VSB TECHNICAL UNIVERSITY OF OSTRAVA | FACULTY OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE | DEPARTMENT OF COMPUTER SCIENCE

Algorithms – QuickSort Animations

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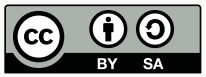


Permutation Visualization – Bars

Permutations

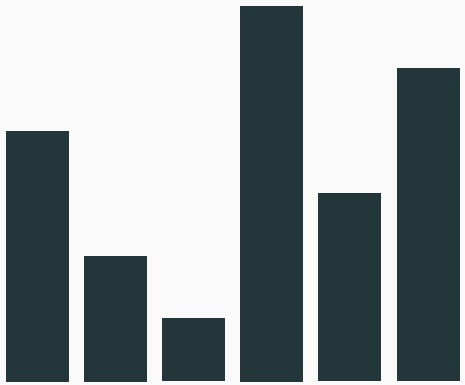
$$\pi = \begin{pmatrix} 1 & 2 & \dots & n \\ \pi_1 & \pi_2 & \dots & \pi_n \end{pmatrix}$$

can be represented as a sequence of n vertical bars, where

- bar order corresponds to the index i,
- the height of the bar corresponds to π_i, and
- the width of all bars is the same and does not matter.

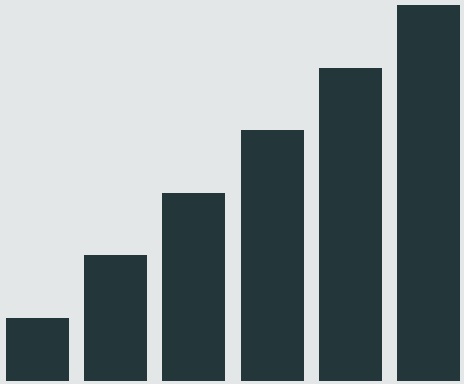
Example

$$\pi = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 4 & 2 & 1 & 6 & 3 & 5 \end{pmatrix}$$

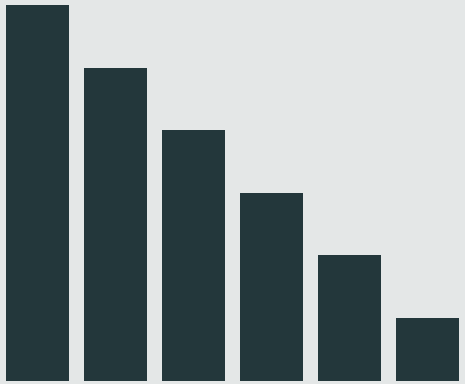


Permutation Visualization – Bars, Examples

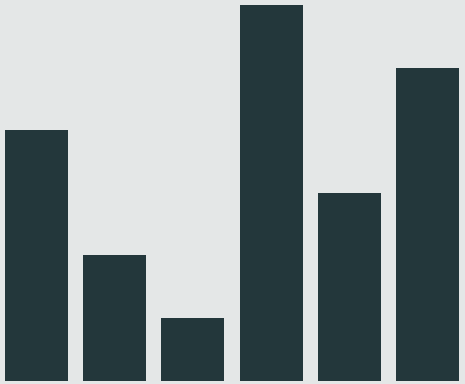
Identical



Reverse



Random



Permutation Visualization – Mosaic

Permutation

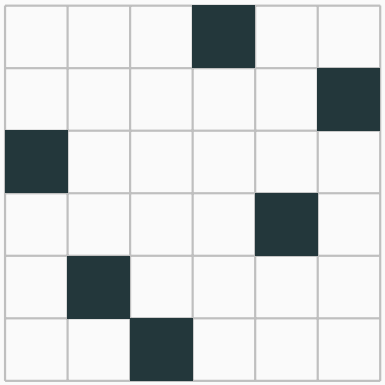
$$\pi = \begin{pmatrix} 1 & 2 & \dots & n \\ \pi_1 & \pi_2 & \dots & \pi_n \end{pmatrix}$$

can be represented by squares in a square grid, of size $n \times n$, where

- column corresponds to index i,
- row of the square corresponds to the value of π_i, and
- the size of all squares is the same and does not matter.

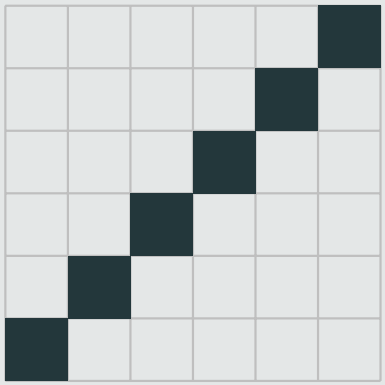
Example

$$\pi = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 4 & 2 & 1 & 6 & 3 & 5 \end{pmatrix}$$

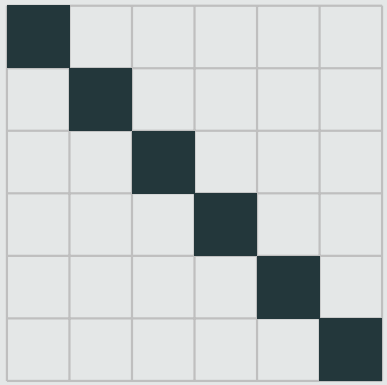


Permutation Visualization – Mosaic, Examples

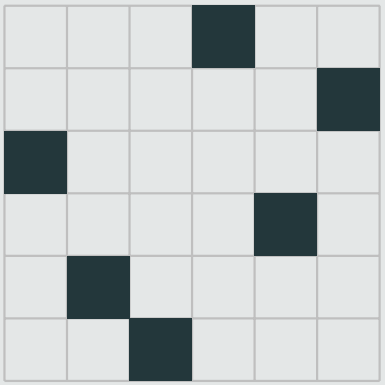
Identical



Reverse



Random



Color Meaning in Visualization

Colors of elements

black – unsorted element

red – the element is currently being compared with another element and possibly exchanged with it

