CS 2420 — Computer Science II
Section 20

Spring 2011

Instructor: **Matthew Flatt**

Reminder

Section 20 is the "systems track."

Course Content
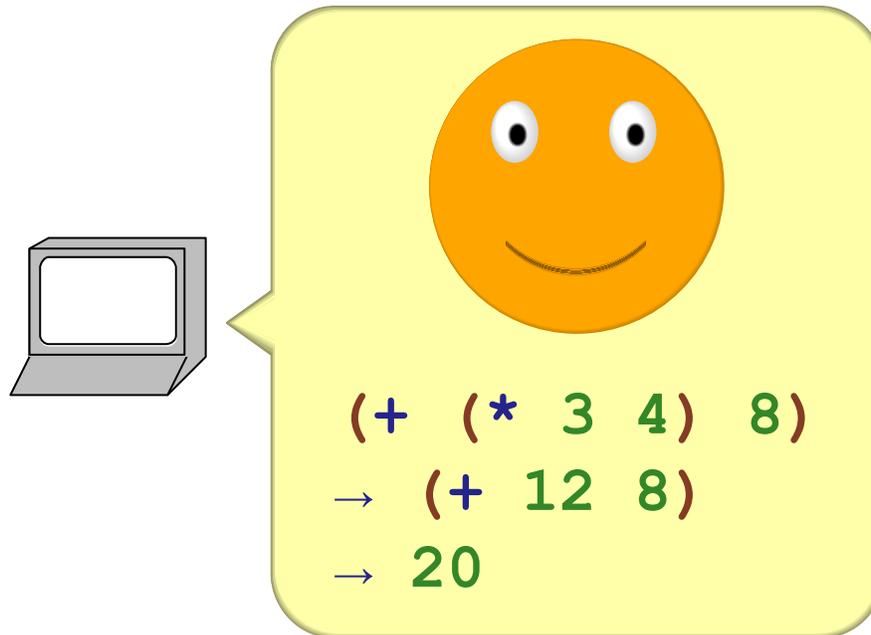
- **Machine model**

  ○ Machine code

  ○ C

- **Data structures**

  ○ Balanced binary trees, hash tables, ...

