

Comparing C and Java

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Both C and Java are imperative languages . Also they are structural . We can also say that they are both has procedural languages concepts in core. Main difference between C and Java is that Java is fully Object Oriented Programming Language. Also Java version 8 has some functional programming features.

1-)READIBLITY

1.1 OVERALL SIMPLICITY

The overall simplicity affects readability of PL. Java and C have not operator overloading features with respect to the C++ . Having more than one way to handle some operation is merging in both Java and C . This negatively affects PL in terms of simplicity . Some user defined operator overloading that is not sensible makes program less readable. Also Java has not 'goto' statement. This feature makes Java more readable .

1.2 ORTHOGONALITY

Orthogonality is closely related to simplicity . If the PL is orthogonal , it has to make a operation with only one way or it can produce more complex structure using independent basic structure . Lack of orthogonality cause to exceptions to the structure of the programming language. Both Java and C have exception with many examples that makes both non- orthogonal language. For example ; for(; ;) and while(1) has same affect that cause infinite loop . Another example is ; we can return primitive types and struct data types but we can not return array from function in C . Nonetheless we can produce more complex data structure using basic data types in C and Java . If we

give an example of orthogonality of Java , private and public access modifier are fully orthogonal each other. Whereas primitive types value are stored in stack but references types value are stored in heap. This exceptions makes Java semi – orthogonal language .

1.3 DATA TYPES

There are four basic data types in C : int , float , double and char. Every data type have storage capacity depend on the computer architecture. So C is machine dependent. Yet there are two types of data type in Java as primitive and non- primitive (reference) types. Primitive types are Boolean , char , byte, short , int ,long ,float, double . All the primitive types has Wrapper class providing a way to use primitive data types as object. Boolean type in C can be 1 or 0 but in Java , Boolean type can be only true or false. Char storage capacity in C one byte whereas two byte in Java including Unicode character. Non – primitive data types in Java includes Class, Interface , Arrays ,String and Enum. Representing the String in C and Java is quite different. String in C provided by char sequence (array) terminating with Null ('\0') character . Whereas in Java , String is immutable object meaning that it can not be changed after the initialization . All the strings reside in the String pool. Despite all this , essence of Java string is also sequence of characters.

Since the Java is pure OOP there are extra features in Java compare to C. Java has Classes , interface OOP. to became OOP. Java Class store multiple data types in itself. We can say that Struct and Union in C also can store multiple data types in itself but Both are quite different from each other.

a-) C STRUCT vs JAVA CLASS

Struct in C is closest concept to Class in Java.

Examples of Struct and Class

```
typedef struct MyStructure { // Structure declaration in C
    int myNum;
    char myLetter;
```

```
struct MyStructure * myStructure    ;
```

```
// struct Mystructure myStructure >> Wrong declaration
```

```
}MyStruct; // End the structure with a semicolon
```

```
public Class MyClass { // Class declaration in Java
```

```
    private int myNum;
```

```
    private char myLetter;
```

```
    public MyClass myClass;
```

```
    public static void myFunction();
```

```
} // There is no need for semicolon
```

- Java has access modifier in beginning of the class. These are private , protected and public.

Whereas in C, the default and only access modifier of the struct is public (global) . Also Java class members also have access modifier but not in struct (default is public). C struct can not contain static member or function within in contrast to Java Classes. Also Struct can not contain itself as member . Both can have nested Struct or Class.

b-) JAVA REFERENCE vs C Pointer

Java does not have pointers, Java has references. The pointers are variables which store memory address of data and can be modified to point to arbitrary addresses. Therefore pointer may cause big problems due to access arbitrary address. Whereas References is sort of pointers that always point to valid address since it can only be reference to the object. All the classes , arrays are references in Java. Size of the Reference in Java is 8 byte but in C it can be vary according to machine architecture. Java references types reside in stack but they hold address of object on the heap like C pointers. Memory allocation is made by malloc keyword in C and new keyword in Java .

c-) Passing Variable in C vs Java

In C , variables are passed by value or references but in Java , variable is passed only by value. What does it mean passing by value or reference ? Passing by values is a mechanism of copying value of variable to another variable in pass by reference, the address of the actual variable passes to another . This concept occur while passing parameter in C.

1.4 Syntax Comparison

In Java all the operations are done within the classes. There is a Main class and static main function within. In C , all the operation are done within the translation unit. Both language requires semicolon end of the code block. Comments are same in both language.

Main Functions

```
public class Main{ //JAVA
```

```
    public static void main ( String [] argv ){
```

```
    }
```

```
}
```

```
int main () { // C
```

```
    return 1;
```

```
}
```

- /* INITLIAZING CLASS and ACCESSING ITS MEMBER*/

```
Myclass myclass = new MyClass();
```

```
myclass.var = 5;
```

- /* INITIALIZING STRUCT and ACCESSING ITS MEMBER*/

```
struct Mystruct mystruct;
```

```
mystruct.var = 5;
```

- /* INITIALIZING STRUCT POINTER and ACCESSING ITS MEMBER USING
DEREFERENCES OPERATOR */

```
struct Mystruct *mystruct = (struct Mystruct *) malloc (sizeof(Mystruct));
```

```
mystruct -> var = 5;
```

- CONTROL STRUCTURE

1-) SELECTION STATEMENTS

1.1 If Statements

If statements are same in C and Java.

```
if (<expression>)
```

```
<statement1>
```

```
else
```

```
<statement2>
```

NOTE:

Also “ : ? ” Operator is used in both C and Java.

```
Ex: int a = 5; int b =6; int min = a>b ? a:b;
```

1.2 Switch Statement

```
switch (<expression>)
```

```
{
```

```
  case <label1> :
```

```
    <statements 1>
```

```
  case <label2> :
```

```
    <statements 2>
```

```
  break;
```

default :

```
<statements 3>  
}
```

Switch case are similar to Both C and Java. But the only integral types are allowed to be used in C as switch parameter. Whereas Java can use `byte`, `short`, `char`, and `int` (note: not `long`) primitive data types or their corresponding wrapper types and Enum types and String class.

