MATH 110 – Mathematics Through Time
Discussion 1 – An Old Babylonian Mathematical Table
September 13, 2013

Assignment

Each group should write up one finished version of your answers to the following questions. **Due:** at the start of class on Wednesday, September 18.

Background

A fairly large number of Old Babylonian tablets with information equivalent to the following table of base 60 numbers have been found. This was clearly a something like a standard part of the Babylonian mathematicians' "calculation toolkit." To make things simpler for a first encounter with "the real thing," I have typeset the table using this convention for the cuneiform number symbols: in the base 60 digits, $<$ represents the "corner symbol" $= 10$ and $\vee$ represents the "wedge symbol" $= 1$ (as given, for instance on BJB, page 44). *Spaces* separate each base 60 digit from the next one. The letter at the left side of the row is added to help us identify the rows in the table.

a	$\vee\vee$	$<<<$
b	$\vee\ \vee\ \vee$	$<<$
c	$\vee\ \vee\ \vee\vee$	$<\ \vee\ \vee\ \vee\ \vee\ \vee$
d	$\vee\ \vee\ \vee\ \vee\ \vee$	$<\ \vee\vee$
e	$\vee\ \vee\ \vee\ \vee\ \vee\vee$	$<$
f	$\vee\ \vee\ \vee\ \vee\ \vee\ \vee\ \vee\vee$	$\vee\ \vee\ \vee\ \vee\ \vee\ \vee\ \vee\ \ <<<$
g	$\vee\ \vee\ \vee\ \vee\ \vee\ \vee\ \vee\ \vee\ \vee$	$\vee\ \vee\ \vee\ \vee\ \vee\vee\ \ <<<<$
h	$<$	$\vee\ \vee\ \vee\ \vee\ \vee\vee$
i	$<\ \vee\vee$	$\vee\ \vee\ \vee\ \vee\ \vee$
j	$<\ \vee\ \vee\ \vee\ \vee\ \vee$	$\vee\ \vee\ \vee\vee$
k	$<\ \vee\ \vee\ \vee\ \vee\ \vee\vee$	$\vee\ \vee\ \vee\ \ <<<<\ \vee\ \vee\ \vee\ \vee\ \vee$
l	$<\ \vee\ \vee\ \vee\ \vee\ \vee\ \vee\ \vee\vee$	$\vee\ \vee\ \vee\ \ <<$
m	$<<$	$\vee\ \vee\ \vee$
n	$<<\ \vee\ \vee\ \vee\vee$	$\vee\vee\ \ <<<$
o	$<<\ \vee\ \vee\ \vee\ \vee\ \vee$	$\vee\vee\ \ <<\ \vee\ \vee\ \vee\vee$
p	$<<\ \vee\ \vee\ \vee\ \vee\ \vee\ \vee\ \vee$	$\vee\vee\ \ <\ \vee\ \vee\ \vee\ \ <<$
q	$<<<$	$\vee\vee$
r	$<<<\ \vee\vee$	$\vee\ \ <<<<<<\ \vee\vee\ \ <<<$
$\vdots$		

Thus for instance, row f would translate to base 60 numbers expressed like this in our notation.

$$8 \qquad 7,30$$

(note the space between the $\vee\ \vee\ \vee\ \vee\ \vee\ \vee\ \vee$ and the $<<<$ on the right on this row).

Questions

A) Translate all the table entries into base 60 numbers like this.

B) Then figure out *what the table is* and explain in a paragraph how the numbers in the second column relate to the numbers in the first. Also, is there any ambiguity involved? Do we see something about the Babylonian number system from this? *Hint:* A good way to approach this is to interpret the numbers in the left column as whole numbers (integers). However, the ones on the right might best understood as base-60 numbers with fractional parts. You will need to say where the *sexagesimal point* goes in each number on the right. That is, what is the whole number part and what is the fractional part of those numbers? The question about ambiguity above is asking whether whatever you came up with first is the only possible interpretation. Or are there other ones too?

C) Babylonian mathematicians would have used a table like this to compute things like the base-60 form of fractions like 5/32. How could this table (and perhaps information from another table) be used for that? Work out the result and explain how you did it.