COMP 221 Homework 7

Due: Friday, November 8, by 11:59 pm

1 Guidelines

Please **type up** and submit a PDF of your solutions. I recommend LaTex, but you are certainly welcome to use Google Docs or some other word processing program. Just make sure to save it as a PDF before submission. If you have to draw any pictures for a question (such as trees, graphs), you can do so **neatly** and then add a picture of it to your PDF file.

If a problem is explicitly marked as a **Programming** question, you will probably need to submit the source code for it (unless otherwise indicated). You should always be writing and submitting a README.md file that answers the requested questions.

Programming language: You are welcome to use Python or Java.

Do your own work: Homework should be individual work. You may discuss problems with other people, but you must write up your solutions yourself. I will not say that the web is off limits, but handing in solutions you find online as if they are your own is also not acceptable. Speaking of, most of these questions are shamelessly stolen from Susan :)

Make sure you have your name on your homework!

- **Question 1**

  For this question, you will create a Huffman Tree and code for this text:

  > WINTER IS NEARLY GONE. TIME FLOWS ON TO A SPRING OF LITTLE HOPE.

  Assign a binary encoding to the tree as we discussed in class. Then, use the tree that you created to encode the word ARAGORN.

- **Question 2**

  Assume we have a long-ish text string:

  ```
  GCCGAGAGCTGAACTACGGTGCCGCTGAACAACCTCTCGGTCGTCGCTGACG
  ```

  and a pattern:

  ```
  GCTGA
  ```

  Use Horspool's algorithm for string matching to find *all* occurrences of pattern in text. Show the shift table you created, and the matches and shifts you used. How many matches did you find?

- **Question 3 - Programming Question**

  Kattis has a problem called "Human Cannonball Run", found here:

  https://open.kattis.com/problems/humancannonball. The solution to this problem requires you to implement Dijkstra's Algorithm, where the human's current location is the source vertex, and the other vertices are the locations of the cannons and the destination location. Assume every cannon is connected to every other cannon, plus the start and end points are connected to all the cannons. The weights of the edges would be the time it would take the person to traverse that distance. The weights from the source to the cannons would be the distance (use Euler's distance formula) divided by the rate at which the human runs. The weights starting at any cannon would be the time to climb into and be shot out of the cannon, plus any running distance time to get to the destination.

  You do not need to pass all the Kattis tests - just the one they give you as "Sample Input 1". Please submit your code with your homework write-up.