

CSE3040 Java Language

Lecture #06

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This material is based on lecture notes by Prof. Juho Kim. Do not post it on the Internet.

1.8. Arrays

- Array Creation: array name, array size, array element (type)
 - new operator creates an array in the heap area of the main memory
int [] a = new int[10]; or int a[] = new int[10];

creates an array a[0], a[1], a[2], ..., a[9]
 - Initial values before assignment
 - int, long, float, ... : 0
 - boolean : false
 - char : ASCII CODE 0
 - string, frame, ... : null

1.8. Arrays

```
class arGabX {
    public static void main(String[] args)
    {
        int    n[] = new int[3];
        double d[] = new double[3];
        boolean b[] = new boolean[3];
        String s[] = new String[3];

        n[2] = 100;
        d[2] = 1.23;
        b[2] = true;
        s[2] = "Java JaBa";

        System.out.println("int\tdouble\tboolean\tString");

        for (int i=0 ; i<3 ; i++)
            System.out.println("" +n[i]+'\\t'+d[i]+'\\t'+b[i]+'\\t'+s[i]);
    }
}
```

1.8. Arrays

- Array index out of range: compiler will not complain, but execution will.

```
class arNew {
    public static void main(String[] args)
    {
        int[] a    = new int[10];
        int    b[] = new int[10];
        int    i;

        for (i=0 ; i<5 ; i++)
        {
            a[i] = (i+1)*10  + 1;
            b[i] = (i+1)*100 + 5;
        }

        // i==10 -> run-time error
        for (i=0 ; i<15 ; i++)
            System.out.println(a[i] + "    " + b[i]);
    }
}
```

1.8. Arrays

- Array value assignment

```
int a[] = {1, 3, 5, 7, 9};
```

```
a[0] = 1, a[1] = 3, a[2] = 5, a[3] = 7
```

```
a[4] = 9
```

- Notice that you do not use a call to new when you use this syntax.
-
- a.length
 - Returns size of array (number of elements)
 - array copy using assignment
 - b = a;

1.8. Arrays

```
class arInit {  
    public static void main(String[] args)  
    {  
        int a[] = {1, 3, 5, 7, 9};  
        int b[] = new int[a.length]; // a.length : size of a[] (5)  
        int i;  
  
        // array copy using assignment  
        b = a;  
  
        for (i=0 ; i<a.length ; i++)  
            System.out.println(a[i] + " " + b[i]);  
    }  
}
```

1.8. Arrays

- Array Copy using arraycopy()

System.arraycopy(srcArray, i, destArray, j, n);

- srcArray : source array
- i : starting position of srcArray
- destArray : destination array
- j : starting position of destArray
- n : the number of copy

```
class arCopy {  
    public static void main(String[] args)  
    {  
        int a[] = {11, 13, 15, 17, 19, 21, 23};  
        int b[] = new int[a.length];  
        int i;  
        System.arraycopy(a, 1, b, 2, 3);  
  
        for (i=0 ; i<a.length ; i++)  
            System.out.println(a[i] + " " + b[i]);  
    }  
}
```

1.8. Arrays

- Assignment and arraycopy()
 - `a[], b[]` are arrays;
`a=b;`
address copy. For example, if address of `a` is 100, address of `b` is 100.
If you change value of `b[]`, `a[]` change.
 - `System.arraycopy(a, 1, b, 2, 3);`
Simple data copy

1.8. Arrays

```
class arGab {
    public static void main(String[] args)
    {
        int a[] = {1, 3, 5, 7, 9};
        int b[] = new int[a.length];
        int i;

        // all component copy from a[] to b[]
        b = a;      // if you use System.arraycopy(a, 0, b, 0, 5);
                   // change of b[] doesn't influence the value of a[]

        // if b[] change, then a[] change
        b[0] = 111; b[1] = 222; b[2] = 333;
        b[3] = 444; b[4] = 555;

        for (i=0 ; i<b.length ; i++)
            System.out.println(a[i] + " " + b[i]);
    }
}
```

1.8. Arrays

- Array Application Example : generate random numbers ranging 10 ~ 99 and stores number of appearances in ranges 10 ~ 19, 20 ~ 29, ..., 90 ~ 99
 - Analysis of arNanSu.java
 - `int a[] = new int a[10];`
array declaration
 - `nsoo = (int) (Math.random()*90 + 10);`
Math.random is the method defined in Math class and returns a random number ranging from 0 to 0.9999...
 - `sib = nsoo / 10;`
`a[sib]++;`
assign sib to decimal part of nsoo, add a[sib] to 1

1.8. Arrays

```
class arNanSoo {
    public static void main(String[] args)
    {
        int    a[] = new int[10];          // a[0], a[1]... a[9] : 0
        int    nsoo, sib;

        for (int i=0 ; i<10 ; i++)
        {
            nsoo = (int)(Math.random()*90 + 10);
            System.out.print(nsoo + " ");

            sib = (int)(nsoo / 10);
            a[sib]++;
        }

        System.out.println("\n\n<random number count>");

        for (int i=1 ; i<10 ; i++)
            System.out.println(i*10 + "~" + ((i+1)*10-1) + " : " + a[i]);
    }
}
```

1.8. Arrays

- Multi-dimensional Array

- Two dimensional array

```
int a[][] = new int[4][3];           =   int [][] a = new int[4][3];
```

from `a[0][0]` to `a[3][2]`

`a.length` \Rightarrow 4 (row)

`a[0].length` \Rightarrow 3 (column)

