4042 Expression Evaluation

Let (a, b) and (c, d) be any two ordered pairs of positive integers. We define two binary operators X and Y on (a, b) and (c, d) in the postfix form as follows:

$$(a, b)(c, d)X = (a + c, \max(b, d)),$$

$$(a, b)(c, d)Y = (\max(a, c), b + d),$$

where the "max" function returns the largest one between two numbers. The result of performing an X operation or a Y operation is also an ordered pair of positive integers.

For any integer n ($n \geq 2$), a postfix expression $Z = z_1 z_2 \dots z_{2n-1}$ of length $2n - 1$ consists of n operands (each of which is an ordered pair of positive integers) and $n - 1$ operators (each of which is X or Y), and meets the following condition: For each sub-expression $Z_i = z_1 z_2 \dots z_i$, $1 \leq i \leq 2n - 1$, the number of operands is greater than the number of operators. The value of Z is also an ordered pair of positive integers and can be obtained by a procedure similar to the evaluation of an ordinary arithmetic expression in the postfix form except that operands are ordered pairs of positive integers and operators are restricted to X and Y. Once the value, say (a, b), of Z is known, we can further compute the product of Z, which is defined to be $a \times b$.

The following example illustrates the evaluation process. Suppose $n = 3$ and $Z = (1, 2)(1, 3)X(2, 1)Y$. The evaluation works as follows. It first evaluates (1, 2) (1, 3) X to get (2, 3), and then evaluates (2, 3) (2, 1) Y to get (2, 4). Therefore the value of Z in this example is (2, 4) and the product of Z is 8.

Now let's make things a bit complicated. Given a Z of length $2n-1$, let each z_i in Z be a variable. To simplify the description, let's rewrite Z as a permutation of $2n - 1$ integers, where each positive integer i between 1 and n appears exactly once and denotes operand i, and the integer 0 appears $n - 1$ times and denotes an operator. Each operand i has a set of k_i ($k_i \geq 1$) ordered pairs of positive integers to choose from, and each operator has the two operator types X and Y to choose from. As a result, by fixing a choice for each of the operands and operators in Z, we can get an expression and its corresponding product. This problem asks you to find the minimum product among all possible expressions.

Here is an example problem instance. Suppose $n = 2$, $Z =$ 2 1 0, and operands 1 and 2 are associated with $\{(1, 2), (2, 1)\}$ and $\{(1, 3)\}$, respectively. There are a total of 4 possible expressions: $(1, 3)(1, 2)X$, $(1, 3)(1, 2)Y$, $(1, 3)(2, 1)X$, and $(1, 3)(2, 1)Y$. The minimum product among the four expressions is 5.

Technical Specification

1. In this problem, it is assumed that n is at most 2000, each k_i is at most 20, and the largest number among all given ordered pairs of positive integers is at most 4000, and the minimum product can be represented with a 32-bit integer.

Input

The first line of an input file consists of a single number denoting the number of test cases in the file.

For each test case, the input format is as follows. The first line gives n. For the next n lines, the ith line gives an even number of positive integers to specify the set of k_i ordered pairs of positive integers for operand i, where the first and second numbers form the first ordered pair, the third and fourth numbers form the second ordered pair, ..., etc. The last line gives $2n - 1$ integers to specify a postfix expression of length $2n - 1$, where a positive integer i denotes operand i, and '`0`' denotes an operator.

Output

For each test case, print out the minimum product on a single line.

Sample Input

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

Sample Output

```
5
8
```