CS 577: Introduction to Algorithms — Program 8 - Nuts and Bolts

Out: April 6, 2021 — Due: April 13, 2021

Coding Question:

Reminders:

- Must be coded individually in your choice of either Python, Java, C, C++, or C#
- There are hidden testcases
- Submitted through Gradescope
- There is a class-wide runtime leaderboard on Gradescope
- We encourage the use of Piazza for debugging help
- Please do not cheat

Problem:

Consider the problem of fitting as many nuts and bolts as possible. You are given ℓ nuts and r bolts. For each nut, you are also given whether it fits or not into each of the r bolts. Your objective is to compute the maximum number of pairs of nuts and bolts that can be fitted together. Keep in mind that once we fit a nut and a bolt, both are unavailable to be fitted with the others.

Input should be read in from stdin. The first line will contain the number of nuts and bolts ℓ and r, respectively. The next ℓ lines each contain r space-separated bits indicating the bolts in which the corresponding nut fits. That is, the bit in line i and column j is 1 if nut i fits into bolt j and 0 otherwise.

Consider the two sample test cases. For the first one, the answer is 2 because we can fit pairs of nuts $\times$ bolts $(1, 3)$ and $(2, 1)$, for example. Moreover, it is impossible to fit all three nuts because nuts 1 and 3 can only fit into bolt 3. For the second one, the answer is 5 because we can fit pairs $(1, 4), (2, 2), (3, 1), (4, 3)$ and $(5, 5)$, and there are no nuts or bolts left over.

Constraints:

- $1 \leq \ell, r \leq 500$
- We can only fit nuts into bolts (or vice-versa), we are not able to fit two nuts or two bolts together.

Sample Test Cases:

input:
3 4
0 0 1 0
1 1 0 1
0 0 1 0

expected output:
2

input:
5 5
1 0 0 1 1
1 1 0 0 0
1 0 0 0 0
0 1 1 0 0
0 0 0 0 1

expected output:
5