Value Assignment

```
int a[][] = {{10, 11, 12}, {20, 21, 22}  
             {30, 31, 32}, {40, 41, 42}}
```

1.8. Arrays

```
class arYeeChaWon {
    public static void main(String[] args)
    {
        int a[][] = { {10,11,12}, {20,21,22}, {30,31,32}, {40,41,42} };
        int i, j, hab;

        System.out.println("a.length      : " + a.length);
        System.out.println("a[0].length : " + a[0].length + '\n');

        for (i=0 ; i<a.length ; i++)
        {
            hab = 0;
            for (j=0 ; j<a[0].length ; j++)
            {
                System.out.print(a[i][j] + " ");
                hab += a[i][j];
            }

            System.out.print("    " + hab + "\n");
        }
    }
}
```

1.8. Arrays

- Three-dimensional Array

```
boolean [][][] a = new boolean [3][4][5];
```

3x4x5 element boolean array a from a[0][0][0] to a[2][3][4]

initial values are false

```
int [][][] a = {{{1, 2}, {3, 4}}, {{5, 6}, {7, 8}}}
```

Programming Lab #06

06-01. Arrays of different types

- What will be printed on the display when you execute this program?
- Guess first, and then run this program and see the result for yourself.

```
public class Ex06_01 {  
    public static void main(String[] args) {  
        int n[] = new int[3];  
        double d[] = new double[3];  
        boolean b[] = new boolean[3];  
        String s[] = new String[3];  
        n[2] = 100;  
        d[2] = 1.23;  
        b[2] = true;  
        s[2] = "Java JaBa";  
        System.out.println("int\tdouble\tboolean\tString");  
        for(int i=0; i<3; i++)  
            System.out.println(" " + n[i] + '\t' + d[i] + '\t' + b[i] + '\t' + s[i]);  
    }  
}
```


06-02. Array index

- What will be printed on the display when you execute this program?
- Guess first, and then run this program and see the result for yourself.
- What is causing the run-time error?

```
public class Ex06_02 {  
    public static void main(String[] args) {  
        int[] a = new int[10];  
        int b[] = new int[10];  
        int i;  
        for(i=0; i<5; i++) {  
            a[i] = (i+1)*10 + 1;  
            b[i] = (i+1)*100 + 5;  
        }  
  
        for(i=0; i<15; i++)  
            System.out.println(a[i] + " " + b[i]);  
    }  
}
```

06-03. Copying an array using assignment

- What will be printed on the display when you execute this program?
- Guess first, and then run this program and see the result for yourself.

```
public class Ex06_03 {  
    public static void main(String[] args) {  
        int a[] = {1, 3, 5, 7, 9};  
        int b[] = new int[a.length];  
        int i;  
  
        b = a;  
  
        for(i=0; i<a.length; i++)  
            System.out.println(a[i] + " " + b[i]);  
    }  
}
```

06-04. Copying an array using arraycopy()

- What will be printed on the display when you execute this program?
- Guess first, and then run this program and see the result for yourself.

```
public class Ex06_04 {  
    public static void main(String[] args) {  
        int a[] = {11, 13, 15, 17, 19, 21, 23};  
        int b[] = new int[a.length];  
        int i;  
  
        System.arraycopy(a, 1, b, 2, 3);  
  
        for(i=0; i<a.length; i++)  
            System.out.println(a[i] + " " + b[i]);  
    }  
}
```

06-05. Difference between two ways of copying arrays

- What will be printed on the display when you execute this program?
- Guess first, and then run this program and see the result for yourself.
- Try using `arraycopy()` instead of assignment and see how the result changes.

```
public class Ex06_05 {  
    public static void main(String[] args) {  
        int a[] = {1, 3, 5, 7, 9};  
        int b[] = new int[a.length];  
        int i;  
  
        b = a;    // copying an array using assignment  
  
        b[0] = 111; b[1] = 222; b[2] = 333; b[3] = 444; b[4] = 555;  
  
        for(i=0; i<a.length; i++)  
            System.out.println(a[i] + " " + b[i]);  
    }  
}
```

06-06. Organizing data with arrays

- What will be printed on the display when you execute this program?
- Guess first, and then run this program and see the result for yourself.

```
public class Ex06_06 {  
    public static void main(String[] args) {  
        int a[] = new int[10];  
        int nsoo, sib;  
        for(int i=0; i<10; i++) {  
            nsoo = (int)(Math.random()*90 + 10);  
            System.out.println(nsoo + " ");  
            sib = (int)(nsoo / 10);  
            a[sib]++;  
        }  
        System.out.println("\n\n<random number count>");  
        for(int i=1; i<10; i++)  
            System.out.println(i*10 + "~" + ((i+1)*10-1) + " : " + a[i]);  
    }  
}
```

06-07. Multidimensional arrays

- What will be printed on the display when you execute this program?
- Guess first, and then run this program and see the result for yourself.

```
public class Ex06_07 {  
    public static void main(String[] args) {  
        int a[][] = { {10,11,12}, {20,21,22}, {30,31,32}, {40,41,42} };  
        int i, j, hab;  
        System.out.println("a.length: " + a.length);  
        System.out.println("a[0].length: " + a[0].length + '\n');  
        for(i=0; i<a.length; i++) {  
            hab = 0;  
            for(j=0; j<a[0].length; j++) {  
                System.out.print(a[i][j] + " ");  
                hab += a[i][j];  
            }  
            System.out.print(" " + hab + "\n");  
        }  
    }  
}
```

End of Class



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