

Customized Comparisons

Bruce



Q: How to sort an array?

- A: that's too easy. Just call the method.
- Java: `Arrays.sort(arr);`
- C++: `sort(arr, arr + n);` // n is the size of array
- Q: What if it's an object array?
- A: Object? ...



Object

- An object is called an *instance* of a class.
- An object is comprised of data values and methods.
- An *instance data value* is used to maintain information specific to individual instances.

```
public class student {  
    public String name;  
    public int grade;  
    public int age;  
}
```

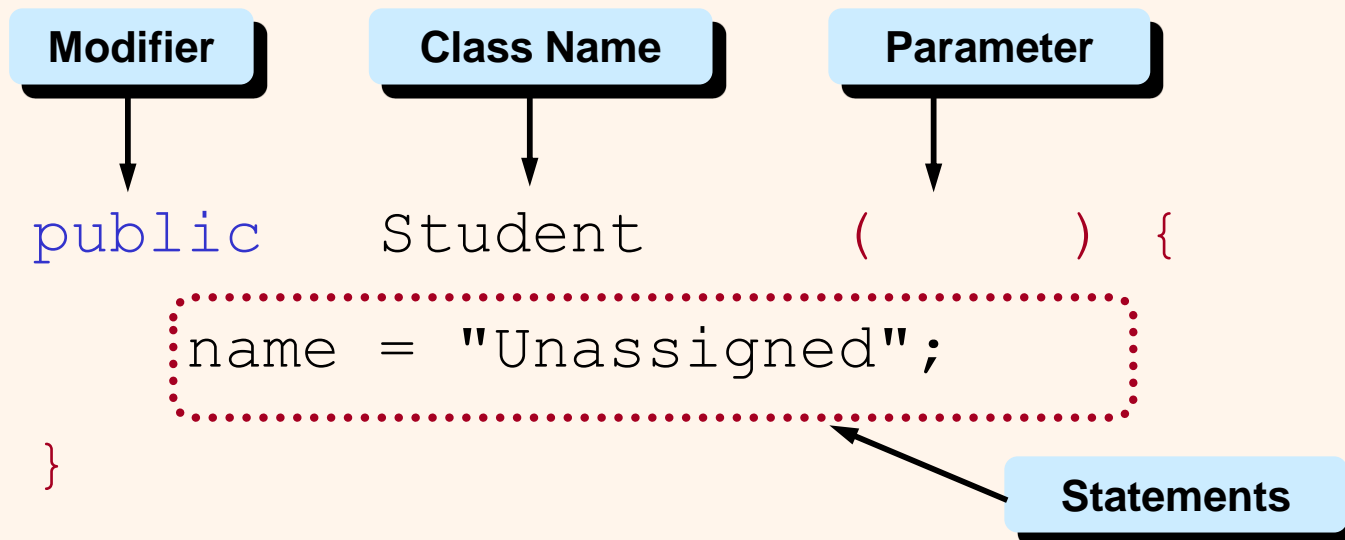
```
class student {  
    public:  
        String name;  
        int grade;  
        int age;  
}
```



Constructor

- A *constructor* is a special method that is executed when a new instance of the class is created.

```
public <class name> ( <parameters> ) {  
    <statements>  
}
```





Example in Java

```
import java.util.*;
public class test {
    public static void main(String[] args) {
        student A = new student("John", 8, 14);
        student B = new student("Alice", 5, 11);
        System.out.println(A.name + " " + A.grade + " " + A.age);
    }
}

class student{
    String name;
    int grade;
    int age;
    student(String s, int g, int a){
        name = s; grade = g; age = a;
    }
}
```



Example in C++

```
#include <bits/stdc++.h>
using namespace std;
class student{
public:
    string name;
    int grade, age;
    student(){ };
    student(string s, int g, int a){
        name = s; grade = g; age = a;
    }
};
int main(){
    student A("John", 8, 14);
    student B = student{"Alice", 6, 11};
    cout << A.name << " " << A.grade << " " << A.age << endl;
    cout << B.name << " " << B.grade << " " << B.age << endl;
}
```



Object array

- An object array is a sequence of objects.
- Example:
 - Create 100 student objects

```
student arr [] = new student[100]; //Java
```

```
student arr[100]; //C++
```



Fill object array with input data

```
Scanner in = new Scanner(System.in);
int numOfStudents = in.nextInt();
student arr [] = new student[numOfStudents];
for(int i=0; i<arr.length; i++){
    String name = in.next();
    int grade = in.nextInt();
    int age = in.nextInt();
    arr[i] = new student(name, grade, age);
}
```

```
int main(){
    student arr[100];
    for(int i=0; i<100; i++){
        cin >> arr[i].name >> arr[i].grade >> arr[i].age;
    }
}
```




How to sort object array (Java)

- The Comparator interface in Java defines a `compare(arg1, arg2)` method with two arguments which represent compared objects

```
class NameComparator implements Comparator<student>{  
    public int compare(student a, student b){  
        return a.name.compareTo(b.name);  
    }  
}
```

```
NameComparator namecmp = new NameComparator();  
Arrays.sort(arr, namecmp);
```



How to sort object array (C++)

- In C++ sort, we can pass in a compare function that accepts two elements in the range as arguments, and returns a value convertible to bool.
- The value returned indicates whether the element passed as first argument is considered to go before the second in the specific strict weak ordering it defines.
- The function shall not modify any of its arguments.

```
bool cmpByName(student A, student B){  
    return A.name < B.name  
}
```

```
sort(arr, arr+n, cmpByName);
```



Practice

- Write a comparator in Java or a compare function in C++ to sort the student object array by age.
- Write a comparator in Java or a compare function in C++ to sort the student object array by grade.



Summary

- Java takes comparator and C++ takes compare function to customize the comparison of objects.
- You can have multiple comparators or compare functions for a specific object.
- Comparators and compare function should not modify the original value of the object