Topics: One-dimensional array

Reading (JV): Sec 6.0, selection sort in Sec 6.2

Arrays

- Arrays are objects. An array is an ordered list of values (or objects) of one type
- The entire array has one name (identifier)
- Each element in the array has an integer index (begins at 0)
- An array of length \( N \) is indexed from 0 to \( N-1 \)

Array declaration and construction

- Declaration syntax:

  \[
  \text{type}[\text{identifier}];
  \]

  Examples:
  - \( \text{int}[\text{counts}] \)
  - \( \text{double}[\text{price}] \)
  - \( \text{String}[\text{names}] \)
  - \( \text{Interval}[\text{series}] \) // assuming an Interval class has been defined

- Instantiation syntax:

  \[
  \text{new \ type[ size ]}
  \]

  \( size \) is an integer

  Example:
  - \( \text{new int[4]} \)

- Declaration and instantiation

  \[
  \text{int limit} = 4;
  \text{double}[\text{price}] ; \quad \text{// declaration}
  \text{price} = \text{new double[limit]} ; \quad \text{// instantiation and assignment}
  \]

- Creating an array using an initializer list

The size of an array is held in the constant \( \text{length} \). \( \text{length} \) is automatically defined when an array is created and cannot be changed. In the above example, the expression \( \text{price.length} \) gives the size of the array \( \text{price} \).

Index operator []

The expression \( \text{identifier}[\text{integer_expression}] \) accesses an element in the array referred to by \( \text{identifier} \)

Examples:

\[
\begin{align*}
\text{int[} & \text{ freq} = \text{new int[101]}; \quad \text{// declaration & instantiation} \\
\text{freq[9+70]} & = 17; \quad \text{//set freq[79] to 17 (freq[79] is the 80th element in freq)} \\
\text{int grade} & = \text{Keyboard.readInt()}; \quad \text{//assume the value to be 1 to 100 inclusive} \\
\text{freq[grade]} & = \text{freq[grade]} + 1; \\
\text{freq[grade]++};
\end{align*}
\]

In the example above, the expression \( \text{freq[2]} \) represents an integer and can be used anywhere an \text{int} variable can be used.
Pattern for processing an array

// assume an array has been created and is referred to by variable arr
for (i=0; i<arr.length; i++) {
    // perform some process (on arr[i])
}

Example

Create an array of length 6 filled with random numbers in the range of 5 to 9. Calculate the sum.

Sorting

- Arrange elements in a list by some specified order
- Sort “in-place” means sort without using extra memory space for holding another copy of the array
- There are many sorting algorithms: selection sort, insertion sort, bubble sort, etc.

Template for selection sort (ascending order)

// Loop from first to second last element

// Find index of minimum value ___________________________

// Swap ith element with minimum value