ETH Zurich
Institut für Theoretische Informatik
Prof. Dr. Angelika Steger
Prof. Dr. Emo Welzl
Prof. Dr. Peter Widmayer

Algorithms Lab

Exercise – *Poker Chips*

You regularly meet with your friends on Thursdays for poker night. Three hours into the evening, and slightly drunk already, you get bored of the game and start stacking up the chips in various ways. This gets you thinking. What if you played a solitaire game with the chips?

The rules are as follows. First distribute the chips randomly into several stacks. Then repeat until no chips are left:

- For any subset (of your choosing) of stacks remove the topmost chip from each of its stacks, *provided these chips all have the same colour*.
- If you removed $k > 1$ chips, award yourself 2^{k-2} points. If you only removed one chip, 0 points.

Your score is the sum of points gained in each step. The goal, of course, is to score the maximum possible number of points.

On the next morning, sober again, you decide to solve the problem once and for all with a program.

Input The first line of the input contains the number $t \leq 60$ of test cases. Each of the t test cases is described as follows.

- It starts with a line that contains one integer `n`, representing the number of stacks you formed ($1 \leq n \leq 5$).
- The next line contains n positive integers `m1 ... mn`, separated by a space, such that $1 \leq m_i \leq 2000$, for $i \in \{1, \dots n\}$, and $\prod_i (m_i + 1) \leq 2^{16}$. Here m_i denotes the number of chips in the i-th stack.
- The following n lines list the chips in the stacks. The i-th such line contains integers `ci1 ... cimi`, separated by a space. Each c_{ij} ($1 \leq c_{ij} \leq 2^{10}$) represents the colour of one chip. c_{im_i} is the chip at the top of the stack (removed first) and c_{i1} is the chip at the bottom (removed last).

Output For every test case the corresponding output appears on a separate line. Each output consists of one integer p: the maximum number of points you can score in the game according to the rules above.

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

1. For the first group of test sets, worth 30 points, you may assume that $n \leq 2$.
2. For the second group of test sets, worth 30 points, you may assume that $m_i \leq 12$ for all $i \in \{1, \dots, n\}$.

3. For the third test set, worth 40 points, there are no additional assumptions.

Sample Input

```
2
2
5 4
2 2 2 1 3
1 2 1 2
3
2 2 2
1 2
2 3
2 4
```

Sample Output

```
2
2
```