Object Oriented Programming using Java

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Outline

1. Array
2. Why to use Array?
3. Declaring an Array
4. Types of Array
5. Single Dimensional Array
6. Multi Dimensional Array

Array

- Array is a collection of elements of similar data type.
- The size (length) of an array is fixed. It cannot be changed after defining.
- The size of an array must be specified by an int or short value.
- The first element of an array starts with index zero.
- An element of an array is accessed by its respective index.
- Java array can be also used as a static field, a local variable or a method parameter.
- Since arrays are objects in Java, we can find their length using the object property **length**. It inherits the Object class, and implements the Serializable as well as Cloneable interfaces.

Array (Cont…)

104	532	703	451	673	983
index[0]	index[1]	index[2]	index[3]	index[4]	index [5]

- Array length: 6
- First index: 0
- Last index: 5

Why to use Array?

- **Code Optimization:** It makes the code optimized, we can retrieve or sort the data efficiently.

- **Random access:** We can get any data located at an index position.

Declaring an Array

- **Declaring**

  Data_Type Variable_Name[];

  Data_Type[] Variable_Name[];

  Class_Name Variable_Name[];

  Object[] Variable_Name;

  Collection[] Variable_Name[];

- **Instantiating/constructing**

  Variable_Name = new Data_Type[Size];

- **Initialization**

  Variable_Name[Index]=Value;

Declaring an Array (Cont…)

- **Declaring, Instantiating and Initialization**

```
Data_Type[] Variable_Name;
Variable_Name = new Data_Type[size];
int[] hello;                    //Declare array
hello = new int[10];            //Allocate memory
```

- In Java, we can declare and allocate memory of an array in one single statement.

```
Data_Type[] Variable_Name = new Data_Type[Size]
int[] hello = new int[10];
```

Declaring an Array (Cont…)

- **Declaring, Instantiating and Initialization (Cont...)**

  Variable_Name[Index]=Value;

  hello[0]=10;

- **Array Literal**

  When the size of the array and variables of array are already known, array literals can be used.

  int[] hello = new int[]{1, 3, 5, 7, 9};

  int[] hello = {1, 3, 5, 7, 9}; //"new int[]" is not required in new version of Java

Types of Array

- Single dimensional array
- Multi dimensional array

Single Dimensional Array

```
class Array
{
   public static void main(String args[])
   {
      int a[]=new int[5];       //Declaration and instantiation
      a[0]=5;                   //Initialization
      a[1]=10;
      a[2]=15;
      a[3]=20;
      a[4]=25;
      System.out.println("Accessing Elements of Array:");
      System.out.println("First Element: " + a[0]);
      System.out.println("Second Element: " + a[1]);
      System.out.println("Third Element: " + a[2]);
      System.out.println("Fourth Element: " + a[3]);
      System.out.println("Fifth Element: " + a[4]);
   }
}
```

Single Dimensional Array (Cont…)

- Output

```
Accessing Elements of Array:
First Element: 5
Second Element: 10
Third Element: 15
Fourth Element: 20
Fifth Element: 25
```

Single Dimensional Array (Cont…)

```
class Array9
{
   public static void main(String args[])
   {
      int a[]={5, 10, 15, 20, 25};       //All in one line
      System.out.println("Accessing Elements of Array:");
      for(int i=0; i<a.length; i++)      //a.length is used to find the size
      {
         System.out.println("The element at a["+i+"] is: "+ a[i]);
      }
   }
}
```

Single Dimensional Array (Cont…)

- Output

```
Accessing Elements of Array:
The element at a[0] is: 5
The element at a[1] is: 10
The element at a[2] is: 15
The element at a[3] is: 20
The element at a[4] is: 25
```

