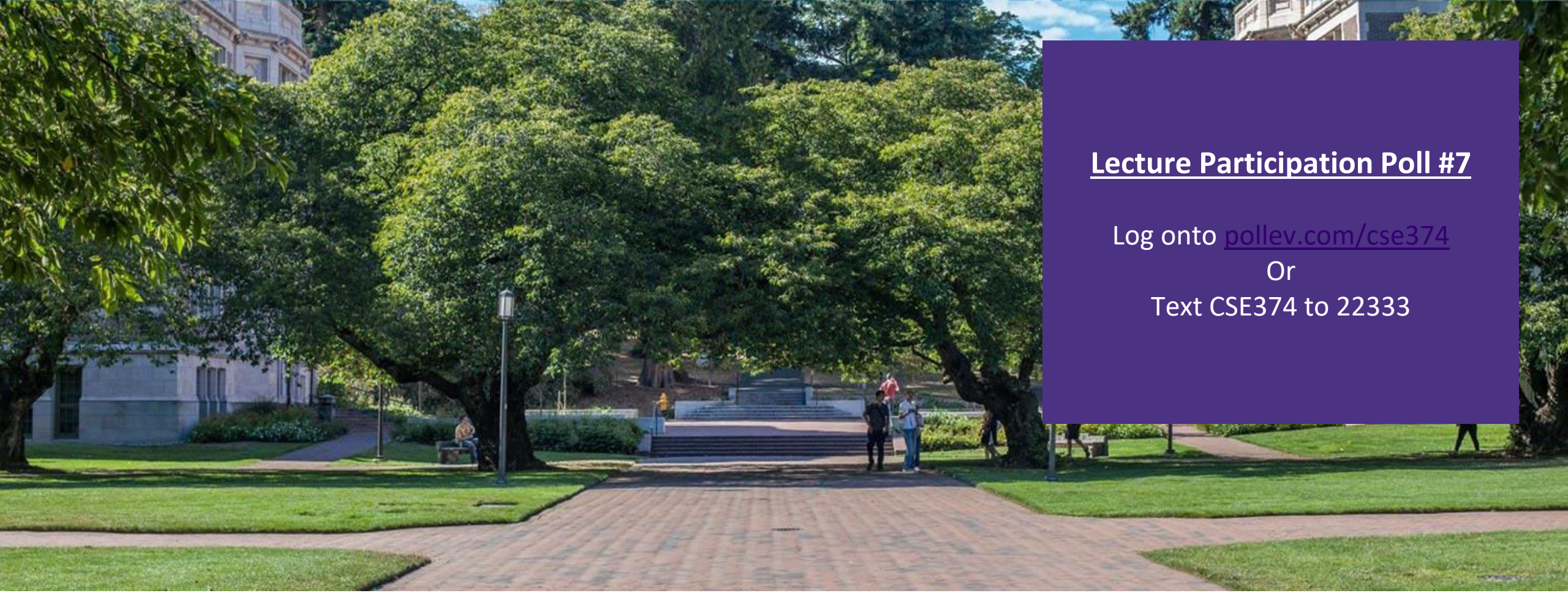


Lecture Participation Poll #7

Log onto pollev.com/cse374
Or
Text CSE374 to 22333

Lecture 8:C Basics

CSE 374: Intermediate Programming Concepts and Tools

Administrivia

- HW1 deadline extended while the autograders scripts get figured out
- HW2 posted due next week

THANK YOU FOR ALL YOUR PATIENCE!

Review: Binary, Bits and Bytes

- **binary**
- A base-2 system of representing numbers using only 1s and 0s
- - vs decimal, base 10, which has 9 symbols

- **bit**
- The smallest unit of computer memory represented as a single binary value either 0 or 1

byte

The most commonly referred to unit of memory, a grouping of 8 bits

Can represent 265 different numbers (28)

