

DISCUSSION FOR FOURTH TUTORIAL

DATE: MONDAY NOV 8 (LBT01), FRIDAY NOV 12 (LCT01), MONDAY NOV 15 (LBT02 & LBT03), FRIDAY NOV 19 (LCT02)

Say that I have a sequence of 1's and 0's written from left to right with a small space between each of them. Below each of the spaces between the 1's and 0's write a 0 if the the two digits above are the same and a 1 if the two digits above are different. If there are n digits in the first row then there will be $n - 1$ in the second row, $n - 2$ in the third, etc. Repeat this until exactly one digit is alone in a line. The question is, what is this last digit?

For example say that my sequence of 1's and 0's is 100100100. I would then draw the following sequence of digits.

```
1  0  0  1  0  0  1  0  0
  1  0  1  1  0  1  1  0
    1  1  0  1  1  0  1
      0  1  1  0  1  0
        1  0  1  1  0
          0  1  1
            1  0
              1
```

I am looking for a rule which explains what will be the digit in the last row without drawing the whole triangle. Your rule should explain for instance what the digit will be if the sequence starts with all 1's or if it is an alternating sequence of 1s and 0s.

There are a couple of interesting ways of generalizing this problem. One way is to consider the same problem with sequences of digits that are 0, 1 and 2. For this you will need to generalize the rule about what digit goes below.