

Algorithms in Genome Research  
Winter 2020/2021

Exercises

Number 1, Discussion: 2020-November-13

- Remember physical mapping by clone-probe hybridization.
  - What are the main assumptions when the problem is modeled as the consecutive ones problem?
  - Discuss experimental reasons why the assumptions do not hold in practice.
- Solve the consecutive-ones problem for the following clone-probe hybridization matrix  $M$  (if possible).

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

- Is it possible to transform the following matrix  $M$  by column re-ordering into a matrix  $M'$  that satisfies the Consecutive Ones Property?

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

If not, which other property is satisfied?

- Create the graph  $G(M)$  and solve the Traveling Salesman Problem.
- What is the length of the shortest tour?
- What is the probe order that this tour corresponds to?
- What is the overall number of blocks of consecutive ones in this order?