Practical 2: Perfect Phylogeny

Name Surname Name Surname

19/09/2023, submission deadline 25/09/2023

Solve the following exercise in groups of two students. Write the Python scripts, perform the computations, and make the graphics that are asked for (if any) in the practical below. Write your solution in a LaTeX document and generate a PDF file with your solution. Take care to number your answers exactly as in this exercise. Upload your solution in PDF format to the web page of the course at `raco.fib.upc.edu` no later than the submission deadline.

You can make use of the Python package **networkx** (and other packages) to compute your answers, as you please. The datasets (if any) can be downloaded from the web page of the course at `raco.fib.upc.edu`.

1. (40 points) Given a file **sequences.fa** of genomic sequences, write a Python script to extract the segregating sites from the sequences into a binary matrix. Give the code of your Python script as your answer to this question, using the LaTeX package **listings**.
2. (5 points) How many genomic sequences are there?
3. (5 points) How many segregating sites do they have?
4. (40 points) Given a file **sequences.fa** of genomic sequences, write a Python script to determine whether there is a perfect phylogeny for the segregating sites of the sequences. Give the code of your Python script as your answer to this question, using the LaTeX package **listings**.
5. (5 points) What is the running time of your script, as a function of the number n of genomic sequences and the number m of segregating sites?
6. (5 points) What is the best possible running time of an algorithm to solve the perfect phylogeny problem?

```
\documentclass[12pt,a4paper]{article}
\usepackage{listings}
\usepackage{mathptmx}
\usepackage{savetrees}
\title{Practical 2: Perfect Phylogeny}
\author{Name Surname \and Name Surname}
\date{19/09/2023, submission deadline 25/09/2023}
\begin{document}
\maketitle
\begin{enumerate}
\item ...
\item ...
\item ...
\item ...
\item ...
\item ...
\end{enumerate}
\end{document}
```