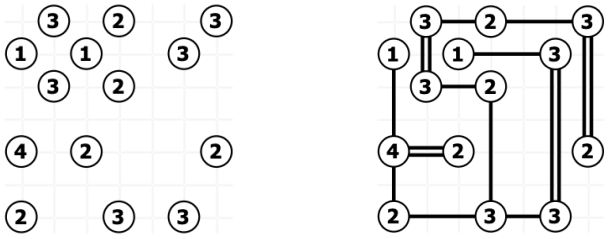
Assignment 2:
Solving Hashi Puzzle using CSP

Due Sunday, 28 November, 11:00pm

Hashi puzzle uses a square grid of cells where some cells contain numbers from 1 and 8 inclusive, which are called islands, and the rest of the cells are empty.[1] The aim is to connect all of the islands into a single connected group by putting bridges between the islands according to the following rules:

- A bridge must begin and end at distinct islands as a straight line in between.
- A bridge may only run vertically or horizontally.
- A bridge must not cross any other bridges or islands.
- At most two bridges connect a pair of islands.
- The number of bridges connected to each island must match the number on that island.

For instance, an instance of this puzzle, and its solution are presented in Figure 1.



(a) (b)

Figure 1: (a) A sample initial board in Hashi puzzle, and (b) its solution.

Input of the problem The input is represented by an $n \times n$ matrix where each nonzero number represents an island and zeros represent empty cells. The lines of the input represent an $n \times n$ matrix that is the configuration of the islands and empty cells as a square grid.

[1] `https://www.puzzle-bridges.com/`

```
0 3 0 2 0 0 3
1 0 1 0 0 3 0
0 3 0 2 0 0 0
0 0 0 0 0 0 0
4 0 2 0 0 0 2
0 0 0 0 0 0 0
2 0 0 3 0 3 0
```

Figure 2: Sample board in Figure 1, represented in the input format

Represent Hashi puzzle as a Constraint Satisfaction Problem (CSP). Find 3 different Hashi puzzles of different difficulties. Use an existing CSP solver, such as

- Google OR-Tools CP Solver: `https://developers.google.com/optimization/`
- python-constraint: `http://labix.org/python-constraint/`

to solve these puzzles based on the CSP representation. Make sure that your solution is readable by human; for instance, you can use a matrix to represent the board.

Submit the following files at SUCourse+:

- A pdf file containing your CSP representation of Hashi puzzle, and a discussion on whether A* or CSP is more appropriate for solving this puzzle.
- The source files containing the representation of Hashi puzzle and the puzzles presented to the CSP solver, and the solutions of the puzzles computed by the CSP solver.

In each of the deliverables above, please include your name and student id.

Demos Make a demo of your solution on 29 November. The time and places will be announced at SUCourse+.