Single Dimensional Array (Cont…)

```
import java.util.*;
class Array8
{
   public static void main(String args[])
   {
        int length;
        Scanner S=new Scanner(System.in);
        System.out.print("Enter Length of Array8: ");
        length=S.nextInt();
        int a[]=new int[length];
        System.out.print("Enter the elements of Array8: ");
        for(int i=0; i<length; i++)
        {
           a[i] = S.nextInt();
        }
        System.out.print("Elements of Array8 are: ");
        for(int i=0; i<length; i++)
        {
           System.out.print(a[i] + "  ");
        }
   }
}
```

Single Dimensional Array (Cont…)

- Output

```
Enter Length of Array8: 3                    //User enters 3
Enter the elements of Array8: 2              //User enters values
3
4
Elements of Array8 are: 2 3 4
```

Single Dimensional Array (Cont…)

- Creating an array of objects

```
class Array1
{
    int ID;
    String Name;
    Array1(int Identity, String Full_Name)
    {
        this.ID = Identity;
        this.Name = Full_Name;
    }
    public static void main (String args[])
    {
        Array1 my_arr[];
        my_arr = new Array1[3];
        my_arr[0] = new Array1(101,"Tanuj");
        my_arr[1] = new Array1(202,"Anwesh");
        my_arr[2] = new Array1(303,"Tarun");
        for (int i = 0; i < my_arr.length; i++)
        {
            System.out.println("Values of my_arr[" + i + "]: " + my_arr[i].ID +" "+ my_arr[i].Name);
        }
    }
}
```

Single Dimensional Array (Cont…)

- Output

  Values of my_arr[0]: 101 Tanuj

  Values of my_arr[1]: 202 Anwesh

  Values of my_arr[2]: 303 Tarun

Single Dimensional Array (Cont…)

- Passing an array to a method

```
class Array2
{
   static void max(int my_arr[])
   {
      int max=my_arr[0];
      for(int i=1; i<my_arr.length; i++)
      {
         if(my_arr[i]>max)
         {
            max=my_arr[i];
         }
      }
      System.out.println(max);
   }
   public static void main(String args[])
   {
      int X[]={45, 87, 76, 100, 56, 301};
      max(X);      //passing array to the method max
   }
}
```

Single Dimensional Array (Cont…)

- Output

  301

Single Dimensional Array (Cont…)

- Returning an array from a method

```
class Array3
{
   static int[] hello()
   {
      return new int[]{100, 200, 400, 800, 1600};
   }
   public static void main(String args[])
   {
     int my_arr[]=hello();      //calling method
     for(int i=0; i<my_arr.length; i++)
     {
        System.out.println(my_arr[i]);
     }
   }
}
```

Single Dimensional Array (Cont…)

- Output

```
100
200
400
800
1600
```

Single Dimensional Array (Cont…)

- Returning an array from a method (Cont…)

```
public class Array4
{
   public static int Index (int[] my_arr, int t)
   {
      if (my_arr == null)
      {
          return -1;
      }
      int l = my_arr.length;
      int i = 0;
      while (i < l)
      {
         if (my_arr[i] == t)
         {
            return i;
         }
         else
         {
             i=i+1;
         }
      }
      return -1;
   }
   public static void main(String args[])
   {
     int[] my_arr = {12, 11, 10, 9, 8, 7};
     System.out.println("12 is at: " + Index(my_arr, 12));
     System.out.println("7 is at: " + Index(my_arr, 7));
   }
}
```

Single Dimensional Array (Cont…)

- Output

  12 is at: 0

  7 is at: 5

Multi Dimensional Array

- A multidimensional array is an array that contains one or more arrays.
- In a multidimensional array, element of the array holds the reference of another array.
- A multidimensional array is created by using one set of square brackets "[]" per dimension.
- It is mostly used.

