

Name: _____

Math 203: Contemporary Mathematics

Chapter 5 test, version (a)

Tuesday, April 28, 2009

60 points

Instructions:

1. This test has 4 pages (including this one) and 3 questions. Please check that you have all of the pages.
 2. Read each question carefully. If you have any questions, please ask.
 3. Answer all of the following questions clearly and completely. Justify all of your answers. Most of the points you receive will be based on the accuracy, completeness, and clarity of your responses. Use full sentences, and avoid saying things that are untrue, ambiguous, or nonsensical.
 4. You may use a calculator for this test, but you may not use a book or any notes.
 5. Give your answer to each question completely and clearly in the space provided. You may use the back of the test pages for scratch work; however, if you want this work to be considered, please make note of it in the space provided for the question.
 6. Erase or cross out work you do not wish to be graded.
 7. You have 25 minutes to complete this test. Good luck!
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Question 1. (36 points.) A country has five states (A, B, C, D, and E), with a total population of 100,000. The country's legislature has 100 seats.

(a) (6 points.) Find the standard divisor.

(b) (15 points.) Fill in the blanks in the table below to apportion the seats according to Hamilton's method.

| State | Population | Standard quota | Integer part | Fractional part | Additional seats | Total seats |
|-------|------------|----------------|--------------|-----------------|------------------|-------------|
| A | 18,150 | | | | | |
| B | 8,350 | | | | | |
| C | 34,800 | | | | | |
| D | 17,300 | | | | | |
| E | 21,400 | | | | | |

(c) (15 points.) Fill in the blanks in the table below to apportion the seats according to Lowndes' method.

| State | Population | Standard quota | Integer part | Fractional part | Relative fractional part | Additional seats | Total seats |
|-------|------------|----------------|--------------|-----------------|--------------------------|------------------|-------------|
| A | 18,150 | | | | | | |
| B | 8,350 | | | | | | |
| C | 34,800 | | | | | | |
| D | 17,300 | | | | | | |
| E | 21,400 | | | | | | |

Question 2. (12 points.) A different country has four states (W, X, Y, and Z), with a total population of 73,000. This country's legislature has 46 seats. The seats are apportioned according to Hamilton's method, with the results shown in the table below.

| State | Population | Seats |
|-------|------------|-------|
| W | 13,000 | 8 |
| X | 21,000 | 13 |
| Y | 10,000 | 7 |
| Z | 29,000 | 18 |

The legislature decides to increase the number of seats to 47. After this is done, the seats are reapportioned according to Hamilton's method, with the results shown in the table below.

| State | Population | Seats |
|-------|------------|-------|
| W | 13,000 | 8 |
| X | 21,000 | 14 |
| Y | 10,000 | 6 |
| Z | 29,000 | 19 |

Compare the two apportionments. What flaw in Hamilton's method has been exposed? Explain. (Recall that the four flaws of apportionment methods described in Section 5.3 are the violation of the quota rule, the Alabama paradox, the population paradox, and the new-states paradox.)

Question 3. (12 points.) The government of the country in Question 2 is facing public outrage because of the flaw in Hamilton's method that became evident after the seats were reapportioned. To avoid such a problem in the future, the government would like to adopt a new apportionment method that is free of all four of these flaws (i.e., an apportionment method that obeys the quota rule and does not allow the Alabama paradox, the population paradox, or the new-states paradox). As a mathematically-minded citizen of this country, you have been asked to give a recommendation for an apportionment method to be used. What recommendation do you make? Why?

Name: _____

Math 203: Contemporary Mathematics

Chapter 5 test, version (b)

Tuesday, April 28, 2009

60 points

Instructions:

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 3. Answer all of the following questions clearly and completely. Justify all of your answers. Most of the points you receive will be based on the accuracy, completeness, and clarity of your responses. Use full sentences, and avoid saying things that are untrue, ambiguous, or nonsensical.
 4. You may use a calculator for this test, but you may not use a book or any notes.
 5. Give your answer to each question completely and clearly in the space provided. You may use the back of the test pages for scratch work; however, if you want this work to be considered, please make note of it in the space provided for the question.
 6. Erase or cross out work you do not wish to be graded.
 7. You have 25 minutes to complete this test. Good luck!
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Question 1. (36 points.) A country has five states (A, B, C, D, and E), with a total population of 100,000. The country's legislature has 100 seats.

(a) (6 points.) Find the standard divisor.

(b) (15 points.) Fill in the blanks in the table below to apportion the seats according to Hamilton's method.

| State | Population | Standard quota | Integer part | Fractional part | Additional seats | Total seats |
|-------|------------|----------------|--------------|-----------------|------------------|-------------|
| A | 15,400 | | | | | |
| B | 37,700 | | | | | |
| C | 10,350 | | | | | |
| D | 9,250 | | | | | |
| E | 27,300 | | | | | |

(c) (15 points.) Fill in the blanks in the table below to apportion the seats according to Lowndes' method.

| State | Population | Standard quota | Integer part | Fractional part | Relative fractional part | Additional seats | Total seats |
|-------|------------|----------------|--------------|-----------------|--------------------------|------------------|-------------|
| A | 15,400 | | | | | | |
| B | 37,700 | | | | | | |
| C | 10,350 | | | | | | |
| D | 9,250 | | | | | | |
| E | 27,300 | | | | | | |

Question 2. (12 points.) A different country has four states (W, X, Y, and Z), with a total population of 60,500. This country's legislature has 95 seats. The seats are apportioned according to Hamilton's method, with the results shown in the table below.

| State | Population | Seats |
|-------|------------|-------|
| W | 18,000 | 28 |
| X | 8,500 | 14 |
| Y | 11,000 | 17 |
| Z | 23,000 | 36 |

The legislature decides to increase the number of seats to 96. After this is done, the seats are reapportioned according to Hamilton's method, with the results shown in the table below.

| State | Population | Seats |
|-------|------------|-------|
| W | 18,000 | 29 |
| X | 8,500 | 13 |
| Y | 11,000 | 17 |
| Z | 23,000 | 37 |

Compare the two apportionments. What flaw in Hamilton's method has been exposed? Explain. (Recall that the four flaws of apportionment methods described in Section 5.3 are the violation of the quota rule, the Alabama paradox, the population paradox, and the new-states paradox.)

Question 3. (12 points.) The government of the country in Question 2 is facing public outrage because of the flaw in Hamilton's method that became evident after the seats were reapportioned. To avoid such a problem in the future, the government would like to adopt a new apportionment method that is free of all four of these flaws (i.e., an apportionment method that obeys the quota rule and does not allow the Alabama paradox, the population paradox, or the new-states paradox). As a mathematically-minded citizen of this country, you have been asked to give a recommendation for an apportionment method to be used. What recommendation do you make? Why?