green – the element is sorted, the element is in the correct position

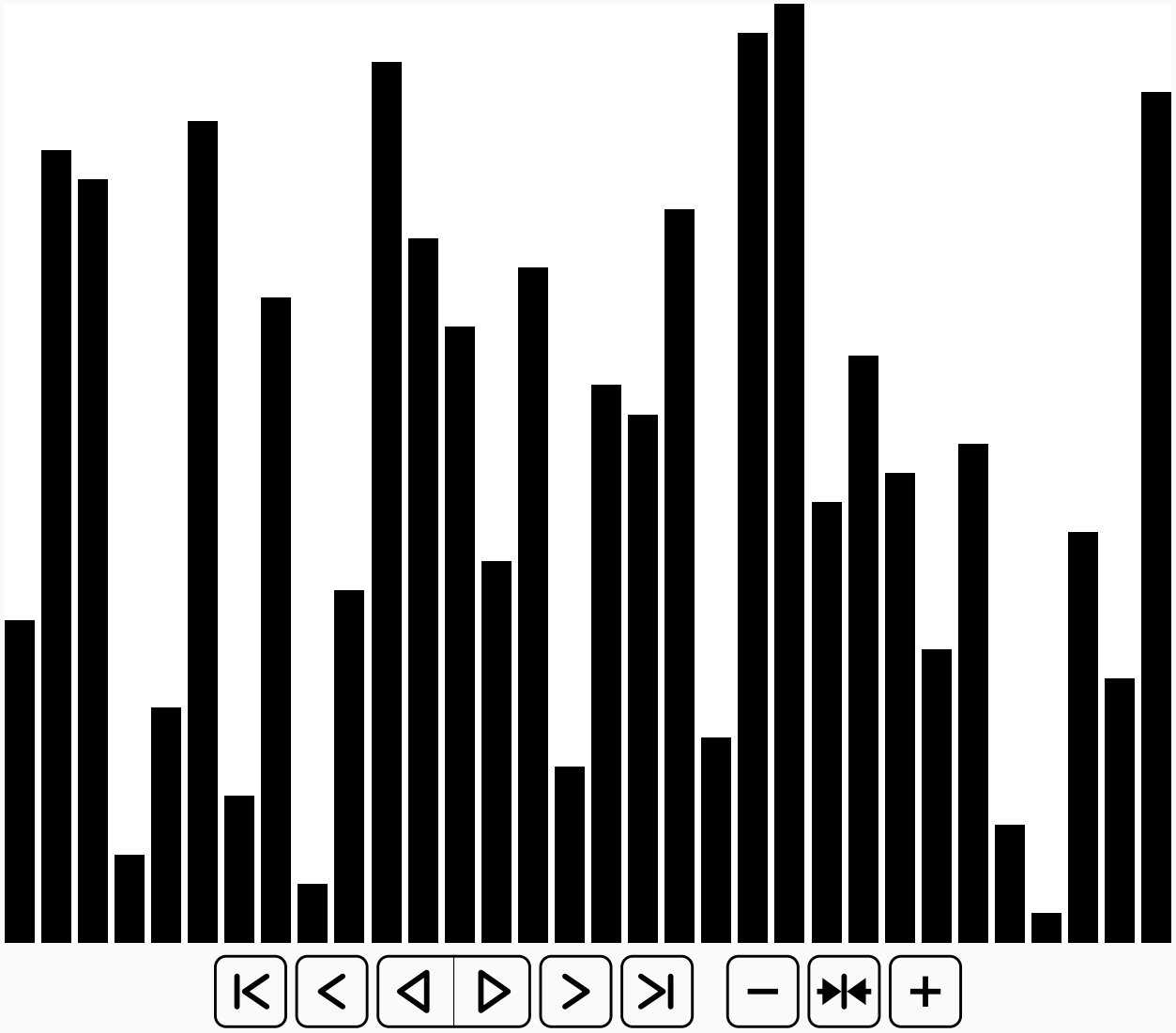
Backgournd colors

orange – the width of the orange background shows the elements that are sorted in the current recursive call of the sorting algorithm

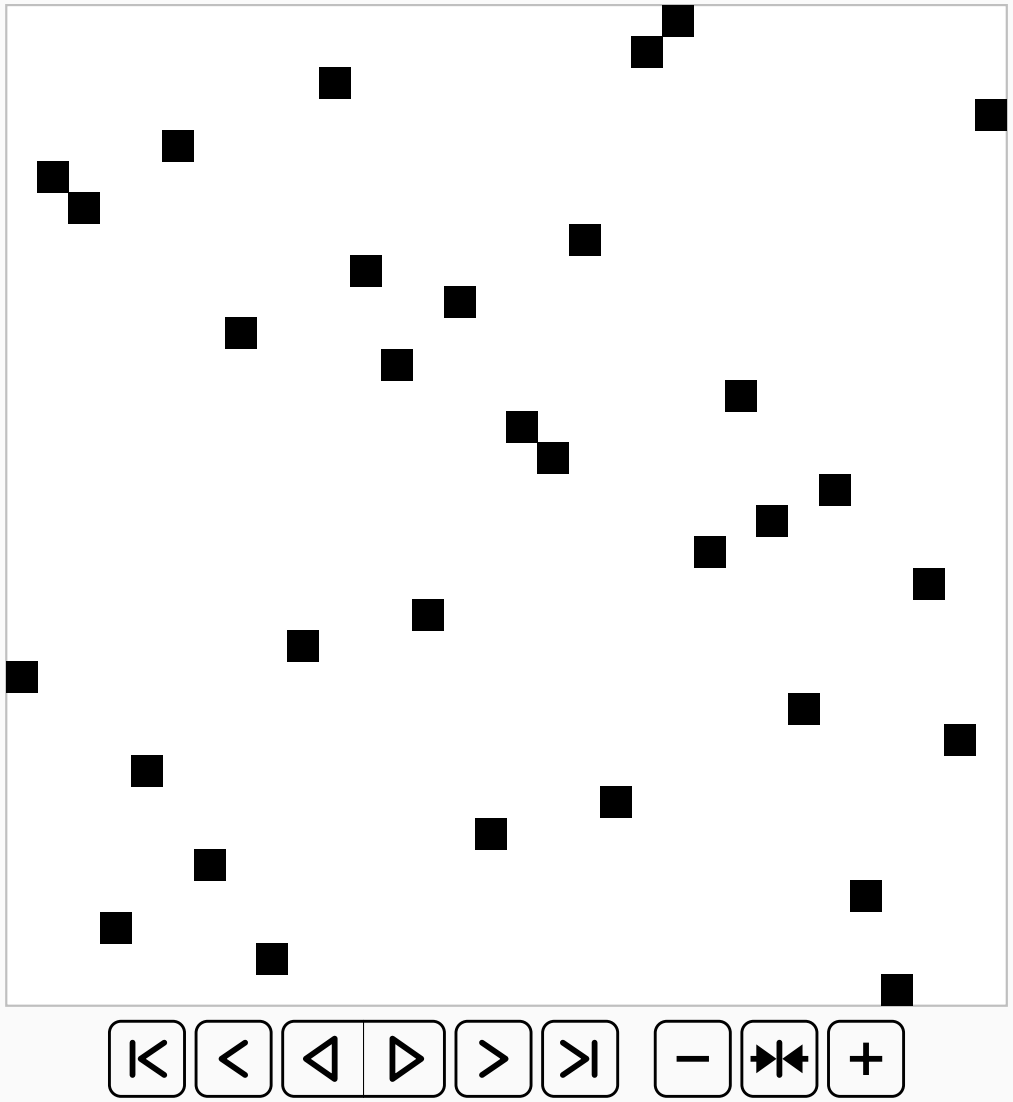
Color Meaning in Visualization (cont.)

modrá – the height of the blue background determines the value of the selected pivot.
The blue background can be imagined as “water surface”, the pivot reaches exactly to “surface”, elements smaller than the pivot are “below the sutface” and elements larger than the pivot protrude “above the surface”.
Before recursively splitting the sorted section into two smaller sections, all elements to the left of the pivot are “below the surface” and to the right of the pivot are “above the surface”.

