Basis of Computer Programming (java A)
Tutorial 5

[Experimental Objective]
- Learn array initializer (Declare, create, and initialize).
- Learn how to print array by for loop
- Learn how to using array to realize some simple algorithms
- Learn how to use online judge system.

[Before Exercises]

(1)   Type following code, try to create two arrays and use two different ways to print them.

```java
int array1[]={1,2,3,4,5};
int array2[]=new int[5];
array2[0]=6;
array2[1]=7;
array2[2]=8;
array2[3]=9;
array2[4]=10;

for(int i=0;i<array1.length;i++){
    System.out.print(array1[i]+"\t");
}
System.out.println();
for(int e:array2){
    System.out.print(e+"\t");
}
System.out.println();
```

(2)   Continue typing, create another array without giving it an address, and then finding what is the difference between two arrays.

```java
int array3[]=null;
System.out.println(array3);

array3=array2;
System.out.println(array3);
```

(3)   Why the first loop cannot change the value of array3?   The second loop can change the value.

```java
for(int e:array3){
    e=1;
}
System.out.println("array3: "+Arrays.toString(array3));
for(int i=0;i<array3.length;i++){
    array3[i]=1;
}
System.out.println("array3: "+Arrays.toString(array3));
```

(4)   We change the value of elements in array3, why are the elements in array2 changed accordingly?

```java
System.out.println("array2: "+Arrays.toString(array2));
```

[Exercises]

1. Basic operation of array
    (1) Declare and create an array named myList with <mark>n (0<n<20)</mark> elements of <mark>double type</mark>.
    (2) Initialize it with input values and print the each element of array you designed.
    (3) Circle shift the elements left and print each element in the shifted array using for-each loop.

    Enter the length of myList:8
    Enter 8 values: 2.5 5.5 3.4 6.4 7.7 2.2 8.9 0.2
    The array:2.5 5.5 3.4 6.4 7.7 2.2 8.9 0.2
    The shifted array:5.5 3.4 6.4 7.7 2.2 8.9 0.2 2.5

2. Suppose there are 10 students in a class, and we want the <mark>average score of these 10 students</mark>. Input 10 scores ([0, 100]) from the keyboard. <mark>Then after removing the highest score and the smallest score</mark>, please find the average score of the other 8 scores.

    Please input 10 scores of these students:88.3 99 45 78 67.5 98.4 23.5 65.5 82 85.4
    Average score is 76.26

3. *(Dice Rolling)* Write an application to simulate the rolling of two dice. The application should use an object of class Random once to roll the first die and again to roll the second die. The sum of the two values should then be calculated. Each die can show an integer value from 1 to 6, so the sum of the values will vary from 2 to 12. Your application should roll the dice 36,000,000 times. Use a one-dimensional array to tally the number of times each possible sum appears. Display the elements of the array orderly in a line.
    For example, the result may be

        2: 1000331
        3: 1998782
        4: 3000018
        5: 4001399
        6: 4999063
        7: 6001271
        8: 4998678
        9: 3998816
        10: 3000375
        11: 2000839
        12: 1000428

4. Write a program that reads the integers between 1 and 100 and counts the occurrences of each. <mark>Assume the input ends with 0</mark>. Here is a sample run of the program

    Enter the integers between 1 and 100: 22 33 35 34 99 87 45 34 23 78 45 33 11 23 87 34 76 0
    11 occurs 1 time
    22 occurs 1 time
    23 occurs 2 times

33 occurs 2 times
34 occurs 3 times
35 occurs 1 time
45 occurs 2 times
76 occurs 1 time
78 occurs 1 time
87 occurs 2 times
99 occurs 1 time

5. Write a program to sort an out-of-order integer sequence in ascending order. Firstly, input how many numbers you will sort, after that input these integer numbers, and finally the program will output the ordered sequence.

How many numbers you will input:10
3 5 2 99 44 54 23 46 87 56
2 3 5 23 44 46 54 56 87 99

Bubble sorting
Original sequence: 35,64,18,22,51,7
For first outer loop: make sure to move the largest number to the end of array
Compare: if(array[i] >array[i+1]){
              Change the value of two elements
          }
loop1: 35,64,18,22,51,7   (no change)
loop2: 35,18,64,22,51,7   (change)
loop3: 35,18,22,64,51,7   (change)
loop4: 35,18,22,51,64,7   (change)
loop5: 35,18,22,51,7,64   (change)

For second outer loop: make sure to move the second largest number to the second end position of array
loop1: 18,35,22,51,7,64   (change)
loop2: 18,22,35,51,7,64   (change)
loop3: 18,22,35,51,7,64   (no change)
loop4: 18,22,35,7,51,64   (change)

Third outer loop:
loop1: 18,22,35,7,51,64 (no change)
loop2: 18,22,35,7,51,64 (no change)
loop3: 18,22,7,35,51,64 (change)

6. Writing a program that prompts the user to enter n ($0<n<10^4$) integers ($0<integer<10^5$)) in ascending order. We want the average value of combinations of picking two numbers from these n integers should larger than the average value of all these integers, and count how many couples satisfy the condition.

(Please try to design your program to accomplish this question as fast as possible)

you can use current2-current1 to test how many time your program execute this algorithm.

```java
long current1=System.currentTimeMillis();
/* your algorithm */
long current2=System.currentTimeMillis();
System.out.printf("your program using %.3f second",(current2-current1)/1000.0d);
```

Enter how many numbers: 5
Enter 5 numbers:
1 2 3 4 5
average=3.0
The number of these couple is 4
your program using 0.004 second

Enter how many numbers: 30
Enter 30 numbers:
2 3 5 6 9 10 12 13 15 16 23 55 66 77 89
101 220 221 222 255 277 280 290 300 303
400 420 455 500 520
average=172.16666666666666
The number of these couple is 194
 your program using 0.004 second