

# Decision Procedures for Verification

## HOMEWORK 3

### Problem 1

Show how SAT solvers can be used in order to solve the following problems:

- (a) Does a direct graph has a hamiltonian path? (A hamiltonian path visits each vertex of the graph exactly once.)
- (b) Does a direct graph has a hamiltonian cycle? (A hamiltonian cycle is a path that begins and ends in the same vertex, and that visits every other vertex exactly once.)
- (c) Does a dinner party problem has a solution? (The dinner party problem is defined as follows. Some number of guests are coming for dinner and will be seated at a single large round table. Some pairs of guests have indicated that they must sit next to each other. Other pairs have indicated that they absolutely refuse to sit next to each other. Find a seating arrangement that satisfies all the constraints.)
- (d) Given an undirected graph  $G = (V, E)$  and a positive integer  $k$ , is there a mapping  $color : V \rightarrow \{1, \dots, k\}$  such that no two adjacents vertices are assigned the same color?
- (e) Is a given Sudoku  $9 \times 9$  puzzle solvable? (Sudoku  $9 \times 9$  puzzles are based on the following rule: fill every cell in such a way that every row, column, and  $3 \times 3$  subgrid contains all the numbers from 1 to 9.)