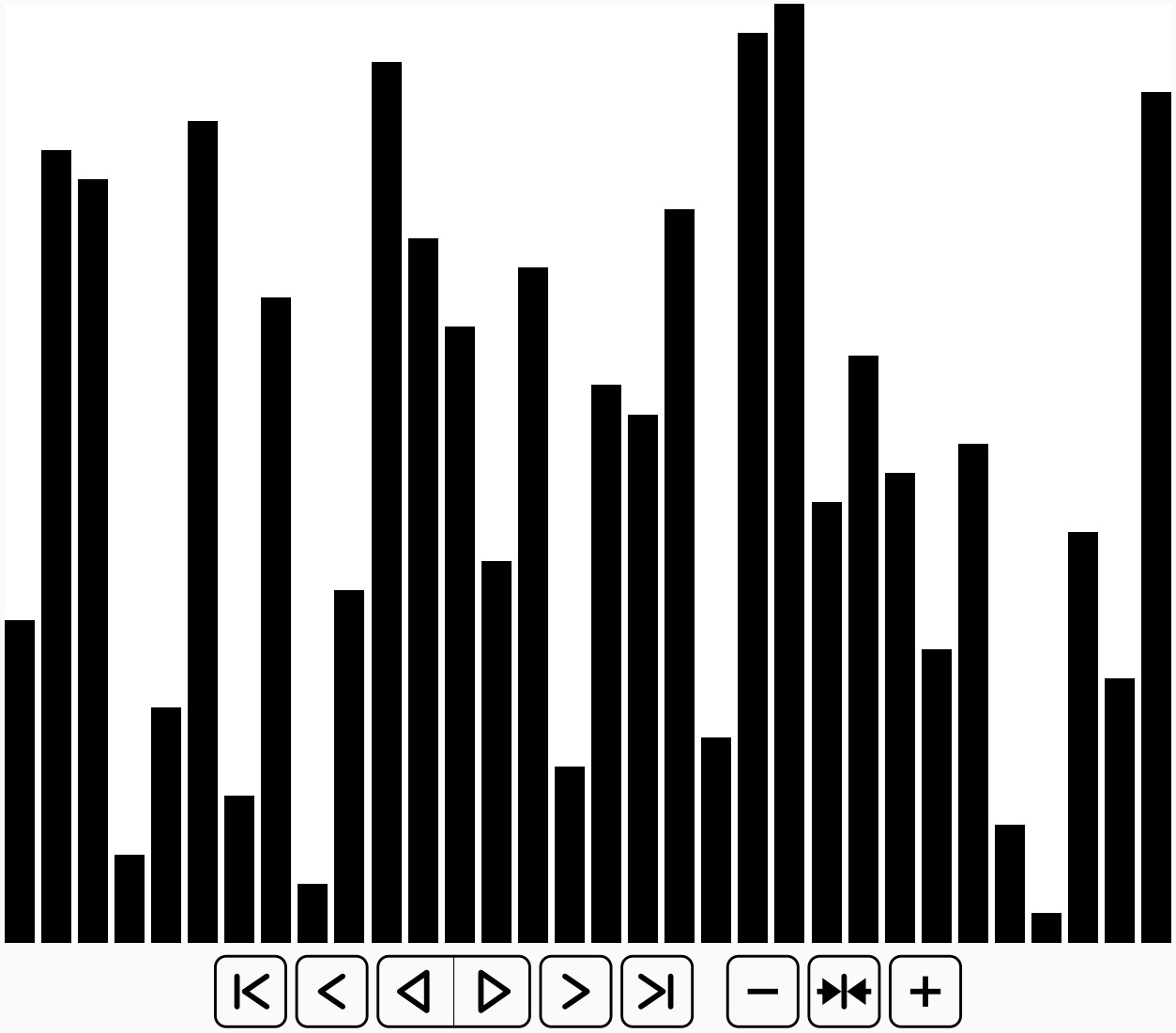
Random Permutation, Middle Element of Subarray as Pivot



