

Data Structures and Algorithms 2, WS 2021/22

Assignment 4

Remark: Please note that it is mandatory to write the exercise on your own, legibly and in logical order. The deadline for this exercise is **Friday, 2022-01-28 18:00**. Your solution has to be handed in via the teach center in form of a pdf-file before this deadline. Please observe also the remarks in the course as well as on the homepage.

Triangulation 3-coloring

You are given a triangulation of a point set. Your task is to design an efficient algorithm that constructs a valid 3-coloring of the points of the triangulation or determines that such a 3-coloring does not exist. A 3-coloring of the points is valid if any two points that are connected with an edge have different colors.

The n points of the triangulation are labeled with the integers $\{1, \dots, n\}$. The triangulation is given by a list of edges with additional triangle points (see Figure 1 for an example):

- Every edge is given by the labels of its two end points (first the smaller point label, then the larger one).
- For every edge, the labels of the point(s) with which the edge forms a triangle (a bounded triangular face) in the triangulation is given (two labels for interior edges and one label for edges on the boundary of the convex hull).

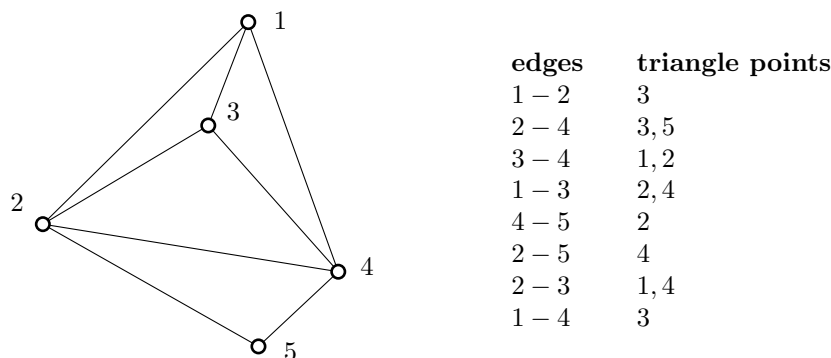


Figure 1: Example of a triangulation and a list of its edges with triangle points.

Explain and describe your algorithm in detail, analyze its runtime and memory requirements, and give reasons for the correctness of your solution.

Note: As detailed in the first lecture of this course, pseudocode (or code) is no explanation of an algorithm and doesn't give points on its own (see also the slides of the first lecture). You can give a pseudocode representation of your algorithm in addition to your explanations if you wish, and if it is helpful (for example, for the runtime- and memory analysis of your algorithm). But you are explicitly not required to do so.