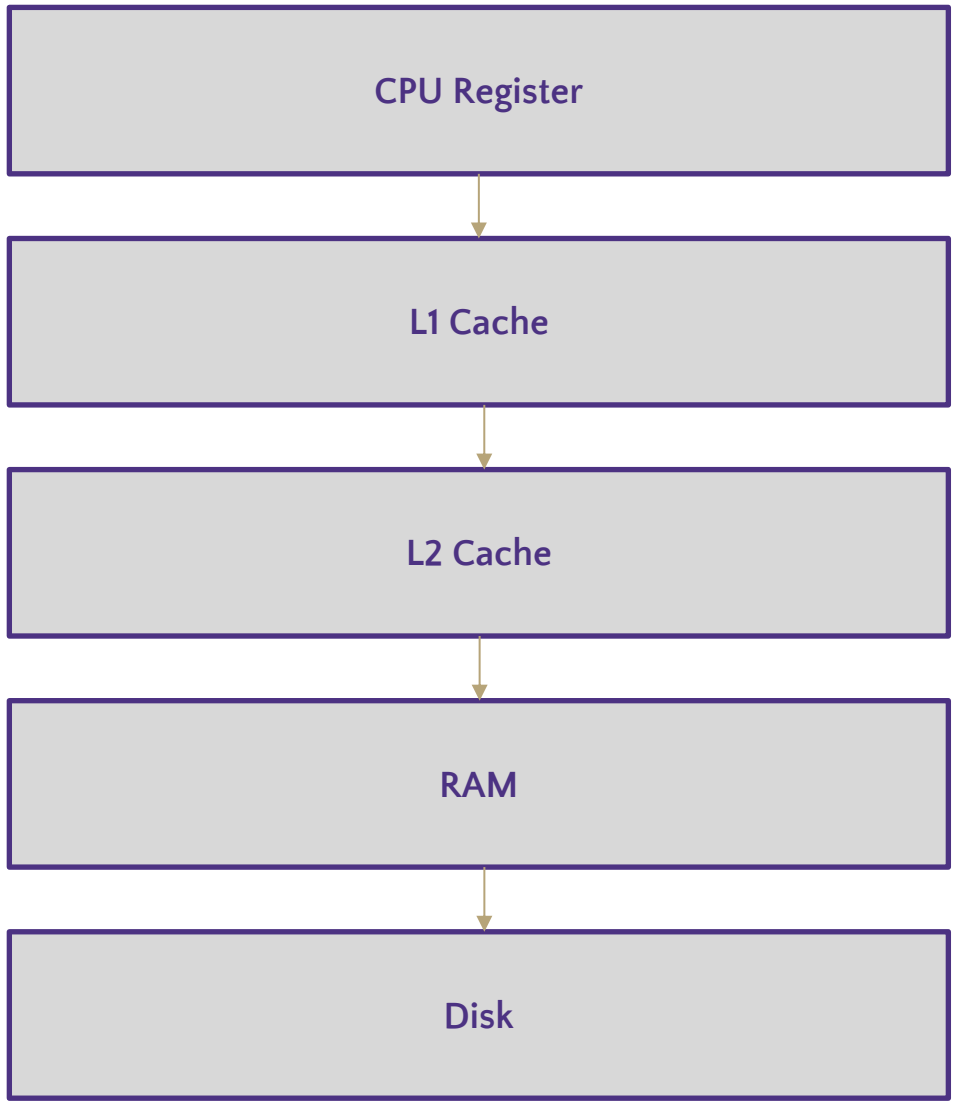
1 Kilobyte = 1 thousand bytes (kb)

1 Megabyte = 1 million bytes (mb)

1 Gigabyte = 1 billion bytes (gb)

Decimal	Decimal Break Down	Binary	Binary Break Down
0	$(0 * 10^0)$	0	$(0 * 2^0)$
1	$(1 * 10^0)$	1	$(1 * 2^0)$
10	$(1 * 10^1) + (0 * 10^0)$	1010	$(1 * 2^3) + (0 * 2^2) + (1 * 2^1) + (0 * 2^0)$
12	$(1 * 10^1) + (2 * 10^0)$	1100	$(1 * 2^3) + (1 * 2^2) + (0 * 2^1) + (0 * 2^0)$
127	$(1 * 10^2) + (1 * 10^1) + (2 * 10^0)$	01111111	$(0 * 2^7) + (1 * 2^6) + (1 * 2^5) + (1 * 2^4)(1 * 2^3) + (1 * 2^2) + (1 * 2^1) + (1 * 2^0)$

Memory Architecture

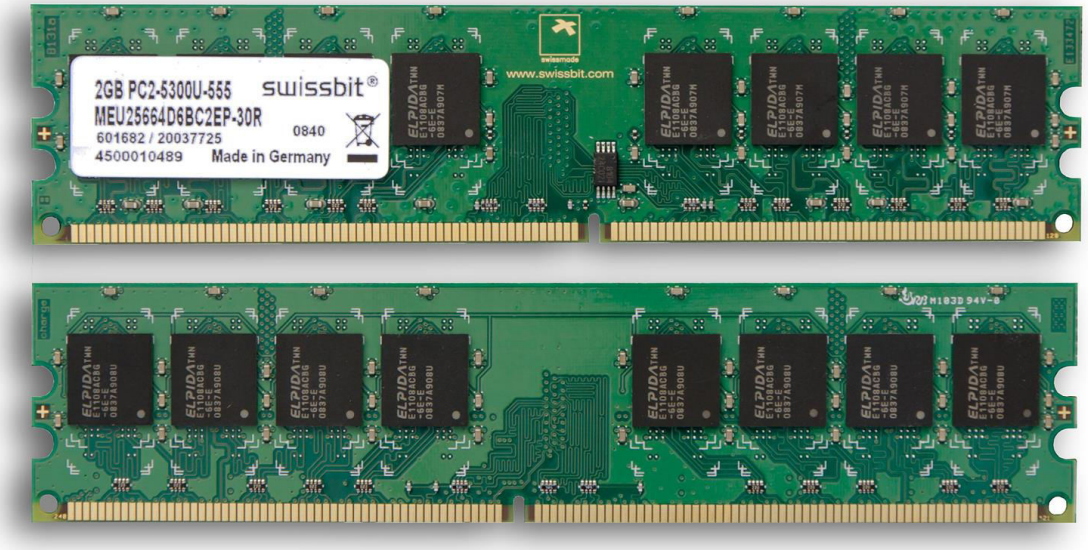


What is it?	Typical Size	Time
The brain of the computer!	32 bits	≈free
Extra memory to make accessing it faster	128KB	0.5 ns
Extra memory to make accessing it faster	2MB	7 ns
Working memory, what your programs need	8GB	100 ns
Large, longtime storage	1 TB	8,000,000 ns