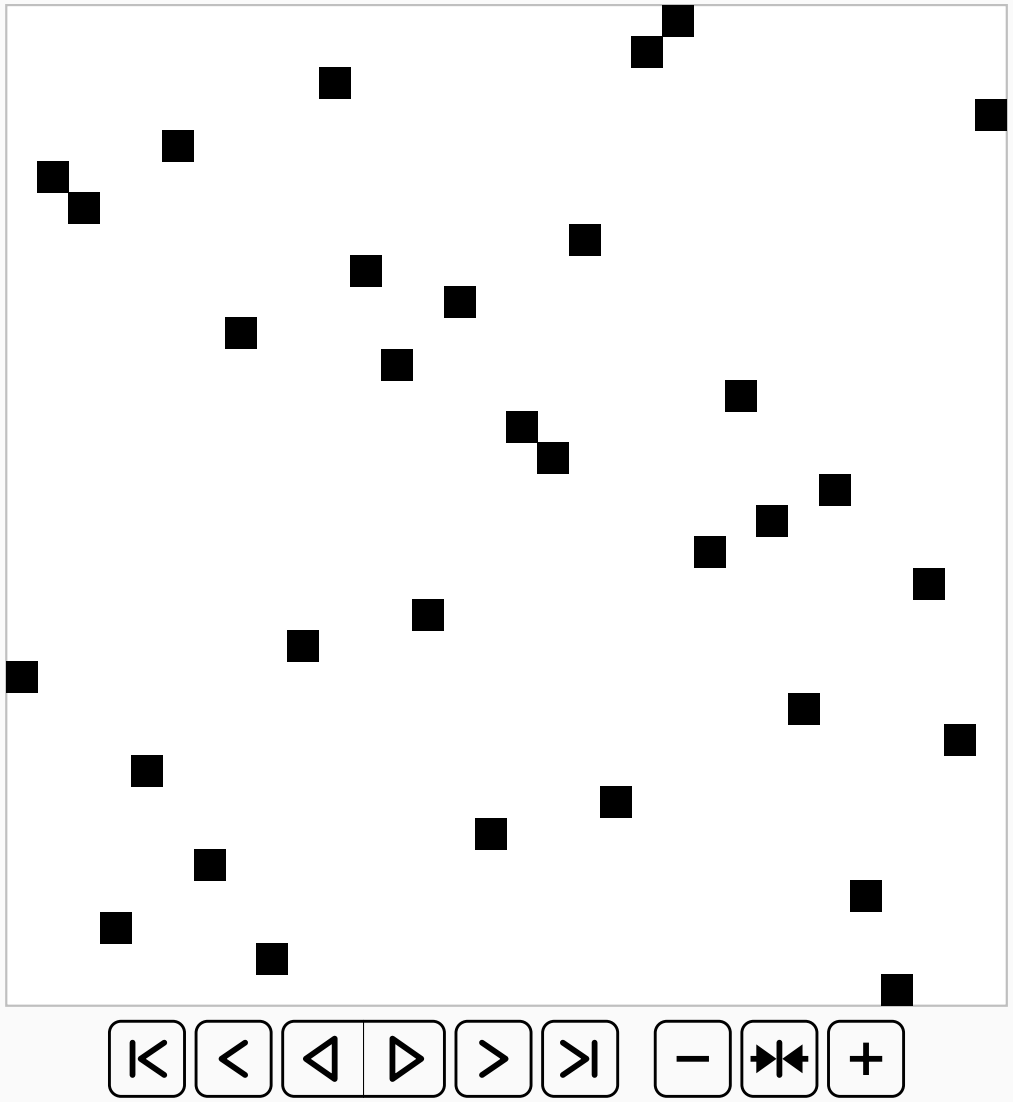
Random Permutation, Middle Element of Subarray as Pivot



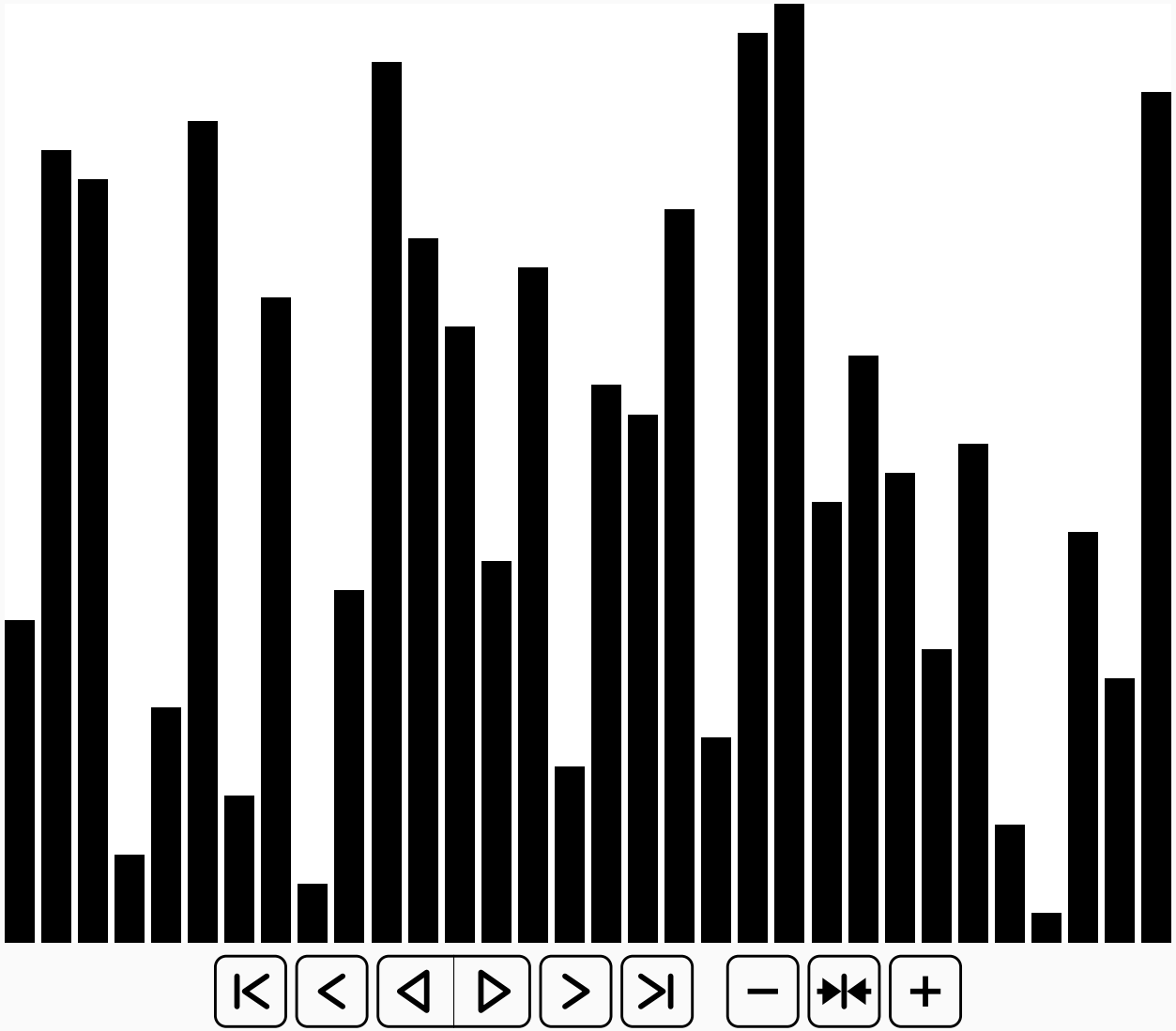
Random Permutation, Median of Subarray as Pivot



