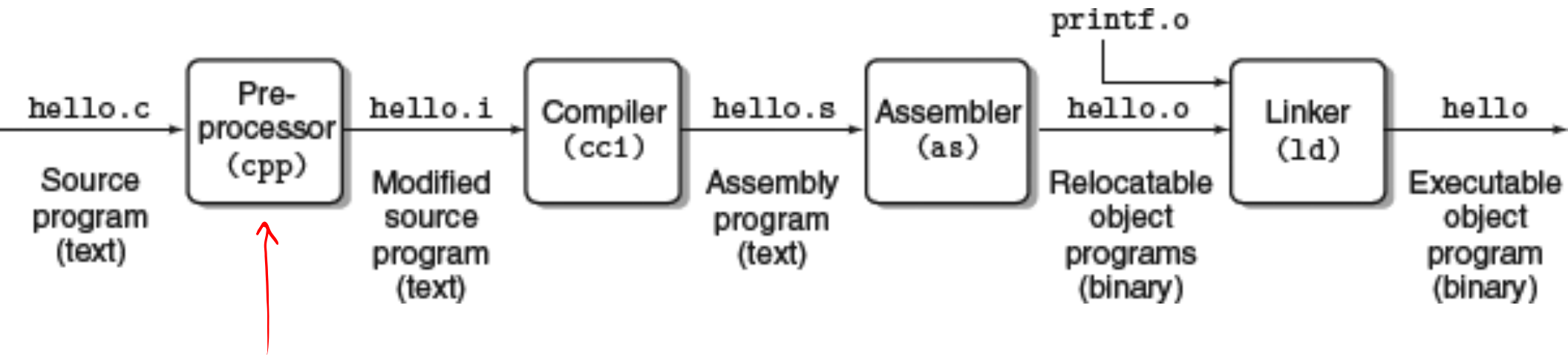
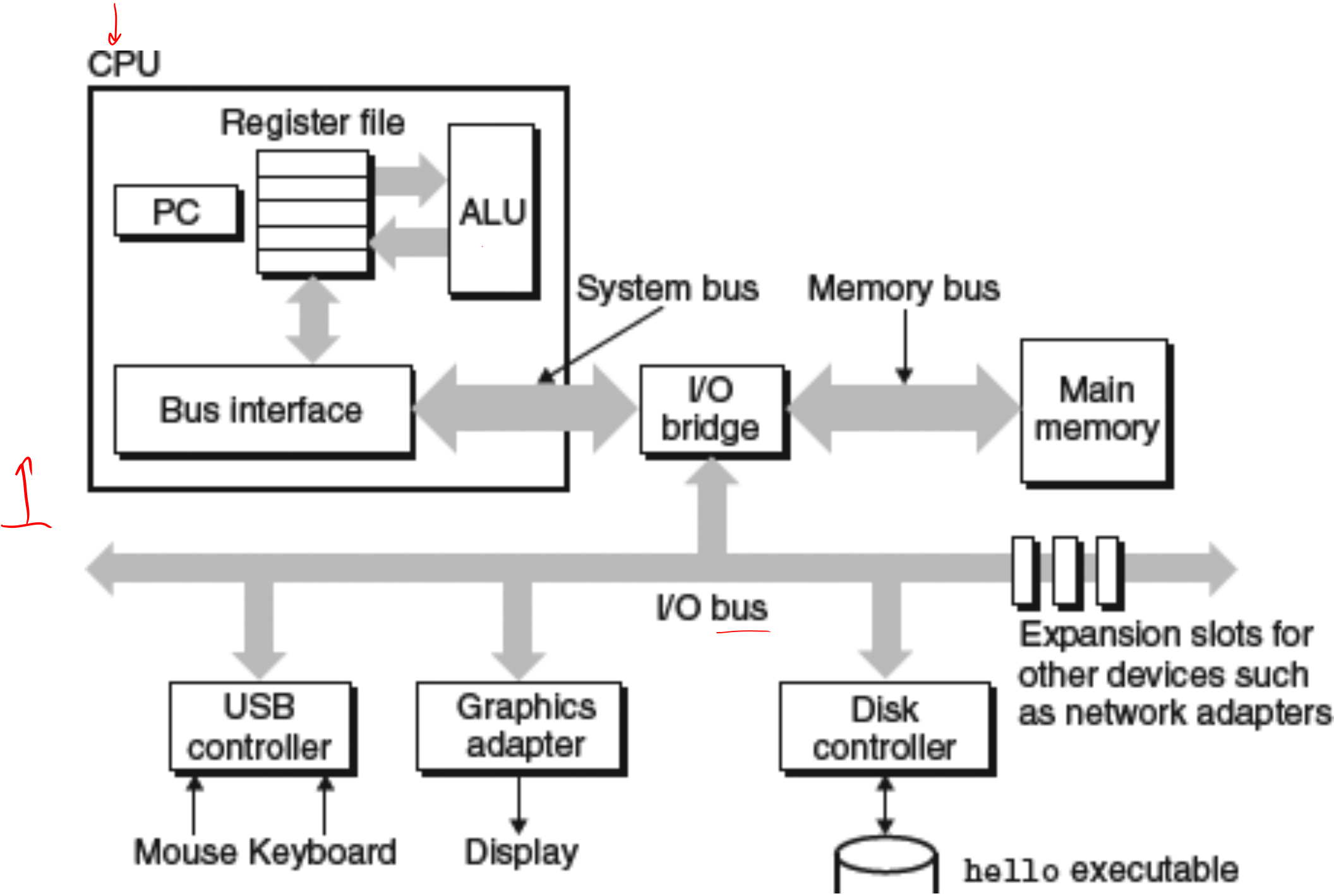