2-) Iteration Statements

- Java and C has three type of iteration statement.

1) **do**

```
<statement>
```

```
while ( <expression> );
```

```
while ( <expression> )
```

```
<statement>
```

2) **for** (<expression> ; <expression> ; <expression>)

```
<statement>
```

- Additional to above , Java also has enhanced loop.

```
for (int i : intArray) {  
    doSomething(i);  
}
```

- Note:

Jump statements (Break, continue , return ..) also have same features.

- C Function vs Java Method

```
<return-type> functionName( <parameter-list> )  
{  
    <statements>  
    return <expression of type return-type>;  
}
```

Function syntax are quite same . All Function of C is global but in Java methods have different namespaces .

- There is huge different between static function in C and Java.

- STATIC FUNCTION and METHOD

```
static void f1 () { //C
}

public class test { // Java
    static void f2() { }
}
```

Static functions in C is restricted to the file where they are declared. Therefore, when we want to restrict access to functions, we make them static. Whereas A static method in Java is a method that is part of a class rather than an instance of that class. Static methods have access to class variables (static variables) without using the class's object (instance) Only static data may be accessed by a static method.

- Array Parameters and Returning the Array

Functions below are exactly same in C .

```
void setArray(int array[], int index, int value);
void setArray(int *array, int index, int value);
```

Returning the array in C .

```
int* getArray();
```

Returning array in Java.

```
int[] getArray();
```

2-) WRITABILITY

Writability is a scale of the simplicity of Language as how easily can be used to create solution for a chosen problem . We can compare Java and C over simple hello world program. Of course this program can not determine the which PL has more convenient in terms of writing .

Java : `System.out.println("Hello World ");`

C : `printf("Hello world")` or `printf("%s", "Hello World");`

To print "Hello world" on console in Java , first we access to System class then we can access the PrintStream class named as "out" static variable in System class . In PrintStream class , we call println method that has multiple overloading types .

But in C , We just call printf function . This may shows writing convenient but if we try to makes big scaled software that have multiple feature . it is better to use Java . Since Java has lots of library and open the api usage easily.

Another comparison example is that enhanced for loop in Java makes more convenient to iterate over the construct . There is no such an feature in C .

Another example is ++count is equal to count = count + 1 in both JAVA and C . This makes convenient of writability .

3-) RELABILITY

- Java supports reliable exception handling mechanism that intercept run-time and compile – time errors in program and makes JAVA robust . Whereas C has no exception handling mechanism but there are another way to prevent errors but it is more difficult .
- Source code of Java gets compiled into byte code that is later interpreted by the JVM (Java Virtual Machine) . Bytecode is resistant to tampering by external environment .
- In Java , Programmer does not need to concerned about the memory allocation . Garbage collector handle the destruction of object when the object is not more used within scope of the program . Whereas in C , if the programmer allocates memory dynamically , he or she must be deallocate the allocated memory from heap . This cause memory leak .
- Risk of C pointer : Uninitialized pointer can make a significant threat . The value stored in an uninitialized pointer could be randomly pointing anywhere in memory. Also dangling pointer can cause memory corruption . If we explain dangling pointer with example ;

```
int * dangling(){
    int a ;
    return &a;
}

void main(){
    int *b = dangling();
}
```

In this scenario , variable a inside the dangling function goes out from the scop when the function is executed . So pointer b points somewhere else .

There is no such a risk in JAVA .

- Type checking design in Java is ensured for nearly all variables in compile time . This eliminates the run time error . So we can say that JAVA is type safe . Whereas if we given an example in C, dynamic memory allocation is type unsafe . We just allocate memory with desired size . It returns void pointer. Also type casting for pointer may cause malicious attack .

4-) COST

Cost of programming languages may be separated into several aspects .

C is a highly portable and extensible because it is not depend on any hardware or system . But if the programmer makes complex software that requires multiple and depended library written in Windows (like wind32.h) or others , C loses its portability . Whereas in JAVA, all the extra features are built into JAVA Virtual Machine implementation which makes JAVA independent .

If the programmer wants quick communication between hardware and software , She or he should be use low level or mid level programming language such an C . Otherwise if the programmer wants to code huge featured software using rich libraries , the programmer should use JAVA . Compilation time and execution time are much smaller in C than JAVA for brief code segment. But with the JIT makes Java faster than the early versions .

Since the JAVA is Object Oriented Language , making huge project espcaailly in Web environment , makes JAVA convenient for this environment . Extending and maintaining a software is easier than C in JAVA .

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MUHAMMED
SİNAN
PEHLİVANOĞLU
1901042664

