

A computer is a device consisting of 3 pieces:

processor: store, manage, interpret + execute programs

Memory: store both data and programs

Mechanism: transfer data to and from outside

Measures of capacity + speed:

Kilo, mega, giga, tera, peta, exa, zetta, yotta

Whether a metric refers to a power of 10 or 2 depends on what is being measured.

Hertz = clock cycle per second (frequency)

$$1 \text{ MHz} = 1,000,000 \text{ Hz}$$

- processor speeds are measured in MHz or GHz

Byte = unit of storage

$$1 \text{ kB} = 2^{10} = 1024 \text{ bytes}$$

$$1 \text{ MB} = 2^{20} = 1048576 \text{ bytes}$$

$$1 \text{ GB} = 2^{30} = 1,099,511,627,776 \text{ bytes}$$

- The main memory RAM is measured in GB

- disk storage is measured in GB for small storage systems, TB for large systems

Measures of time and space:

milli, micro, nano, pico, femto, atto, zepto, yocto

Example: Harddrive access times

main memory access times

* Cycle time is reciprocal of clock frequency *

detecting and correcting errors

Parity bit

- detect single bit errors
 - o even parity add a bit so total # of 1s is even
 - o odd parity add bit so total 1 is odd
- can only detect not correct

Hamming distance

→ bit position where strings differ

Greater distance = better error detect / correct

Hamming ($7,4$) code (error correction)

- encodes 4 data bits into 7 w/ added parity
- detect + correct

encoding: Fixed vs variable

fixed length: all symbols use same number of bits

variable: more common symbol get shorter codes
less frequent get longer

Reduces message length

Prefix: No code is prefix of another
decoding unambiguous

RAM Compact Computer

- microprocessor is brain
- executes program instructions

→ computers w/ large main memory capacity can run larger programs w/ greater speed than small computer having small memory.

→ RAM stands for random access memory. This means the memory contents can be accessed directly if you know its location.

→ Cache is a type of memory that can be accessed faster than RAM.