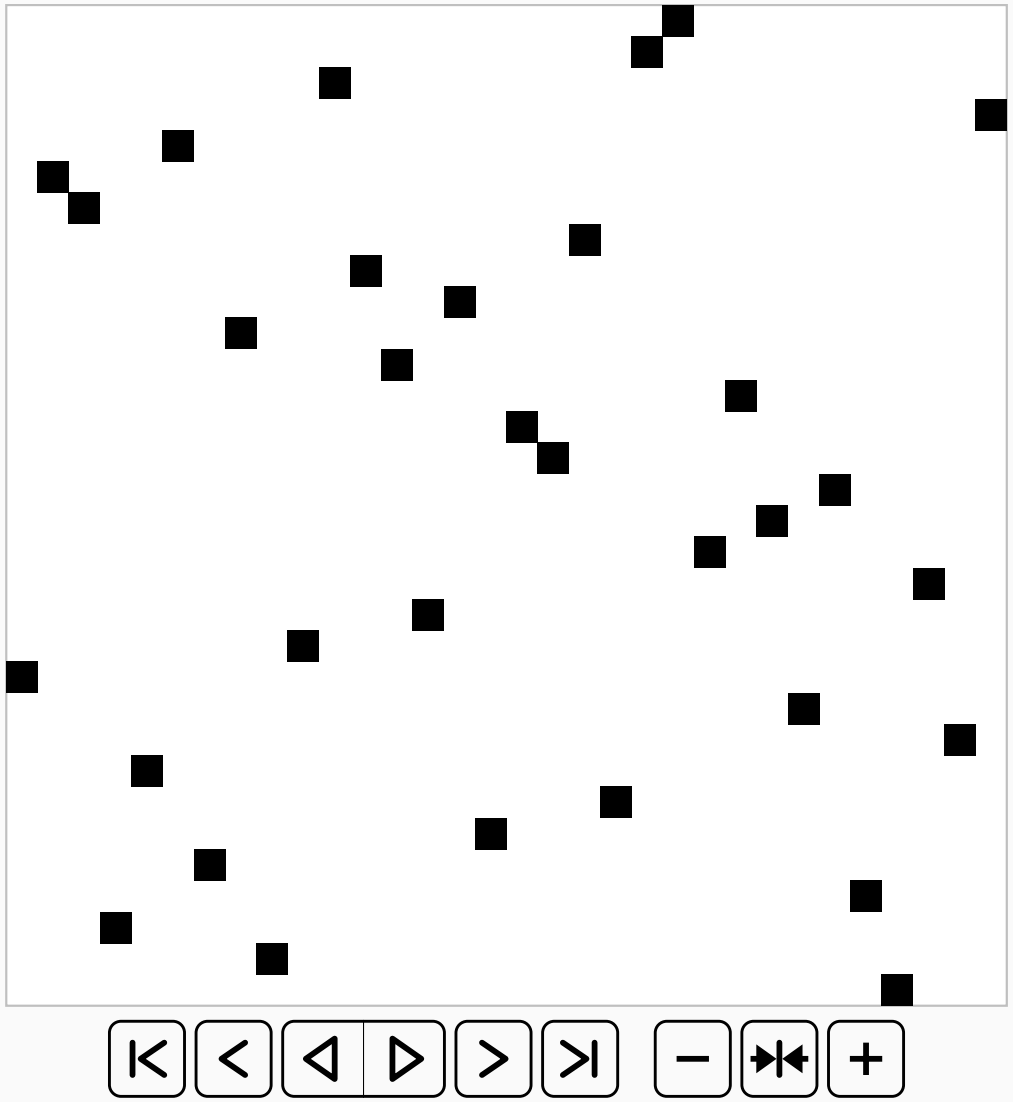
Random Permutation, Median of Subarray as Pivot



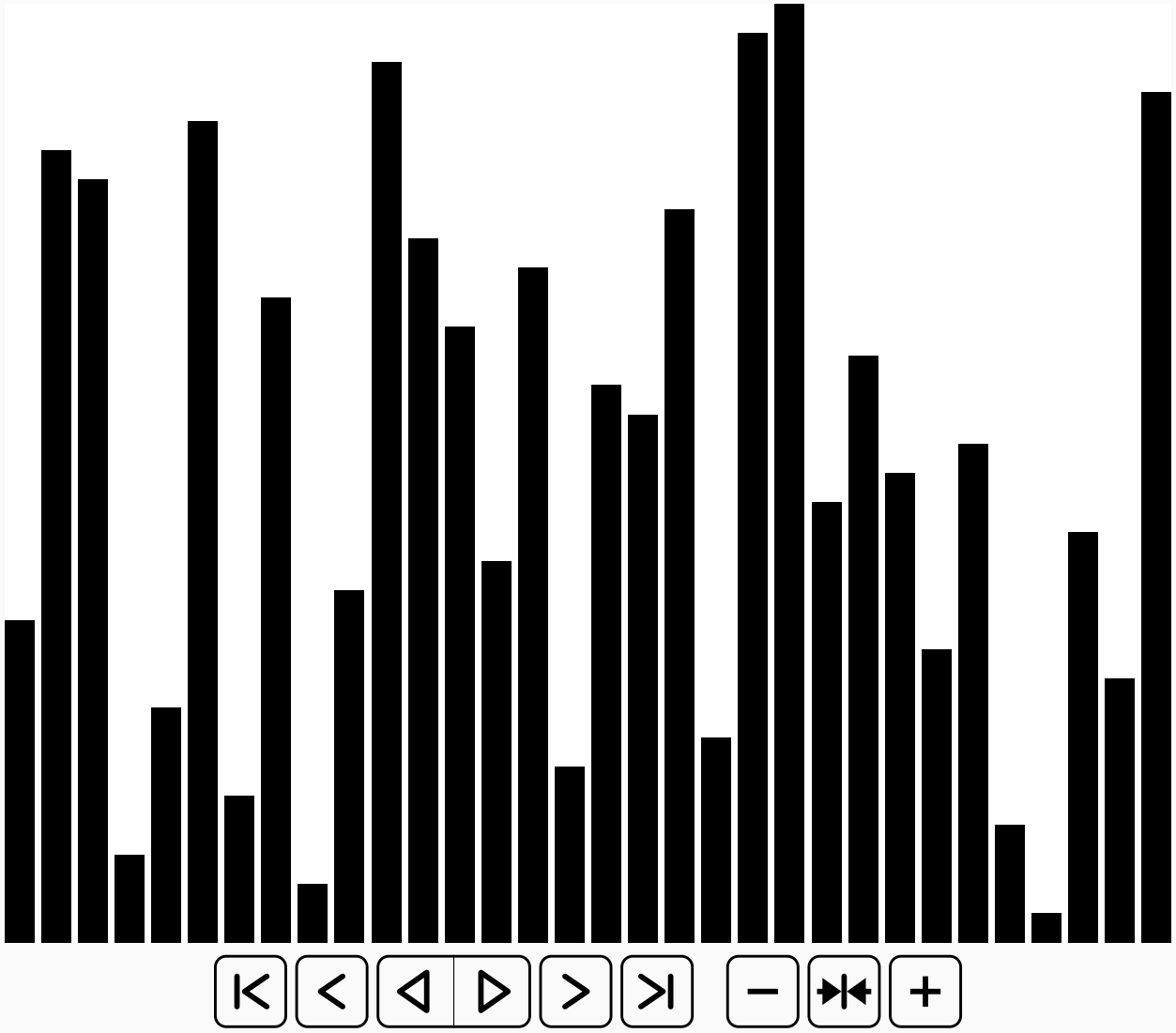
Random Permutation, Minimal Element of Subarray as Pivot



