1. Exercise
"Bioinformatische Methode in der Genomforschung"

Wintersemester 2021

Sebastian Böcker, Martin Hoffmann

Assignment: 27.10.2021
Due: 3.11.2021

Exercise 1 (5 Points) Physical mapping with Clone-probe Hybridisierung.

1. What are the most important assumptions when modeling the physical-mapping problem using the Consecutive-Ones problem?
2. Give experimentally relevant arguments for why these assumptions cannot be fullfilled in reality

Exercise 2 (10 Points) Solve the Consecutive-Ones Problem (if possible) for the following Clone-probe Hybridisation matrix using PQ-trees

$$M = \begin{pmatrix} 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \end{pmatrix}$$

Exercise 3 (5 Points)

Create the Graph $G(M)$ for the following Matrix M andd solve the Travelling Salesperson Problem (TSP)

$$M = \begin{pmatrix} 1 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 1 & 0 \end{pmatrix}$$

1. What is the length of the optimal TSP route?
2. Which Probe-order corresponds to this route?

3. How many Consecutive-Ones blocks exist in this order?

Exercise 4 (5 Points)

Permutations on PQ-Trees

1. Given a PQ-Tree ((D,E,G),(H,B,[A,F],G)), where [] denotes a p-node containing a list of its children and () denotes a q-node containing a list of its children; give the amount of permutations over fA,...,Hg that are represented by this PQ-tree

Hint: A permutation of the set of leafs is obtained by reading the leaf labels from left to right. The PQ-tree (A,B,C,D,E,F,G,H) for example represents 8! possible permutations