RAM (Random-Access Memory)

- **– RAM is where data gets stored for the programs you run. Think of it as the main memory storage location for your programs.**

– RAM goes by a ton of different names: memory, main memory. RAM are all names for this same thing



Process Name	Memory	Compressed M...	Threads
kernel_task	1.19 GB	0 bytes	144
IntelliJ IDEA	1,018.0 MB	194.7 MB	56
Microsoft PowerPoint	545.1 MB	238.9 MB	18
WindowServer	330.7 MB	170.9 MB	8
nsurlsessiond	320.8 MB	239.4 MB	3
Mattermost Helper	315.4 MB	32.0 MB	19
Google Chrome	291.7 MB	17.5 MB	31
Google Chrome Helper (Rend...	243.4 MB	91.5 MB	14
zoom.us	239.7 MB	61.8 MB	20
Google Chrome Helper (Rend...	236.6 MB	26.7 MB	14
Google Chrome Helper (GPU)	235.2 MB	19.7 MB	10
Google Chrome Helper (Rend...	203.4 MB	27.9 MB	16
Sublime Text	186.5 MB	170.9 MB	12
spindump	158.4 MB	80.0 MB	3
SystemUIServer	148.5 MB	24.9 MB	4
Finder	139.9 MB	56.3 MB	4
java	128.2 MB	61.3 MB	24
java	126.3 MB	110.3 MB	23
java	124.4 MB	27.8 MB	28
mds_stores	115.5 MB	36.2 MB	4
Mattermost	112.3 MB	37.5 MB	44
Cold Turkey Blocker	109.1 MB	49.2 MB	9
Google Chrome Helper (Rend...	102.8 MB	33.0 MB	16
Mail	91.4 MB	25.6 MB	7
Google Chrome Helper (Rend...	90.1 MB	62.4 MB	13
Google Chrome Helper (Rend...	88.1 MB	54.8 MB	13
Mattermost Helper	82.5 MB	44.8 MB	5
Google Chrome Helper (Rend...	77.4 MB	32.5 MB	13
Google Chrome Helper (Rend...	72.7 MB	51.4 MB	13

MEMORY PRESSURE

Physical Memory:	16.00 GB
Memory Used:	9.81 GB
Cached Files:	1.94 GB
Swap Used:	628.0 MB

RAM can be represented as a huge array

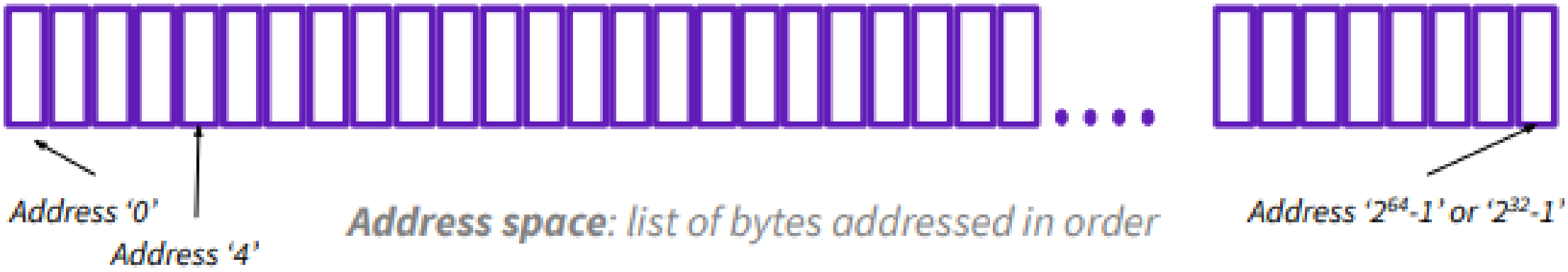
RAM:
- addresses, storing stuff at specific locations
- random access

=

Arrays
- indices, storing stuff at specific locations
- random access

If you're interested in deeper than this : https://www.youtube.com/watch?v=fpnE6UAfbtU or take some EE classes?

Working memory.



- Programs are said to have access to this 2^{64} byte space
  - '64 bit' system refers to needing 64 bits to index the space
  - But really don't - many other things are also using this space
- Location in array is the 'address' of a byte
- Programs keep track of addresses of each of their pieces of memory
- Accessing unused address causes a 'segmentation fault'

The Stack

- An area of local memory set aside to hold local variables
- Functions like the stack data structure – first in first out
- When we call a function it **allocates** memory on the stack for all local variables
  - Size of memory depends on datatype
- When the function returns the memory for the local variables is **deallocated**
- Java has been doing something similar in the background for you all along- garbage collector

Blinky and Pointer Fun!