Due: 2022/2/19 23:59

Homework 1 Solution

Problem 1. (30 points) Give a feature of C, C++ or Java that illustrates orthogonality. Give a feature that illustrates non-orthogonality.

Solution. For C++:
Orthogonality: a program can embed conditional branches inside loops or vice versa
Non-orthogonality: a function can not return an array and an array can not be passed to a function by value □

Problem 2. (30 points) Choose a programming language that you are familiar with. Point out its programming paradigm(s). Then list its basic data types with explanation.

Solution. Example for Java programming language:
Programming paradigm: **Object-oriented**
Basic data types: There are two kinds of types in the Java programming language: **primitive types** and **reference types**

- 8 different **primitive types**
  - **byte:** from -128 to 127, inclusive
  - **short:** from -32768 to 32767, inclusive
  - **int:** from -2147483648 to 2147483647, inclusive
  - **long:** from -9223372036854775808 to 9223372036854775807, inclusive
  - **char:** from '\u0000' to '\uffff' inclusive, that is, from 0 to 65535
  - **float:** values include the 32-bit IEEE 754 floating-point numbers
  - **double:** values include the 64-bit IEEE 754 floating-point numbers
  - **boolean:** represents a logical quantity with two possible values, indicated by the literals true and false
- 4 different **reference types**: class type, interface type, type variable, array type.

```
class Point { int[] metrics; }
interface Move { void move(int deltax, int deltay); }
```

(From the official specification document of Java SE)

Example for C programming language:
Programming paradigm: **Imperative**

- 6 **basic data types** in C:
  - **int:** Basic signed integer type. Capable of containing at least the [−32,767, +32,767] range.
  - **short:** Short signed integer type. Capable of containing at least the [−32,767, +32,767] range;
  - **long:** Long signed integer type. Capable of containing at least the [−2,147,483,647, +2,147,483,647] range;
  - **float:** Real floating-point type, usually referred to as a single-precision floating-point type.
  - **long:** Real floating-point type, usually referred to as a double-precision floating-point type.
  - **char:** Smallest addressable unit of the machine that can contain basic character set.

  (From wikipedia)

□

Problem 3. (40 points) We have learned the difference between compiler and interpreter. Now research compiled languages and interpreted languages. Then list the advantages and disadvantages of these two languages.

Solution.
Compiled languages:

- **Advantages:** Usually it's faster than those interpreted languages at run time, ...
- **Disadvantages:** Additional time needed to complete the entire compilation step before testing; Platform dependence of the generated binary code, ...

Interpreted languages:

- **Advantages:** Platform independent; smaller executable program size, ...
- **Disadvantages:** Usually it's slower than compiled languages at run time, ...

□