Math 365

Section 3.1

The Roman Numerals

<table>
<thead>
<tr>
<th>Symbol</th>
<th>M</th>
<th>D</th>
<th>C</th>
<th>L</th>
<th>X</th>
<th>V</th>
<th>I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>1000</td>
<td>500</td>
<td>100</td>
<td>50</td>
<td>10</td>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>

- Here are the rules:
  - Never use more than three consecutive identical symbols.
  - If a smaller value precedes a larger value, subtract the smaller from the larger to find the represented value.
  - Each instance of subtraction can only be done with a single digit.
  - Subtraction can only be done with the numerals standing for 1, 10, and 100 (I, X, and C, respectively).
  - Subtraction can only be done with one of the next two higher symbols. That is, I can only be subtracted from V or X, X can only be subtracted from L or C, and C can only be subtracted from D or M.
  - For values over 3999, an over score is used to indicate multiplication by 1000. For example, the number 7000 would be written VII.$^\text{V}$. Note: Living in simple times, the Romans rarely had a need for large numbers, so there is a fair amount of disagreement about how large numbers (over 3999) were written.

Problem 1

Write each Roman Numeral as a decimal numeral.

a) MCMXCIX

b) CDCLIX

Problem 2

Write each decimal numeral as a Roman numeral.

a) 3469

b) 345,123

Problem 3

The Egyptian Numeration System

Write the Egyptian number below using decimal numerals.

Problem 4

Find the sum shown below.
Problem 5a
The Babylonian Numerals

Find the decimal form of the Babylonian numeral below.

a) 𒆠𒆠𒆠𒆠𒆠

Problem 5b

Find the decimal form of the Babylonian numeral below.

b) 𒆠𒆠𒆠𒆠𒆠

Problem 6

Write 582 using Mayan numerals.

Problem 7

What did the Mayan numeration system have that Egyptian and Babylonians did not have?

Problem 8

- Complete the following table.

<table>
<thead>
<tr>
<th>Hindu-Arabic</th>
<th>Babylonian</th>
<th>Egyptian</th>
<th>Roman</th>
<th>Mayan</th>
</tr>
</thead>
<tbody>
<tr>
<td>72</td>
<td>&lt;</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Problem 9

Count the number of objects in the indicated base.

a) base ten  

b) base three  

c) base two  

d) base five  

e) base eight  

f) base nine
Problem 10
Write the three numbers preceding and succeeding each of the following:

a) \( \text{EET}_{12} \)

b) \( 10011_{2} \)

Problem 11a
Convert each of the following base-ten numbers to numbers in the indicated bases.

a) 753 to base five

Problem 11b
Convert each of the following base-ten numbers to numbers in the indicated bases.

b) 3239 to base twelve

c) 404 to base four

Problem 11c
Convert each of the following base-ten numbers to numbers in the indicated bases.

c) 404 to base four

Problem 12a
Write each of the following numbers in base ten:

a) \( 1101101_{2} \)

Problem 12b
Write each of the following numbers in base ten:

b) \( 444_{5} \)
Problem 12c
Write each of the following numbers in base ten:
c) $2ET_{\text{twelve}}$

Problem 13
Change $42_{\text{eight}}$ to base two without first changing to base ten.

Problem 14
If $2b_{\text{six}} = 17_{\text{eight}}$, where $b$ is the second digit of the number, what is the value of $b$?

Problem 15
Write $12^5 + 25 \cdot 12^4 + 23$ in base twelve notation without multiplying out $12^5$ and $12^4$. 