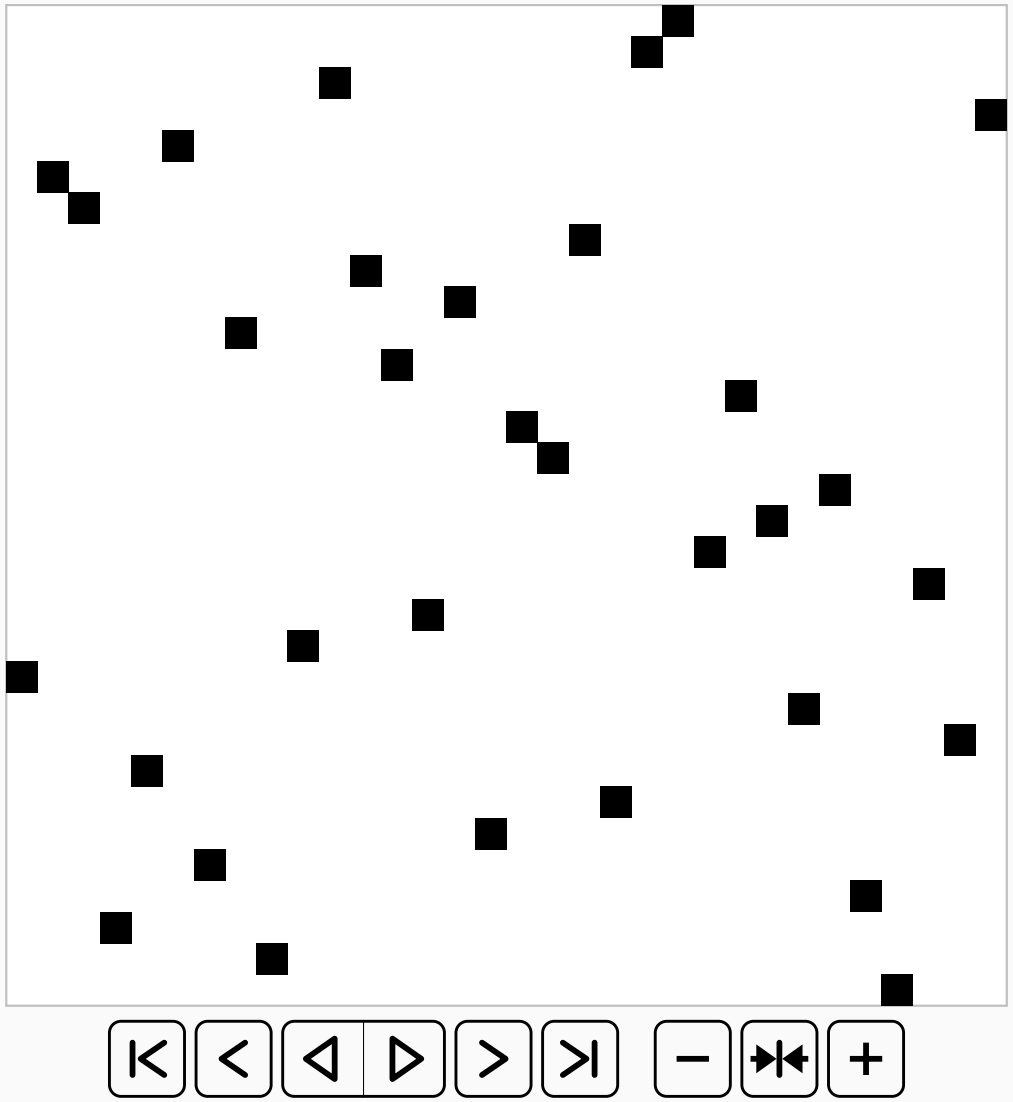
Random Permutation, Minimal Element of Subarray as Pivot



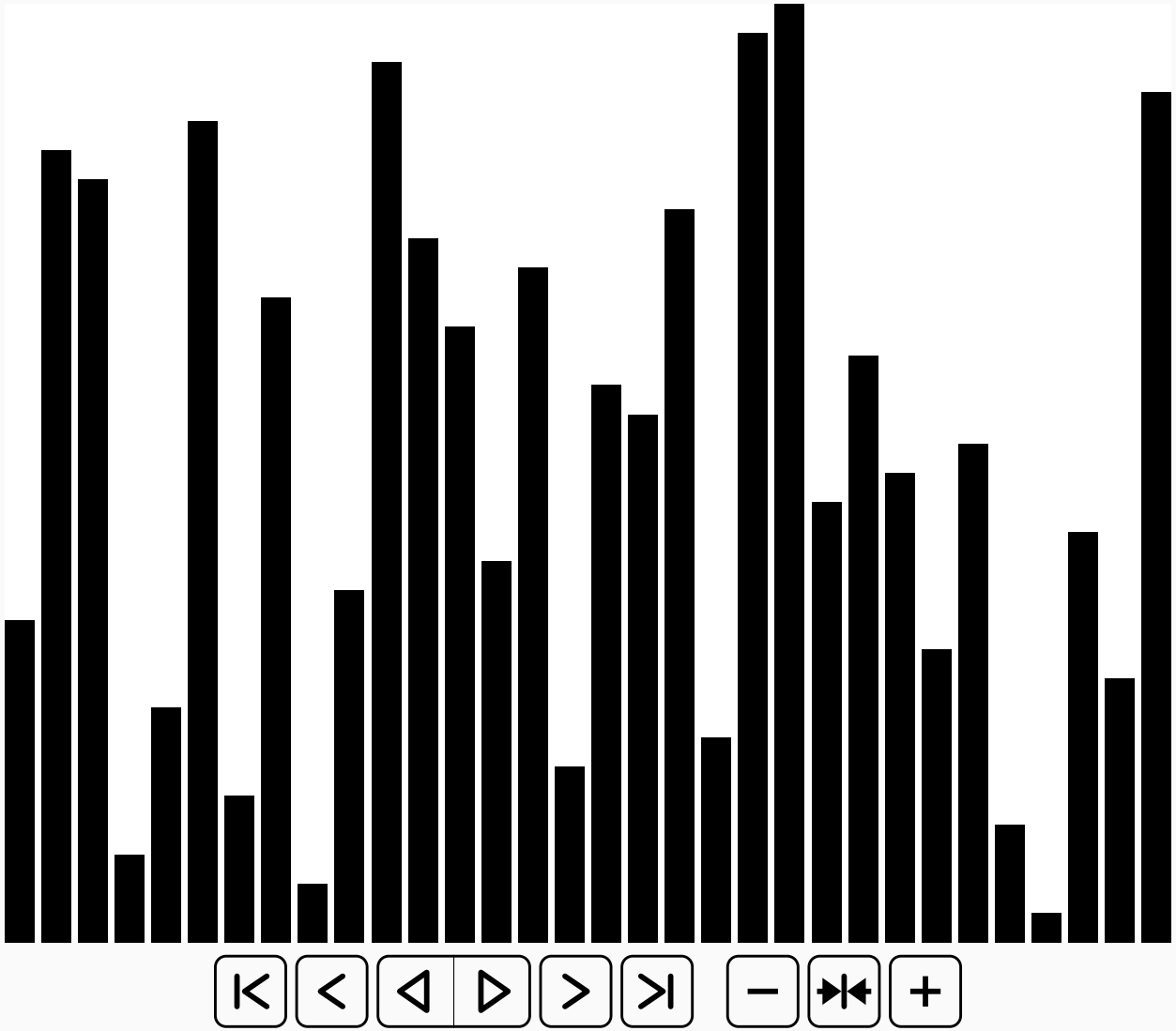
Random Permutation, Leftmost Element of Subarray as Pivot



