Griffin's OH 4/23/22

COMS 1004 Introduction to Computer Science and Programming in Java

Quick Announcements

Announcements for the week of April 23th 2022

- This Class ends on April 28th
- Quiz 6 will be on April 28th so study now if you deem it necessary
- Problem Set 6 is due on Monday please start on it if you haven't already done so
- Please Start Submitting Questions for the Review Video [see this link]

Topics for the Week

1. Turing Machines

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Turing Machines

A bit of CS Theory

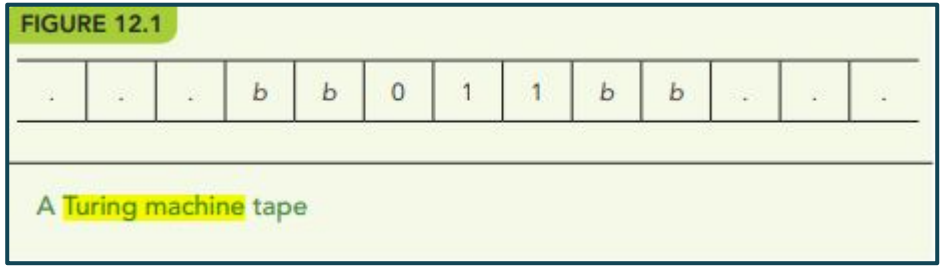
The exposure you get to Turing Machines in get COMS 1004 is meant to prepare you to see them in greater detail in CS Theory. Let's dive into what a turing machine is:

A Turing machine is a theoretical model of computation that includes a (conceptual) tape extending infinitely in both directions. The tape is divided into cells, each of which contains one symbol.

The Turing machine is designed to carry out only one type of primitive operation. Each time such an operation is done, three actions take place:

1. Write a symbol in the cell (replacing the symbol already there).
2. Go into a new state (it might be the same as the current state).
3. Move the "read head" one cell left or right.

Turing Machines



The image in the top right is an example of a turing machine tape. For purposes of Cannon's assignments you start on the leftmost blank spot. Turing machine instructions are formatted as such: (Current State, Current Symbol, Next Symbol, Next State, Direction). The Symbol is what is in the boxes, you will always start in state 1 (unless stated otherwise) and you will perform the given operations until you run out, or potentially run into a loop.

Let's do an example!

Turing Machine Example

Suppose we have this tape: … b 1 1 1 b … and the following instruction set: (1,1,0,2,R) and (2,1,1,1,R)

Determine its output:

Remember we start from the leftmost non blank and start in state 1

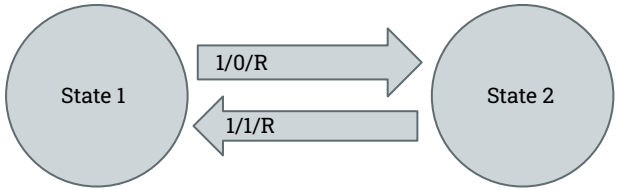
First set of instructions to execute is (1,1,0,2,R) so we will write a 0 in its place the state is now a 2 and we move to the right tape is now b 0 1 1 b. Now we execute (2,1,1,1,R) Write a 1 in its place go to state 1 and move right, tape is now b 0 1 1 b, now we execute (1,1,0,2,R) Write a 0 in its place go to state 2 and move right tape is now b 0 1 0 b and we have no more matching instructions! Final tape is: … b 0 1 0 b …

State Diagrams for Turing Machines

You'll be asked to draw State Diagrams that coordinate with the instruction sets from time to time.

1. Draw a bubble for each state, in the last example there are two state so 2 bubbles
2. Draw arrows to bubbles with labels that contain (current symbol, next symbol, direction)

So for the previous example here is the state diagram for these instructions (1,1,0,2,R) and (2,1,1,1,R):



Anytime the current state and next state match you will have an arrow looping back to the same state!

Link to Video Drive and Other Resources

Link to Video Drive:
Video Drive

Link to My Office Hour Materials:
Useful Files