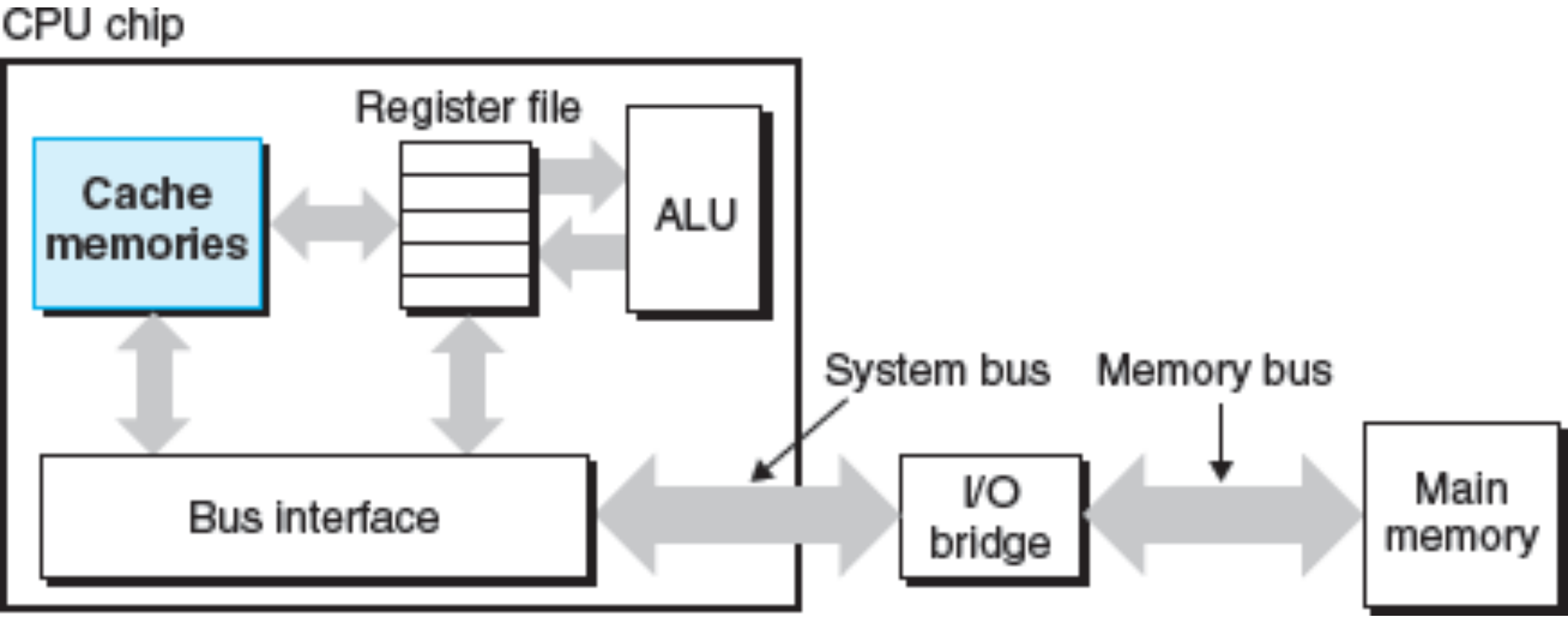
Tai CON uh Vìch

