COMP 110-003
Introduction to Programming
In-Class Exercise: Selection Sort

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Review: Arrays

• `int[] scores = new int[5];`

• This is like declaring 5 strangely named variables of type `int`:
  – `scores[0]`
  – `scores[1]`
  – `scores[2]`
  – `scores[3]`
  – `scores[4]`

• Especially, you can use `score[i]` to locate a single one
Review: Index

- Variables such as scores[0] and scores[1] that have an integer expression in square brackets are known as:
  - *indexed variables*, *subscripted variables*, *array elements*, or simply *elements*

- An *index* or *subscript* is an integer expression inside the square brackets that indicates an array element
  - ArrayName[index]
Review: Array and Index

- Index numbers start with 0. They do NOT start with 1 or any other number.
- The array name represents a memory address, and the $i^{th}$ element can be accessed by the address plus $i$. 

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>data</td>
<td>62</td>
<td>51</td>
<td>88</td>
<td>70</td>
<td>74</td>
</tr>
<tr>
<td>m address</td>
<td>25131</td>
<td>25132</td>
<td>25133</td>
<td>25134</td>
<td>25135</td>
</tr>
</tbody>
</table>
Review: Creating an Array

- Array is a special class and we create its objects
  - Syntax for creating an array:
    - `Base_Type[] Array_Name = new Base_Type[Length]`;
  - Example:
    - `int[] pressure = new int[100];`
  - Alternatively:
    - `int[] pressure;`
    - `pressure = new int[100];`
Review: Length of An Existing Array

• An array is a special kind of object
  – It has one public instance variable: length
  – length is equal to the length of the array
    Pet[] pets = new Pet[20];
    pets.length has the value 20
  – You cannot change the value of length because it is final
Review: Don’t be OUT OF BOUNDS!

• Indices MUST be in bounds
  – `double[] entries = new double[5]; // from [0] to [4]`
  – `entries[5] = 3.7; // ERROR! Index out of bounds`

• Your code will compile if you are using an index that is out of bounds, but it will give you a run-time error!
Today’s Topic: Sorting

• Given an array of numbers, sort it into ascending/descending order

• Before sorting:

| 4 | 7 | 3 | 9 | 6 | 2 | 8 |

• After sorting:

| 2 | 3 | 4 | 6 | 7 | 8 | 9 |
There are so many ways......

- Sorting is an extremely important question in computer science:
  - Google “sorting animation”

- We consider a very simple idea in this class
  - Find the minimum value in array, and put it in the front
  - Find the minimum value in the remaining array (without the first value), and put it in the front of the remaining array (without the first value)
  - Repeat until we meet the end of the array
Selection Sort Pseudocode

for (index = 0; index < length; index++) {
    Find index of smallest value of array between index and end of array;
    Swap values of current index and the index with the smallest value;
}

Selection Sort

1. Initial array: 4 7 3 9 6 2 8
2. Find the smallest element (2) and swap it with the first element: 2 7 3 9 6 4 8
3. Move on to the second position, find the smallest element (3) and swap it with the second element: 2 3 7 9 6 4 8

Result: 2 3 7 9 6 4 8
Swap

private static void swap(int i, int j, int[] a) {
    int temp = a[i];
    a[i] = a[j];
    a[j] = temp;
}

• This method will swap the value of a[i] and a[j]
• Remember that a is a memory address
  – None of a, i and j are changed in this code
  – Only a[i] and a[j] are changed – they are not local!
Requirement

• Complete the given template and make it run
  – The template is given as an assignment on Sakai
• Test your program by test cases on next page
• The deadline is 12:00PM. You must upload your file before that time
  – The website will be close at that time
  – You can upload it many times. Don’t do it in the last min!
• If you think you are done, you can raise your hand and let me know
Test Case 1

Enter the size of the array:
1
Enter the numbers in the array:
5
The current elements in the array are:
5.
The elements in the sorted array are:
5.
Test Case 2

Enter the size of the array:
3
Enter the numbers in the array:
3
2
1
The current elements in the array are:
3, 2, 1.
The elements in the sorted array are:
1, 2, 3.
Test Case 3

Enter the size of the array:
6
Enter the numbers in the array:
4
3
1
5
4
3

The current elements in the array are:
4, 3, 1, 5, 4, 3.
The elements in the sorted array are:
1, 3, 3, 4, 4, 5.
Insertion Sort

- If you are done and feel bored
  - Try insertion sort, print the array in each loop
  - Before each loop:
    - Read: http://en.wikipedia.org/wiki/Insertion_sort
  - After each loop:
    - Raise hand if you are done or have problems