots.

	Anne	Brad	Carla	Dave	Ed	Fran	Greg	Harry	Ian
First:	R	T	T	S	R	T	S	R	T
Second:	S	R	S	R	T	R	R	S	S
Third:	T	S	R	T	S	S	T	T	R

(a) Give the preference schedule for this election.

First:						
Second:						
Third:						

(b) Find the winner of the election using:

(i) The Plurality Method.

(ii) The Borda Count Method.

2. Twelve students rank Coke, Sprite, Pepsi, and Mountain Dew (denoted C, S, P, and M below) on their preference ballots as shown.

	Alice	Ben	Cal	Don	Ed	Fred	Gil	Hap	Ian	Jan	Ken	Lon
First:	S	C	P	C	C	C	S	C	S	S	C	S
Second	P	P	M	P	P	P	P	P	P	P	P	P
Third:	C	M	C	S	S	M	C	S	C	C	M	C
Fourth:	M	S	S	M	M	S	M	M	M	M	S	M

(a) Give the preference schedule for this election.

First:					
Second:					
Third:					
Fourth:					

(b) Find the winner of the election using:

(i) The Plurality Method.

(ii) The Borda Count Method.

3. A committee of 35 faculty is used to rank candidates W, X, Y, and Z for the position of Dean. They rank the candidates according to the following table:

Number of faculty:	8	7	9	4	7
First	Z	X	Y	Z	Z
Second	X	Y	X	Y	Y
Third	Y	W	W	X	W
Fourth	W	Z	Z	W	X

(a) Find the winner of the election using the Plurality Method.

(b) Find the winner of the election using the Borda Count Method.

4. A poll of judges is used to choose a winner from among three pieces of artwork (labelled A, B, and C) submitted for a competition. The following table shows the ranking of the judges.

Number of judges:	8	6	4	4	3
First	B	A	C	C	A
Second	C	B	B	A	C
Third	A	C	A	B	B

(a) Find the winner of the election using the Plurality Method.

(b) Find the winner of the election using the Borda Count Method.

5. An election among four candidates W, X, Y, and Z has the following preference schedule:

Number of voters:	5	8	9	1	4
First	Z	W	Y	X	W
Second	Y	X	Z	W	Y
Third	X	Z	W	Z	X
Fourth	W	Y	X	Y	Z

(a) Find the winner of the election using the Plurality Method.

(b) Find the winner of the election using the Borda Count Method.

Problems for Section 4.2

Sharpen your Skills: (Answers in back of text.)

1. Answer the following questions for the Math Club election in Problem 1 and 3 from Section 4.1.

Number of Voters:	2	2	2	2	1
First:	R	T	T	S	R
Second:	S	R	S	R	T
Third:	T	S	R	T	S

(a) Who wins if the Plurality With Elimination Method is used?

(b) Who wins if the Method of Pairwise Comparisons is used?

2. Fourteen voters rank Coke, Pepsi, Sprite, and Mountain Dew as shown at right. Answer these questions:

Number of Voters:	5	3	1	3	2
First:	S	C	P	C	M
Second:	P	P	M	P	P
Third:	C	S	C	M	C
Fourth:	M	M	S	S	S

(a) Who wins if the Plurality With Elimination Method is used?

(b) Who wins if the Method of Pairwise Comparisons is used?

3. The preference schedule of the election in Problem 5 of Section 4.1 is shown at right.
   (a) Who wins if the Plurality With Elimination Method is used?

Number of voters:	5	8	9	1	4
First	Z	W	Y	X	W
Second	Y	X	Z	W	Y
Third	X	Z	W	Z	X
Fourth	W	Y	X	Y	Z

   (b) Who wins if the Method of Pairwise Comparisons is used?

4. The preference schedule of the election in Problem 6 of Section 4.1 is shown at right.
   (a) Who wins if the Plurality With Elimination Method is used?

Number of voters:	8	7	6	2	1
First	A	D	D	C	E
Second	B	B	B	A	A
Third	C	A	E	B	D
Fourth	D	C	C	D	B
Fifth	E	E	A	E	C

   (b) Who wins if the Method of Pairwise Comparisons is used?

Problems for Section 4.4

Sharpen Your Skills: (Answers in back of text.)

In the tables in problems 1 and 2, the second column shows the standard quotas of the states listed when apportioning a 20 seat legislature. Find the lower quotas, and determine which state(s) get an extra seat if Hamilton's Method is used..

1.

State	Standard Quota	Lower Quota	Extra Seat?
A	3.4		
B	2.15		
C	5.6		
D	4.05		
E	4.8		
Total:			

2.

State	Standard Quota	Lower Quota	Extra Seat?
A	1.335		
B	5.415		
C	3.5		
D	4.42		
E	5.33		
Total:			

3. The enrollments at Parkview High School for three math classes are shown below. There are a total of 25 sections to be apportioned among the three courses.

	Enrollment	Standard Quota
Pre-Algebra	224	
Geometry	346	
Algebra	425	
Total:		

(a) Find the standard divisor and explain what it means in the context of this problem.

(b) Find the standard quotas and explain what they mean in the context of this problem.

4. A clinic has 225 nurses working four different shifts. The number of nurses working each shift is to be apportioned to the shifts according to the average number of patients in that shift.

Shift	Avg. Number of Patients	Standard Quota
A	869	
B	1025	
C	619	
D	187	
Total:		

(a) Find the standard divisor and explain what it means in the context of this problem.

(b) Find the standard quotas and explain what they mean in the context of this problem.

Communicate the Concepts: (Answers in back of text.)

5. How does the Hamilton Method use fractional parts in determining an apportionment?

6. In apportionment of a legislative body, what does the standard divisor represent? What does each standard quota represent?

7. Suppose a legislative body is apportioned twice. What needs to be true about the two apportionments in order for there to be an example of the Alabama Paradox?

8. Suppose a legislative body is apportioned twice. What needs to be true about the two apportionments in order for there to be an example of the Population Paradox?

9. State the Quota Rule, and explain why Hamilton's Method always produces an apportionment that satisfies this rule.

10. What does the sum of the standard quotas equal in any apportionment problem?