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Algorithms Lab

Exercise – *Even matrices*

You are part of a team to develop a new kind of pseudorandom number generator (PRNG). To gauge how good your algorithm is at producing random matrices of bits, you are running several different statistical tests.

For example, if

$$M = \begin{pmatrix} x_{1,1} & x_{1,2} & & x_{1,n} \\ x_{2,1} & x_{2,2} & \cdots & x_{2,n} \\ & \vdots & \ddots & \\ x_{n,1} & x_{n,2} & & x_{n,n} \end{pmatrix}$$

was a truly random matrix of bits, then it would have the property that the sum

$$\sum_{i'=i_1}^{i_2} \sum_{j'=j_1}^{j_2} x_{i',j'}$$

is even for about half of the quadruples (i_1, i_2, j_1, j_2), $1 \leq i_1 \leq i_2 \leq n$ and $1 \leq j_1 \leq j_2 \leq n$.

To check whether this is the case, you need to count the number of such quadruples.

Input The first line of the input contains the number $t \leq 10$ of test cases. Each of the t test cases is described as follows.

- It starts with a line that contains an integer n such that $1 \leq n \leq 200$.
- n lines follow. An i-th line contains n space separated bits $x_{i,1}, \ldots, x_{i,n}$, for every $1 \leq i \leq n$.

Output For each test case output a line that contains the number of quadruples (i_1, i_2, j_1, j_2), $1 \leq i_1 \leq i_2 \leq n$ and $1 \leq j_1 \leq j_2 \leq n$, for which the sum

$$\sum_{i'=i_1}^{i_2} \sum_{j'=j_1}^{j_2} x_{i',j'}$$

is even.

Points There are three groups of test sets, worth 100 points in total.

1. For the first group of test sets, worth 20 points, you may assume that $1 \leq n \leq 10$.
2. For the second group of test sets, worth 50 points, you may assume that $1 \leq n \leq 50$.
3. For the third group of test sets, worth 30 points, there are no additional assumptions.

Corresponding sample test sets are contained in `sample`i`.in/out`, for $i \in \{1, 2, 3\}$.

Sample Input

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

Sample Output

```
5
15
52
```