Introduction to Computer Architecture: Takeaways

Syntax

- Accessing the address for a variable's location in storage:

```
my_int = 5

id(my_int)
```

- Checking how many of bytes of memory a variable occupies:

```
my_int = 200

size_of_my_int = sys.getsizeof(my_int)
```

- Returning the current processor time in seconds:

```
import time

time.clock()
```

Concepts

- A computer must be able to do four things:
    - Take input.
    - Produce output.
    - Store data.
    - Perform computation.
- Keyboards and mouses are examples of input devices while screens, monitors, and speakers are examples of output devices.
- Computers can store data either in random-access memory or in disk storage.
- We can think of data as occupying "slots" in large, linearly-arranged pieces of hardware. We refer to each "slot" as one byte.
- Small integers and characters can be stored in one byte while larger date types, like strings, require multiple bytes.

- Low-level languages often interact with portions of memory explicitly; therefore, data types have very predictable memory usage. On the other hand, high-level languages empower you to express logic quickly and easily.
- We use a base-10 number system, which means each digit corresponds to a power of 10.

Number	Base 10 Expression
008	0 * (10^2) + 0 * (10^1) + 8 * (10^0)
091	0 * (10^2) + 9 * (10^1) + 1 * (10^0)
453	4 * (10^2) + 5 * (10^1) + 3 * (10^0)

- Binary is a number system where every digit is either `0` or `1`. This is sometimes referred to as a base-2 number system.
- In binary, the conversion is the exact same except each digit corresponds to a power of 2.

Binary	Base 2 Expression	Base 10 Value
001	0 * (2^2) + 0 * (2^1) + 1 * (10^0)	1
010	0 * (2^2) + 1 * (2^1) + 0 * (2^0)	2
100	1 * (2^2) + 0 * (2^1) + 0 * (2^0)	4
101	1 * (2^2) + 0 * (2^1) + 1 * (2^0)	5

- Characters are stored as binary and each character has its own binary number.
- A central processing unit (CPU) is a chip in the computer that can perform any computation.
- When a computer executes a program, the program is stored in memory as a sequence of machine instructions. The CPU reads the program like a book keeping a program counter and it points to the next instruction a CPU should execute.
- Once the CPU executes an instruction, the program counter moves to the instruction that's adjacent in memory. However, control flow statements can alter how the program counter traverses instructions in memory. Functions can also change the order of statement execution.
- A processing unit that executes one instruction at a time is called a core. A multi-core processor can execute more than one set of instructions at a time.

Resources

- Binary numbers
- Central Processing Unit