- **Algorithms**

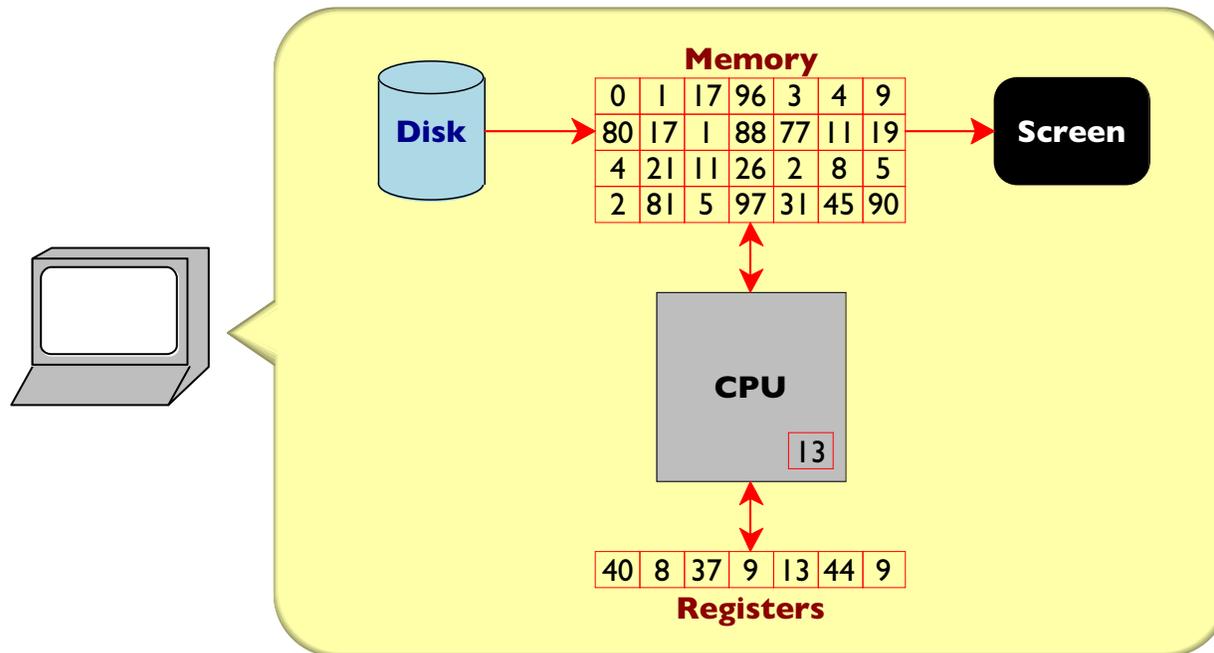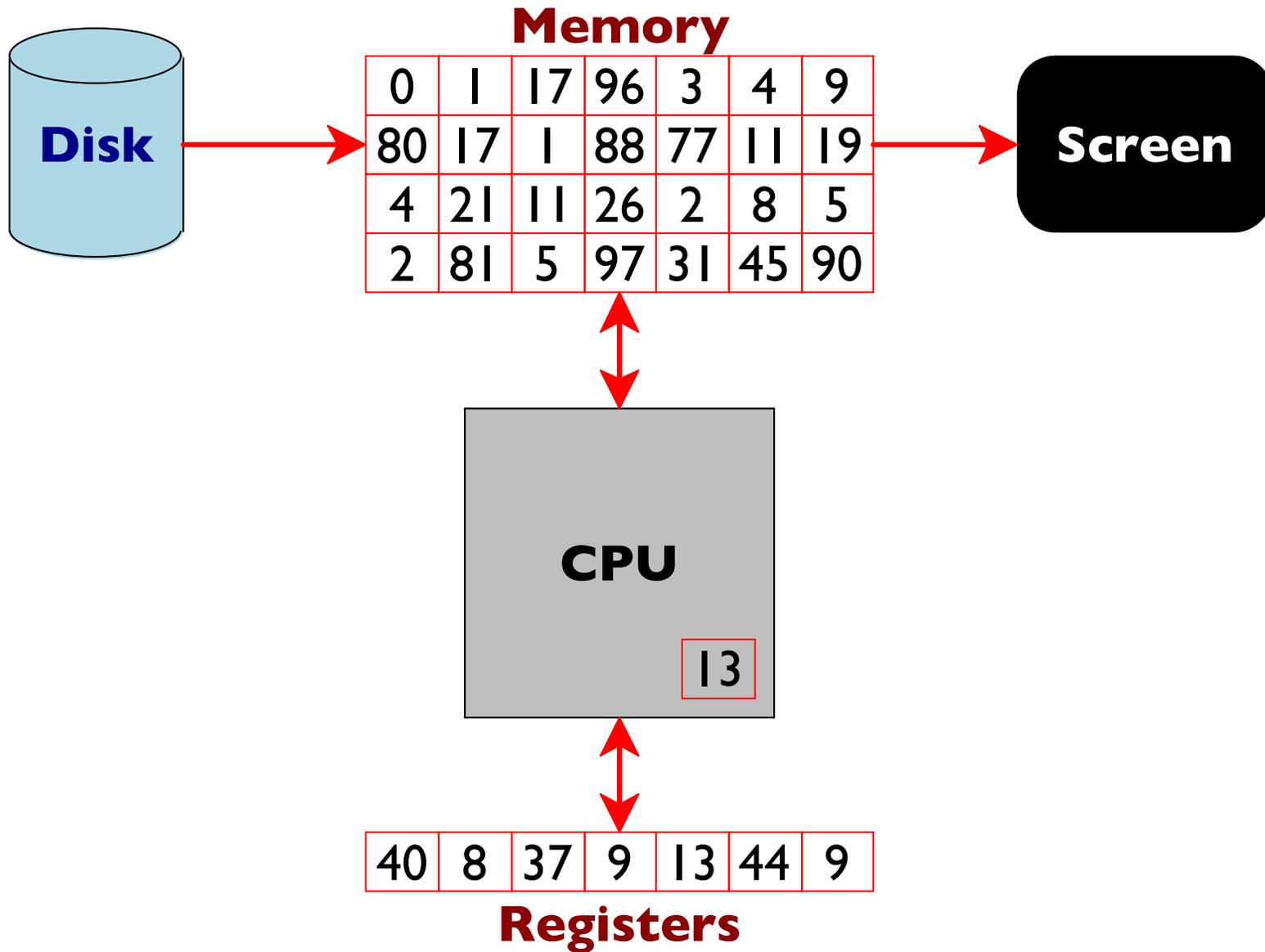 ○ Binary search, dynamic programming, ...