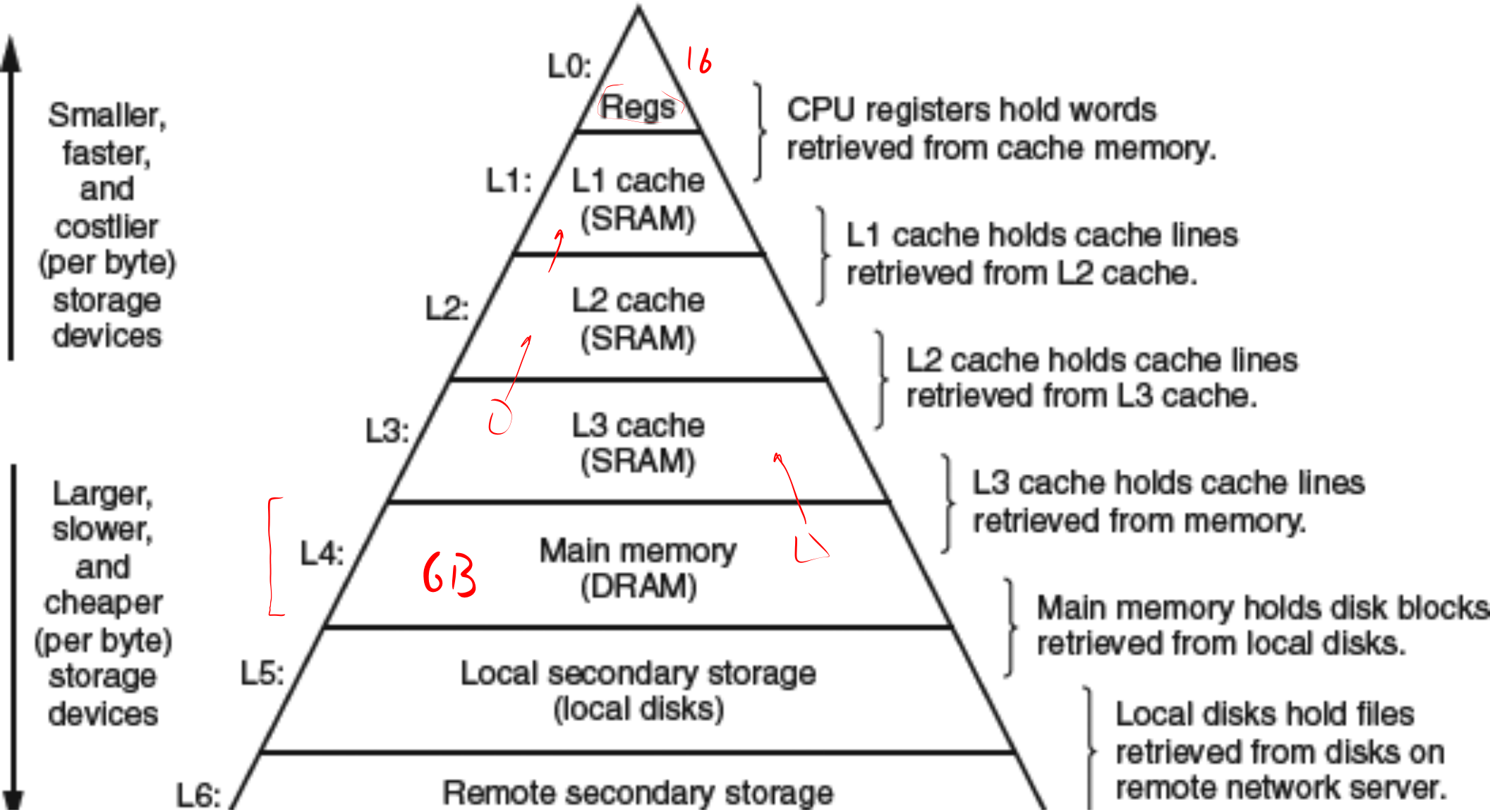
#include "foo.h"