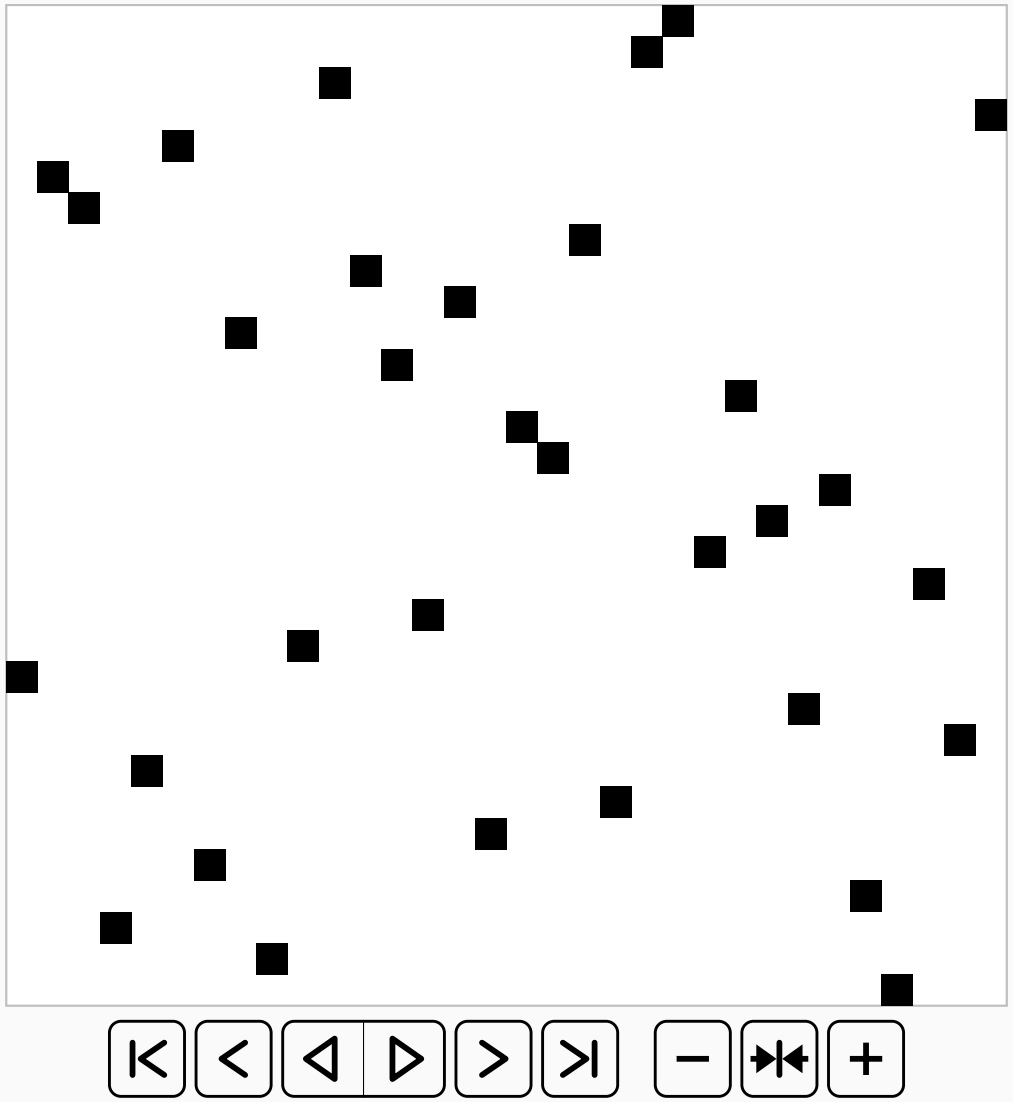
Random Permutation, Leftmost Element of Subarray as Pivot



