Operation and Operands of Computer HardwareInstruction

Computer instruction is a binary code that determines the micro-operations in a sequence for a computer. They are saved in the memory along with theinformation. Each computer has its specific group of instructions. They can becategorized into two elements as ***Operation codes*** (Opcodes) and ***Address***. Opcodes specify the operation for specific instructions, and an address determines the registers or the areas used for that operation.

Operands are definite elements of computer instruction that show what information is to be operated on. The most important general categories of data are

1. Addresses
2. Numbers
3. Characters
4. Logical data

In many cases, some calculation must be performed on the operand reference to determine the main or virtual memory address.

In this context, addresses can be considered to be unsigned integers. Other common data types are numbers, characters, and logical data, and each of these is briefly described below. Some machines define specialized data types or data structures. For example, machine operations may operate directly on a list or a string of characters.

Addresses

Addresses are nothing but a form of data. Here some calculations must be performed on the operand reference in an instruction, which is to determine the physical address of an instruction.

Numbers

All machine languages include numeric data types. Even in non-numeric data processing, numbers are needed to act as counters, field widths, etc. An important difference between numbers used in ordinary mathematics and numbers stored in a computer is that the latter is limited. Thus, the programmer is faced with understanding the consequences of rounding, overflow and underflow.

Here are the three types of numerical data in computers, such as:

1. Integer or fixed point: Fixed point representation is used to store integers, the positive and negative whole numbers (… -3, -2, -1, 0, 1, 2, 3, …). However, the programmer assigns a radix point location to each number and tracks the radix point through every operation. High-level programs, such as C and BASIC usually allocate 16 bits to store each integer. Each fixed point binary number has three important parameters that describe it:

- Whether the number is signed or unsigned,
- The position of the radix point to the right side of the sign bit (for signed numbers), or the position ofthe radix point to the most significant bit (for unsigned numbers).
- And the number of fractional bits stored.

2. Floating point: A Floating Point number usually has a decimal point, which means **0, 3.14, 6.5,**
and**-125.5** are Floating Point

The term *floating point* is derived from the fact that there is no fixed number ofdigits before and after the decimal point, which means the decimal point can float. There are also representations in which the number of digits before and after the decimal point is set, called ***fixed-point*** representations. In general, floating-point representations are slower and less accurate than fixed- point representations, but they can handle a larger range of numbers.

3. Decimal number: The decimals are an extension of our number system. We also know that decimals can be considered fractions with 10, 100, 1000, etc. The numbers expressed in the decimal form are called decimal numbersor decimals. For example:1, 4.09, 13.83, etc. A decimal number has two parts, and a dot separates these parts (.) called the ***decimal point***.

- **Whole number part:** The digits lying to the left of the decimal point form the whole number part. The places begin with ones, tens, hundreds, thousands and so on.
- **Decimal part:** The decimal point and the digits laying on the right of the decimal point form thedecimal part. The places begin with tenths, hundredths, thousandths and so on.

Characters

A common form of data is text or character strings. While textual data are most convenient for humans. But computers work in binary. So, all characters, whether letters, punctuation or digits, are stored as binary numbers. All of the characters that a computer can use arecalled ***character set***s.Here are the two common standards, such as:

1. American Standard Code for Information Interchange (ASCII)
2. Unicode

ASCII uses seven bits, giving a character set of 128 characters. The charactersare represented in a table called the ASCII table. The 128 characters include:

- 32 control codes (mainly to do with printing)
- 32 punctuation codes, symbols, and space
- 26 upper-case letters
- 26 lower-case letters
- numeric digits 0-9

We can say that the letter 'A' is the first letter of the alphabet; 'B' is the second, and so on, all the wayup to 'Z', which is the 26th letter. In ASCII, each character has its own assigned number.