

# Theory of Computational Complexity

## First Assignment

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Answer all the questions in the following two problems. Submit your report to the instructor during the lecture on November 15th.

### Problem 1 (short questions)

1. What are NP-complete problems?
2. Is it likely that the problem of finding a perfect matching in a given graph is NP-complete?
3. How does the complexity of solving one NP-complete problem affect the complexity of solving any problem in NP?
4. List 10 NP-complete problems (you can look at books or other references)?

### Problem 2 (NP-completeness)

A 3-coloring of a graph  $G=(V,E)$  is a function  $c: V \rightarrow \{\text{red, black, blue}\}$  such that the inequality  $c(u) \neq c(v)$  holds for any edge  $(u,v) \in E$ .

Consider the following problem called *Graph-3-Colorability*: given a directed graph  $G=(V,E)$ , decide if  $G$  has a 3-coloring. Show that this problem is NP-complete.