Programming Assignment 3: Logician

CECS 328

1 Deadline

Friday, October 29th, 2021 at 5 PM

2 Introduction

A logician is examining a sequence of logical statements in order to create an example of an algorithm for one of his classes. The statements are numbered from 0 to $N-1$, and for any given pair of statements, they are either contradictory or non-contradictory. For the purposes of his example, he requires a subset S of statements (taken from his original list of N) such that each statement in S has at least k_1 *other* statements in S that are non-contradictory and k_2 *other* statements in S that are contradictory. (You should not think of a statement as being contradictory *nor* non-contradictory to itself.) The logicians goal is to determine, among all possible sets S, the largest.

3 Your code

Input will be a matrix of boolean values, a value for k_1, and a value for k_2. If the value $[i][j]$ in the matrix is true (resp. false), then statement i is not (resp. is) contradictory to statement j.

Your output will be a set of integers that represent the set S of statements that you have chosen. It should be the largest among all possible sets that satisfy the professor's requirements.

The Java header for the function in StudentSolver.java is:

```
public static HashSet<Integer> solve(boolean[][] m, int k1x, int k2x)
```

The Python header for the function is:

```
def solve(m, k1x, k2x)
```

The C++ header for the function is:

```
static std::set<int> solve(bool** m, int matrixSize, int k1x, int k2x);
```

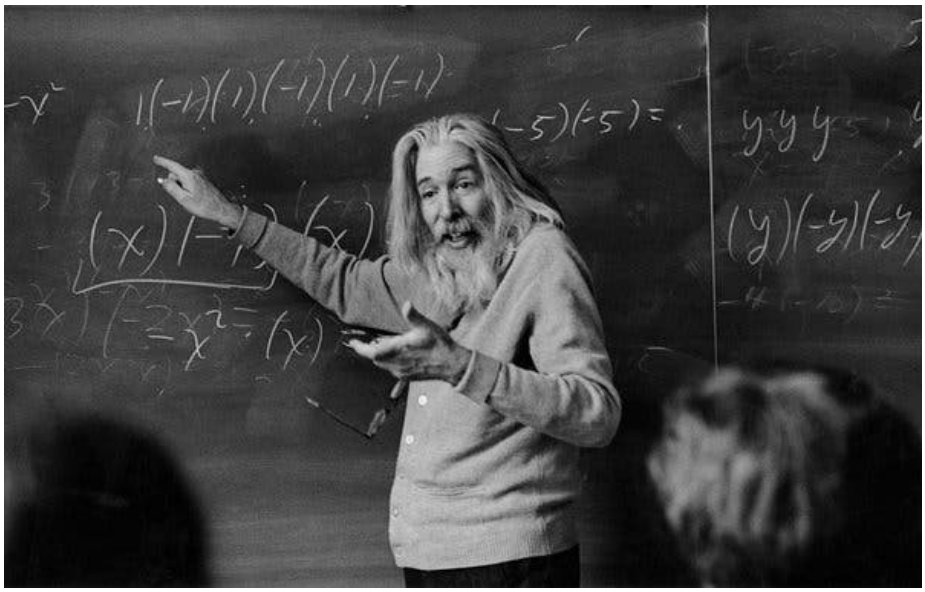

Figure 1: Robert Smullyan- inventor of knights and knaves puzzles and improver of Godel's incompleteness theorem

4 Example

Assume that the matrix is the following:

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

where 0 is false and 1 is true, and assume that $k_1 = 2$ and $k_2 = 1$.

The largest set of statements that is consistent with the restrictions is $\{0, 1, 3, 4\}$. 0 does not contradict 3 and 4 but does contradict 1. 1 does not contradict 3 and 4 but does contradict 0. 3 does not contradict 0 and 1 but does contradict 4. 4 does not contradict 0 and 1 but does contradict 3.

Important note: The diagonal entries in the matrix can essentially be ignored for the purposes of this problem.