CMPS 10 Lecture Notes: Lecture 16 (2-25-2016)

Hey gang! As you probably know, these note are written by Ben. But as you also may know if you attended lecture today, Ben actually gave the lecture! So he was too busy standing in front of everyone and drawing on the chalk board to also take notes of what he was talking about. That said, these notes can still cover the things that we talked about broadly speaking!

Part 1: Midterm

The process of finding out how you did on the midterm will be composed of three parts:

Part 1: Your grade on your midterm can be found on eCommons. By now, they should already be available.
Part 2: Over the weekend, you should receive an e-mail with instructions on how to check the breakdown of your score (i.e., how you did on each snap question, how many lecture choice questions you got right).
Part 3: In class on Tuesday, the professor will go over all of the midterm questions and explain the correct answers.

If you at any point have any questions about anything, please let Ben or Pardis know.

Part 2: Counting Systems

When we count using "normal" numbers we use the digits 0-9, that is, there are 10 distinct symbols. This is known as a base 10 counting system. But as it just so happens, there are many other counting systems as well! Base 2 is relevant to our needs, since Base 2 only has two digits: 0 and 1.

This segment was primarily brought up to make us feel comfortable "understanding" what a binary string is in a mathematical context, and to make us feel good about translating a binary string from base 2 to base 10.

More information can be found in this Wikipedia Article on Numeral Systems).

Part 3: Turing Machines

We talked about how a Turing Machine, though theoretically very simple, is just as capable of as much computation as your laptops and your phones (it just might go a little slower!)

They consist of the following thing:

- A tape – which can be thought of as an infinite strip of paper, split up into boxes (or "cells").
- A head – which points to a specific cell on the tape at any given moment.
- An Alphabet – a set of symbols that can go inside of the cells of the tape.
- A State/Instruction Table – a table that tells the head what it should do based on what the current state is and what the head is looking at. The types of instructions you can have are:
  - Move: Either move the tape one to the left, one to the right, stay still, or HALT.
  - Write: Replace the current symbol on the tape with a symbol from the alphabet (note that there is nothing stopping you from writing the same symbol that you are currently looking at).
  - Change State: You can change the label currently associated with our state. In class we had such illustrious names as "Start" and "Elephant." These names can really be anything you want, though for your own sanity, it probably makes sense to attempt to give them descriptive names.

And then we did a couple of simple examples, like bit inversion, and adding one to a binary string. You can find a fun interactive example of the 'adding one' example here: Khan Academy on Turing Machines).

Part 4: The Chinese Room

The Chinese Room was a theory by John Searle against the idea of "Strong AI." The idea is that if someone who does *not* speak Chinese is stuck in a room and handed slips of paper with chinese symbols on them, and all they

have at their disposal are lots of books with instructions that explain what to write down on a different slip of paper if they see certain symbols (which they then stick out of the room to be received by the people who asked the question), then to the people outside the room, it seems as if someone inside the room who understands Chinese is hearing their question, thinking about it, and responding to it. However, we know that NO understanding actually took place, and the person in the room was merely manipulating symbols. And the idea is that this is exactly what computers are doing.

In our Turing Machine example, the machine didn't understand the concept of addition; it only knew that if it saw certain symbols in certain states, then it should start doing specific things. We interpret the actions as addition, we accept it as a convincing simulation of addition, but it doesn't know that it is doing addition, and it never will.

That's the basic premise of the Chinese Room. You can read more about it (with some fun cartoons) here: Chinese Room Guide.

Conclusion

And that's more or less what we talked about! I had a great time giving lecture today, thanks for the opportunity!