Programming Part

Selection Sort (20 pts)

Problem Description

Given an array **a** with N numbers $\mathbf{a}[1], \mathbf{a}[2], \ldots, \mathbf{a}[N]$ (possibly repeated), run the following selection sort algorithm on the array, as introduced in Lecture 1 of the class, for a budget of B swaps or until the array is sorted. Then, print out the content of the array.

Note that there are many different variant versions of the selection sort algorithm. You are asked to implement the version below *exactly* to produce the correct answer for this problem.

```
SELECTION-SORT(a)
1  for i = 1 to a.length
2      m = GET-MIN-INDEX(a, i, a.length))
3      if i ≠ m
4          SWAP(a[i], a[m])
5  return a // which has been sorted in place
```

```
GET-MIN-INDEX(a, ℓ, r)
1  m = ℓ // store current min. index
2  for i = ℓ + 1 to r
3      // update if i-th element smaller
4      if a[m] > a[i]
5          m = i
6  return m
```

Input

The first line includes two integers N and B, representing the size of the array and the budget on the number of swaps. The second line includes N integers, representing the elements of the array $\mathbf{a}[1], \mathbf{a}[2], \ldots, \mathbf{a}[N]$. All numbers are separated by a space.

Output

- If the array can be sorted within B swaps, output a line of

  `The array is [the content of the array] after [X] swaps.`

  where `[the content of the array]` lists the final $\mathbf{a}[1], \mathbf{a}[2], \ldots, \mathbf{a}[N]$ after sorting, and `[X]` is the actual number of swaps taken, which would be a unique number using the version of the selection sort algorithm above.

- If the array is not sorted after B swaps, output a line of

  `The array is [the content of the array] after [B] swaps.`

  where `[the content of the array]` lists the intermediate $\mathbf{a}[1], \mathbf{a}[2], \ldots, \mathbf{a}[N]$ after the B swaps, and `[B]` is just the number B.

Constraint

- $1 \leq N \leq 2^{10}$
- $1 \leq B \leq 2^{10}$
- $-2^{30} \leq \mathbf{a}[n] \leq 2^{30}$ for $n \in \{1, 2, \ldots, N\}$

Sample Testcases

Sample Input 1

```
3 2
1 3 2
```

Sample Output 1

```
The array is 1 2 3 after 1 swaps.
```

Sample Input 2

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

Sample Output 2

```
The array is 1 2 4 3 after 2 swaps.
```

Sample Input 3

```
4 2
2 2 4 1
```

Sample Output 3

```
The array is 1 2 2 4 after 2 swaps.
```

Hint

- By design, you can pass this homework by simulating the selection sort algorithm properly. There is no need for other arithmetic calculations or cuts.