Bioinformatics computing
COSC 494/594
Homework #1

Reading:

Read Chapter 1 of the text (first week)
Read sections 3.1-3.4; 3.6 of the text (week of 1/31)

Problems: (due 2/2/2022)

1. Review honor code statement in the syllabus and read the accompanying document. Please state in the accompanying writeup to this assignment that you have read and agree to the terms (2 points)

2. Download the complete genomic sequence of bacteriophage lambda (accession NC_001416.1) and include it in your submission as "lambda.fasta" (1 points)

3. Write a small program to reverse complement the lambda genome. Save the new sequence with a FASTA header of ">reversed" and name the resulting file as "lambda.rev.fasta". Include this file and the source code in your submission, and instruct your instructor how to compile and run it in the accompanying write up called "report.txt" (5 points)

4. Write a small program that reports nucleotide frequencies and dinucleotide frequencies of lambda. Add instructions on how to run it and include your actual output in your write up (report.txt), and also include your code in the submission (5 points)

5. Download the human mitochondrial genome (NC_012920). Place it in your submission as "human_mito.fasta." Download the Neanderthal hypervariable region (AF254446). Save it in your submission as "neander_sample.fasta." (1 points)

6. Write small programs to compute the log of the probability of the Neanderthal sequence under a multinomial model and a markov model of order 3, both of which are trained from the human mitochondrial sequence. Place the code in your submission and report the results in your write up. (8 points)

7. Generate a random sequence of 20,000 characters using a Markov model of order 3 trained on the human mitochondrial genome (you can start with your code from part #5). Place the code for this in your submission and tell your instructor how to run it in your write up. (8 points)