

Problem E

Min-Max List Partitioning

Input file: pe.txt

Problem Statement

Let $L = \langle a_1, a_2, \dots, a_n \rangle$ be an *ordered* list of n integers a_1, a_2, \dots, a_n . An ordered list $L' = \langle b_1, b_2, \dots, b_m \rangle$ is a *sub-list* of L if $1 \leq m \leq n$ holds and there exists an integer i ($1 \leq i \leq n - m + 1$) such that for all $j = 1, 2, \dots, m$, we have $b_j = a_{i+j-1}$. Let p and q be two integers with $1 \leq p \leq n, 1 \leq q \leq n$, and $p \times q \geq n$. A (p, q) -way *partitioning* of L is to divide L into p *non-overlapping* sub-lists

$$\langle a_1, a_2, \dots, a_{m_1} \rangle,$$

$$\langle a_{m_1+1}, a_{m_1+2}, \dots, a_{m_1+m_2} \rangle,$$

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$$\langle a_{m_1+m_2+\dots+m_{p-1}+1}, a_{m_1+m_2+\dots+m_{p-1}+2}, \dots, a_{m_1+m_2+\dots+m_{p-1}+m_p} \rangle$$

such that $m_1 + m_2 + \dots + m_p = n$ and each sub-list has at most q numbers (i.e., for all $j = 1, 2, \dots, p$, $m_j \leq q$). The *value* of a sub-list is the summation of the numbers in the sub-list. The *cost* of a (p, q) -way partitioning is the *maximum* of the values over the p sub-lists. A (p, q) -way partitioning is *optimal* if its cost is *minimum* among all possible (p, q) -way partitionings. The min-max list partitioning problem is to find the cost of an optimal (p, q) -way partitioning.

Example: Suppose $L = \langle 1, 2, 4 \rangle$, $p = 2$, $q = 2$. L has six possible sub-lists $\langle 1 \rangle$, $\langle 2 \rangle$, $\langle 4 \rangle$, $\langle 1, 2 \rangle$, $\langle 2, 4 \rangle$, $\langle 1, 2, 4 \rangle$. There are two $(2, 2)$ -way partitionings $S_1 = \{\langle 1 \rangle, \langle 2, 4 \rangle\}$ and $S_2 = \{\langle 1, 2 \rangle, \langle 4 \rangle\}$. The cost of S_1 is 6 and the cost of S_2 is 4. S_2 is an optimal partitioning, but S_1 is not.

Input File Format

The first line of an input file consists of a single number denoting the number of test cases in the file. There is a single line containing a '/' character separating two consecutive test cases. The end of the file is marked with a line containing a '.' character. For each test case, the first three lines specify n , p , and q , respectively, with $n \leq 4000$. The next n lines give an ordered list L of n integers, one on each line.

Output Format

For each test case, print on a single line the cost of an optimal (p, q) -way partitioning.

Sample Input

2
3
2
2
1
2
4
/
4
2
3
1
3
5
7
.

Sample Output

4
9