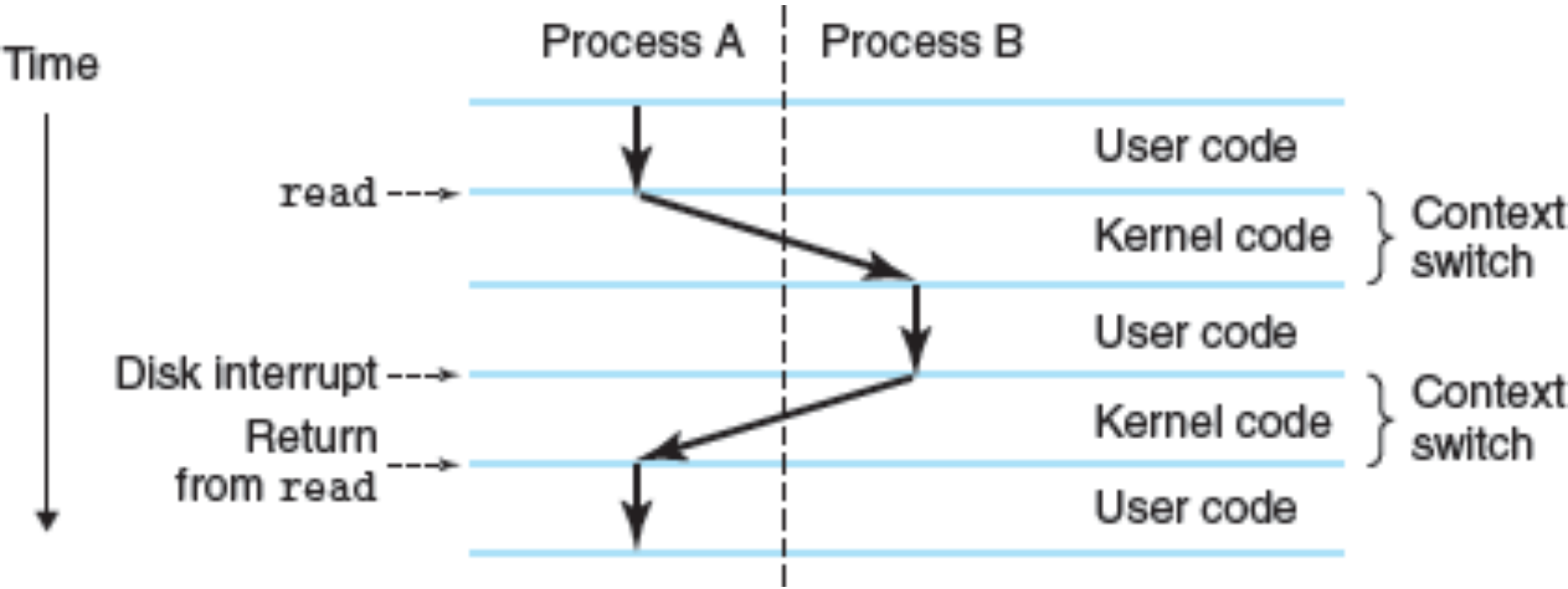
#define X 1+2

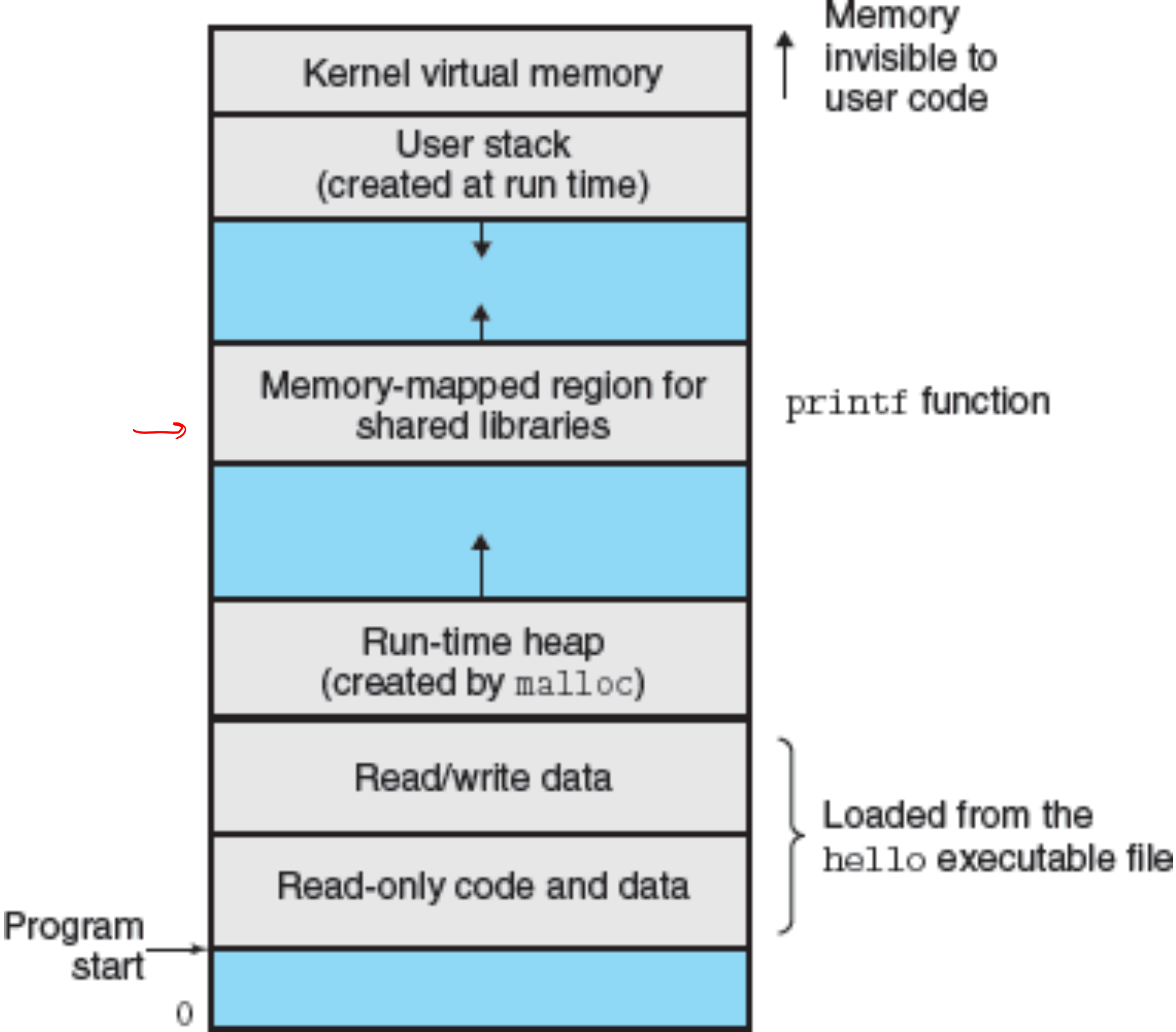


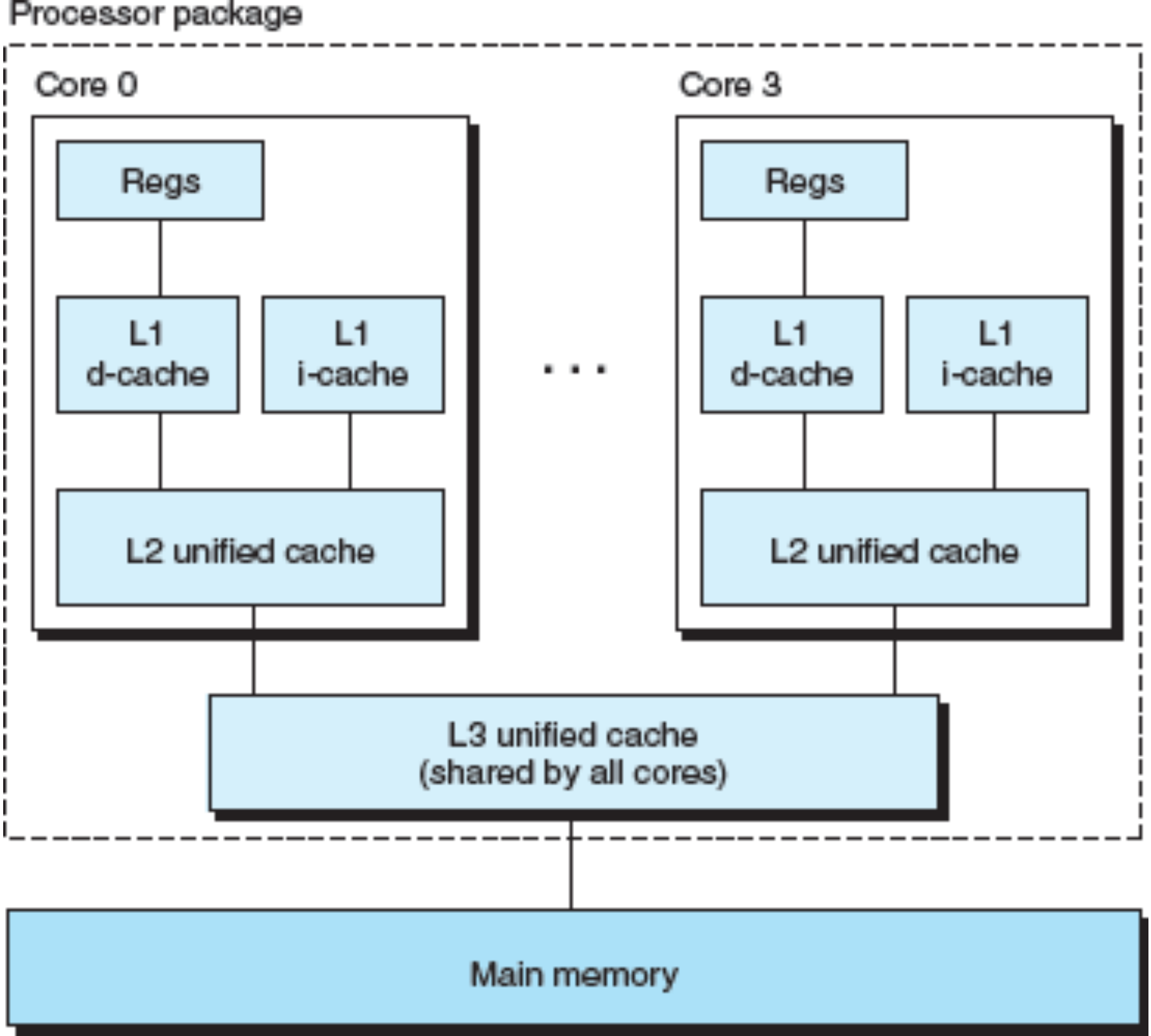

CPU
Register file
PC
ALU
System bus
Memory bus
Bus interface
I/O bridge
Main memory
I/O bus
Expansion slots for other devices such as network adapters
USB controller
Graphics adapter
Disk controller
Mouse Keyboard
Display
hello executable


CPU chip
Register file
Cache memories
ALU
System bus
Memory bus
Bus interface
I/O bridge
Main memory


Smaller, faster, and costlier (per byte) storage devices
Larger, slower, and cheaper (per byte) storage devices
L0:
Regs
L1:
L1 cache (SRAM)
L2:
L2 cache (SRAM)
L3:
L3 cache (SRAM)
L4:
Main memory (DRAM)
L5:
Local secondary storage (local disks)
