IOI Training Camp 2010 – Test 2, 17 June, 2010

Problem 1 Landscaping

Farmer John is making the difficult transition from raising mountain goats to raising cows. His farm, while ideal for mountain goats, is far too mountainous for cattle and thus needs to be flattened out a bit. Since flattening is an expensive operation, he wants to remove the smallest amount of earth possible.

The farm is long and narrow and is described in a sort of two-dimensional profile by a single array of N integer elevations, like this

```
1 2 3 3 3 2 1 3 2 2 1 2,
```

which represents the farm's elevations in profile, depicted below with asterisks indicating the heights:

```
    * * *     *
  * * * * *   * * *   *
* * * * * * * * * * * *
1 2 3 3 3 2 1 3 2 2 1 2
```

A contiguous range of one or more equal elevations in this array is a *peak* if both the left and right hand sides of the range are either the boundary of the array or an element that is lower in elevation than the peak. The example above has three peaks.

Determine the minimum volume of earth (each unit elevation reduction counts as one unit of volume) that must be removed so that the resulting landscape has no more than K peaks. Note well that elevations can be reduced but can never be increased.

If the example above is to be reduced to 1 peak, the optimal solution is to remove $2 + 1 + 1 + 1 = 5$ units of earth to obtain this set of elevations:

```
    * * *     -
  * * * * *   - - -   -
* * * * * * * * * * * *
1 2 3 3 3 2 1 1 1 1 1 1
```

where -'s indicate removed earth.

Input format

The first line of input has two space-separated integers, N and K. The next N lines contain a single integer each indicating the elevations: line $i+1$ contains the elevation for index i.

Output format

The output should be a single integer, the minimum volume of earth that must be removed to reduce the number of peaks to K.

Test Data

You may assume that $1 \leq N \leq 1000$ and $1 \leq K \leq 25$. All elevations are in the range $[1..10^6]$.

Example

Here is the sample input and output corresponding to the example above.

Sample input	Sample output
12 1 1 2 3 3 3 2 1 3 2 2 1 2	5

Time and memory limits

The time limit for this task is 2 seconds. The memory limit is 44 MB (actual limit 32 MB, plus 12 MB buffer for 64-bit compilation).