CS 1410-20 Machine

CS 2420-20 Machine

The Jam2000 Machine
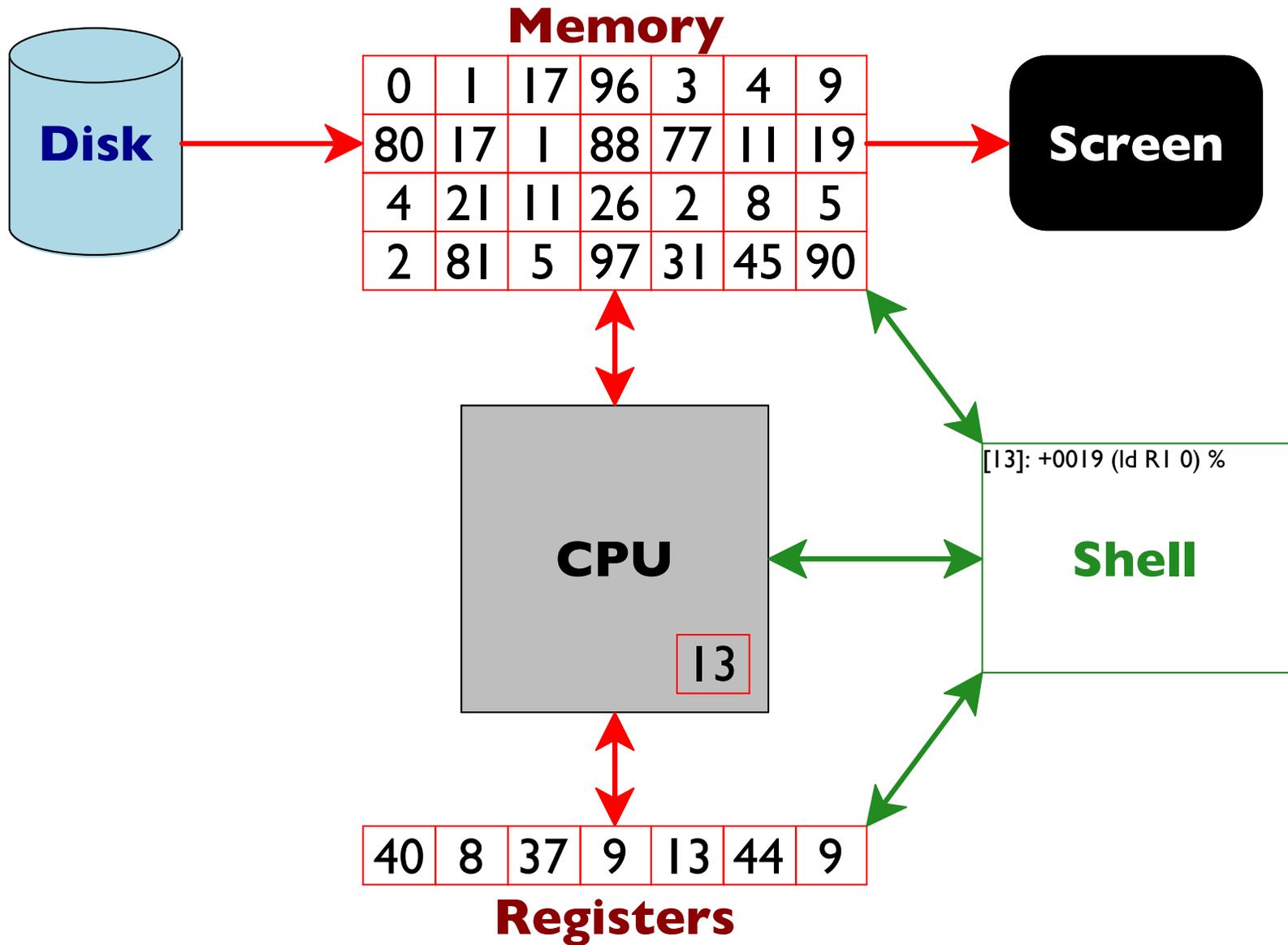
Memory

0	1	17	96	3	4	9
80	17	1	88	77	11	19
4	21	11	26	2	8	5
2	81	5	97	31	45	90

Disk

Screen

CPU

13

40	8	37	9	13	44	9

Registers

The Jam2000 Machine

Memory

0	1	17	96	3	4	9
80	17	1	88	77	11	19
4	21	11	26	2	8	5
2	81	5	97	31	45	90

Disk

Screen

CPU

13

[13]: +0019 (ld R1 0) %

Shell

40	8	37	9	13	44	9

Registers

Everything is a Number

The number 1490:   **1490**

The "copy register 4 to 1" instruction: **1490**

The name of the 1491st memory cell: **1490**

A greenish-blue pixel: **1490**

Everything is a Number

The number 1490: 1490

The "copy register 4 to 1" instruction: 1490

The name of the 1491st memory cell: 1490

A greenish-blue pixel: 1490

In fact, everything is represented by a number between -99999999 and 99999999

- but memory addresses are 0 to 9999

- only some numbers are sensible instructions

- the screen ignores some digits

Pixels

- Screen memory starts at 8000

- Digits encode red, green, and blue intensities:

$$? \quad ? \quad d_r \quad d_r \quad d_g \quad d_g \quad d_b \quad d_b$$

0	990000	9900	99	888888	999900

Instructions

Numbers encode actions like "put the number $d_7d_6d_5d_4d_3d_2$ in register x":

$$\text{(ldi R}x\ d_7d_6d_5d_4d_3d_2\text{)}$$

$$d_7\quad d_6\quad d_5\quad d_4\quad d_3\quad d_2\quad x\quad 9$$

"Put the number 77 in register 6":

$$\text{(ldi R6 77)}$$

$$0\ \ 0\ \ 0\ \ 0\ \ 7\ \ 7\ \ 6\ \ 9$$