L6:
Remote secondary storage
CPU registers hold words retrieved from cache memory.
L1 cache holds cache lines retrieved from L2 cache.
L2 cache holds cache lines retrieved from L3 cache.
L3 cache holds cache lines retrieved from memory.
Main memory holds disk blocks retrieved from local disks.
Local disks hold files retrieved from disks on remote network server.


Time
Process A
Process B
User code
read
Kernel code
Context switch
User code
Disk interrupt
Kernel code
Context switch
Return from read
User code


Kernel virtual memory
User stack
(created at run time)
Memory-mapped region for
shared libraries
Run-time heap
(created by malloc)
Read/write data
Read-only code and data
Program
start
0
Memory
invisible to
user code
printf function
Loaded from the
hello executable file


Processor package
Core 0
Core 3
Regs
Regs
L1
d-cache
L1
i-cache
L1
d-cache
L1
i-cache
. . .
L2 unified cache
L2 unified cache
L3 unified cache
(shared by all cores)
Main memory

0001 0010 1100 1011

0x12CB

- even
- odd because B is odd

0xFFFFFFFF

$2^{10} \sim 1000$

$2^{|a\,b|}$

$2^{3-} = 2^{30} 2^{-}$ ~1000^3

- pos $(2^{32}-1) \sim 4$ billion

→ - neg

in decimal, is -1

With n bits, the largest integer I can represent is

$2^n - 1$ unsigned

$2^{n-1} - 1$ signed

Write x << y without shifts: $x \cdot 2^y$

x * pow(2, y)

3330 $<<_{10}$ 3

3330000

if (x/y) * y == x, then

what can we say about x and y?

x == 0 or x % y == 0

y ≠ 0