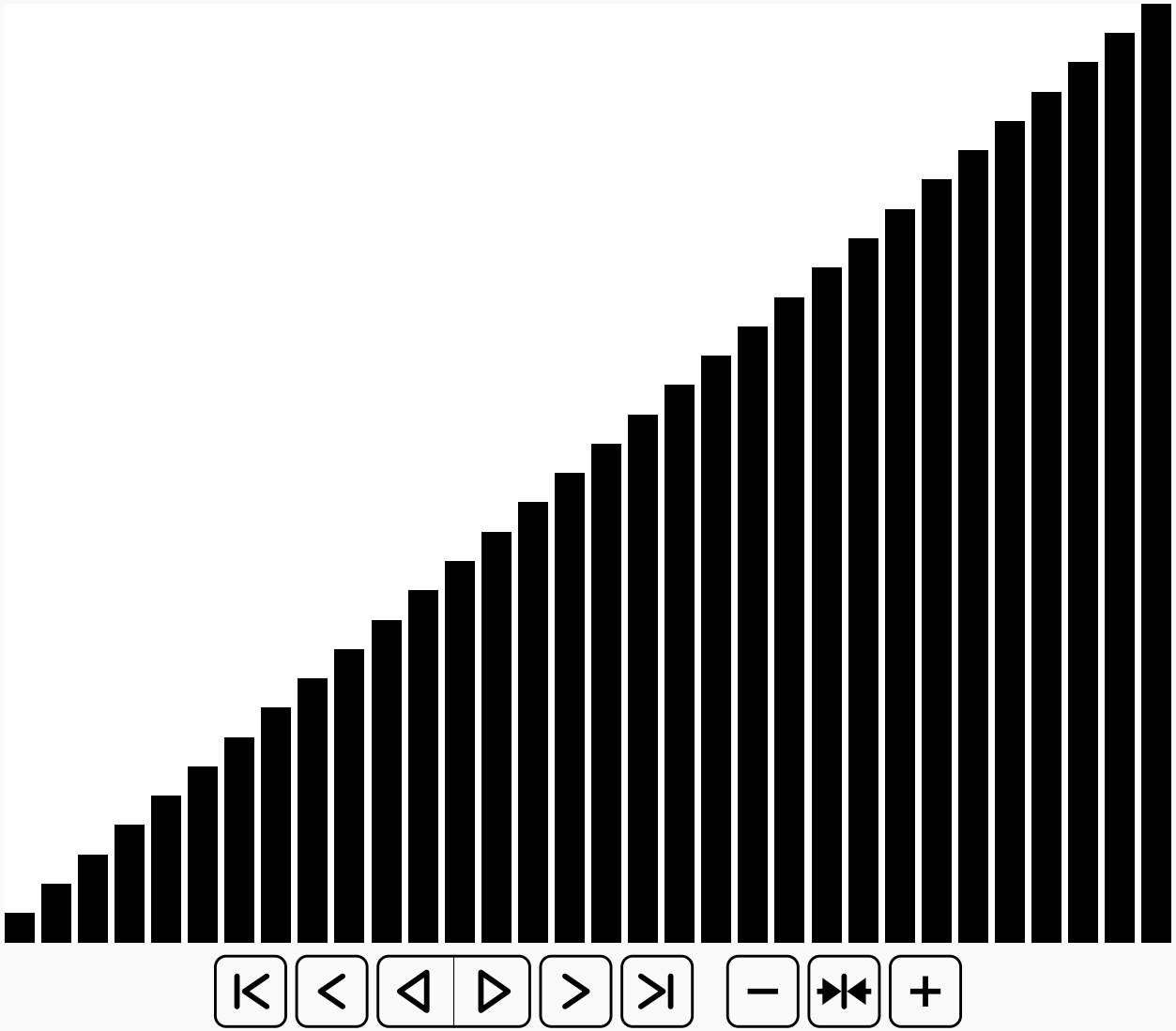
Random Permutation, Random Element of Subarray as Pivot



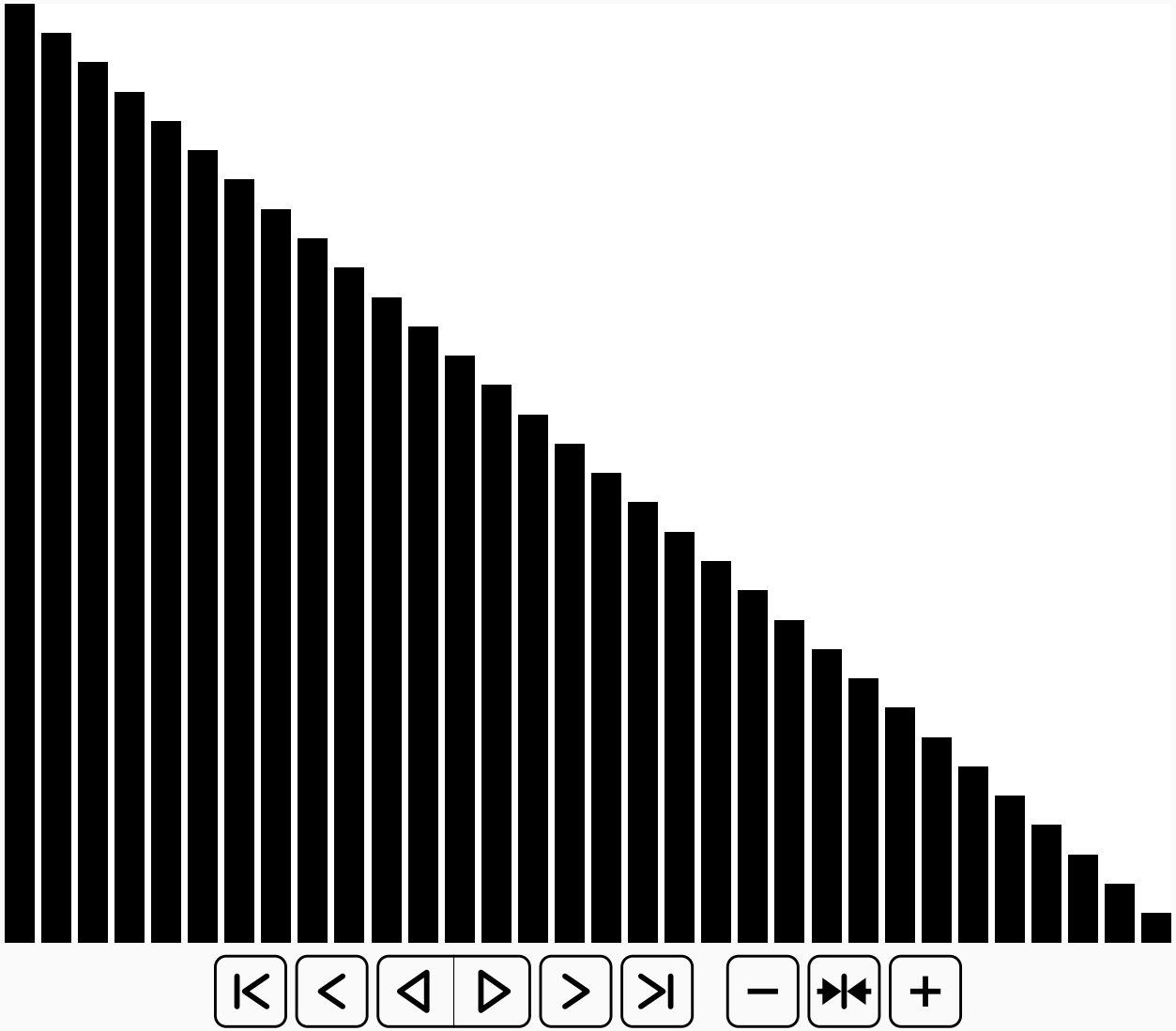
Random Permutation, Random Element of Subarray as Pivot



Identical Permutation, Middle Element of Subarray as Pivot



Reverse Permutation, Middle Element of Subarray as Pivot



Reverse Permutation, Middle Element of Subarray as Pivot