

Math 130
Fall 04

Study Group Homework: Base 5
Due Wednesday November 3

Remember: Depth is more important than speed. This assignment is designed to take at least your whole study group period, but as long as you're engaging deeply with the material, it's better to not finish than to rush through (but don't get bogged down on the challenge problem).

Note: If you wish, you can cut some base 5 blocks from graph paper. You can also use the online base 5 blocks applet at <http://www.arcytech.org/java/b10blocks/b5blocks.html>.

1. Attached at the back of this sheet are several counting grids that list the base 5 numbers from 0 to 444_5 , in order. Your group should also have several overheads with the counting grids on them.

- a. Look for patterns in the grids. Prepare to describe your patterns to your classmates. As much as possible, justify your patterns (i.e. explain why they happen).
- b. On one grid, color all numbers that contain a 3. How would the color pattern be similar/different if you colored in all numbers containing 0, 1, 2, or 4?
- c. On another grid, color all numbers whose digits sum to 10_5 . What patterns do you notice? Try some other digit sums.
- d. On another grid, color all numbers where the last two digits are the same. What patterns do you notice? With a different color, color all numbers where the second-to-last digit is greater than the last digit. With a third color, color all numbers where the second-to-last digit is less than the last digit. What patterns do you notice?
- e. On another grid, color the evens with one color. Go back to your definitions of even/odd that you wrote in your notebook on the first day of class. Does your coloring match that definition? Does everyone in your group agree on the coloring? Discuss.
- f. **Challenge:** Find a rule for quickly determining whether a base 5 number is even or odd. Without converting to base 10, determine whether 4322110_5 is odd or even.
- g. Describe your patterns in your notebook. Feel free to paste in some of your counting grids.

2. In this game, you will start on one square of the counting grid. There are eight possible moves: \leftarrow , \uparrow , \rightarrow , \downarrow , \swarrow , \nwarrow , \nearrow , and \searrow . For example, $21 \searrow = 32$.

- a. Describe each of these moves. What do they do to the starting number?
- b. Now, without looking at your grid, do the following, and explain your reasoning: i.) $221 \rightarrow =$ ii.) $221 \uparrow =$ iii.) $303 \searrow =$ iv.) $41 \searrow \nearrow =$
v.) $322 \uparrow \uparrow \uparrow \rightarrow \nwarrow =$

c. Have everyone in your group make up a puzzle like this. Make it challenging! Then take turns having the rest of the group solve each person's puzzle. Don't peek at the grids!

d. What is the quickest way to get from 12 to 40? Solve separately, don't look at the grids, and compare your answers. Did everyone in the group get the same answer? Is there more than one right answer?

e. If you haven't already, write in your notebook about this problem.

3. a Below are two partially completed counting grids (or pieces of counting grids). The grids have width 10_5 , but the numbers aren't entered in the same order as on the grids you just used. For each grid, fill in the squares marked "???", without filling in the other squares and without looking at the counting grids you used in question 1. Use your understanding of the base 5 system.

312				321
????				????

????		1001		????
	????			
				????

b. Below are two pieces of counting grids. The grids also have width 10_5 . Fill in the missing squares. Once again, use your understanding of base 5; don't look at any of the counting grids you've used before.

333		

	2000	

4. If you have time, you can get started on the homework for later in the week: Read pages 105-112 in the green book, and do problems 2 f, g, h; 3 (Babylonian only), 6, 7, 9, 10.

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