Multi Dimensional Array (Cont…)

- To declare a multidimensional array variable, specify each additional index using another set of square brackets.

```
int twoDimen[ ][ ] = new int[4][5];
int[][] twoDimen = { {1, 2, 3, 4}, {5, 6, 7} };

int mltiDimen[][][] = new int[2][3][4];
int[][][] multiDimen = { { {1, 2, 3}, {4, 5, 6}, {7, 8, 9} } };
```

Multi Dimensional Array (Cont…)

```
class Array5
{
   public static void main(String args[])
   {
      int my_arr[][] = {{34, 87, 39}, {31, 65, 12}, {27, 64, 29}};
      for (int i=0; i<=2 ; i++)
      {
         for (int j=0; j <=2 ; j++)
         {
            System.out.print(my_arr[i][j] + " ");
         }
         System.out.println();
      }
   }
}
```

Multi Dimensional Array (Cont…)

- Output

```
34 87 39
31 65 12
27 64 29
```

Multi Dimensional Array (Cont…)

```
class Array10
{
   public static void main(String args[])
   {
      int my_arr[][][] = { { {1, 2, 3}, {4, 5, 6}, {7, 8, 9} } };
      System.out.println("Elements of 3D array are: ");
      for (int i = 0; i < 1; i++)
      {
         for (int j = 0; j < 3; j++)
         {
            for (int k = 0; k < 3; k++)
            {
               System.out.println ("my_arr [" + i + "][" + j + "][" + k + "]: " + my_arr[i][j][k]);
            }
            System.out.println();
         }
      }
   }
}
```

Multi Dimensional Array (Cont…)

- Output

```
Elements of 3D array are:
my_arr [0][0][0]: 1
my_arr [0][0][1]: 2
my_arr [0][0][2]: 3

my_arr [0][1][0]: 4
my_arr [0][1][1]: 5
my_arr [0][1][2]: 6

my_arr [0][2][0]: 7
my_arr [0][2][1]: 8
my_arr [0][2][2]: 9
```

Multi Dimensional Array (Cont…)

```
class Array11
{
   public static void main(String args[])
   {
      int my_arr[][][] = { { {1, 2, 3}, {4, 6}, {7, 8, 9} } };
      System.out.println("3D array is: ");
      for (int Array_2D[][]: my_arr)
      {
         for (int Array_1D[]: Array_2D)
         {
            for (int element: Array_1D)
            {
               System.out.print(element + " ");
            }
            System.out.println();
         }
         System.out.println();
      }
   }
}
```

Multi Dimensional Array (Cont…)

- Output

```
3D array is:
1 2 3
4 6
7 8 9
```

Multi Dimensional Array (Cont…)

```
public class Array6
{
  public static void main(String args[])
  {
    int a[][]={{1, 3, 5}, {7, 9, 11}};
    int b[][]={{2, 4, 6}, {8, 10, 12}};
    int c[][]=new int[2][3];
    for(int i=0; i<2; i++)
    {
      for(int j=0; j<3; j++)
      {
         c[i][j]=a[i][j] + b[i][j];
         System.out.print(c[i][j] + " ");
      }
      System.out.println();
    }
  }
}
```

Multi Dimensional Array (Cont…)

- Output

```
3   7  11
15 19 23
```

Multi Dimensional Array (Cont…)

- Write a Java program to multiply two matrices:

A= 2 4 6
8 10 12
14 16 18

B= 1 3 5
7 9 11
13 15 17

Multi Dimensional Array (Cont…)

```
public class Array7
{
   public static void main(String args[])
   {
      int a[][]={{2, 4, 6}, {8, 10, 12}, {14, 16, 18}};
      int b[][]={{1, 3, 5}, {7, 9, 11}, {13, 15, 17}};
      int c[][]=new int[3][3];
      for(int i=0; i<3; i++)
      {
        for(int j=0; j<3; j++)
        {
           c[i][j]=0;
           for(int k=0; k<3; k++)
           {
              c[i][j]+=a[i][k] * b[k][j];
           }
           System.out.print(c[i][j] + " ");
        }
        System.out.println();
      }
   }
}
```

Multi Dimensional Array (Cont…)

- Output

```
108 132 156
234 294 354
360 456 552
```

thank you . . .

Slides are prepared from various sources, such as Book, Internet Links and many more.