ECE/CS 433

Introduction to Computer Graphics

Class 7

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Advanced Graphics Lab

Announcements

- HW 2 was due last night
- HW 3 will be released today
- Submit through WebCT
- No need to let me know of late days

Last time

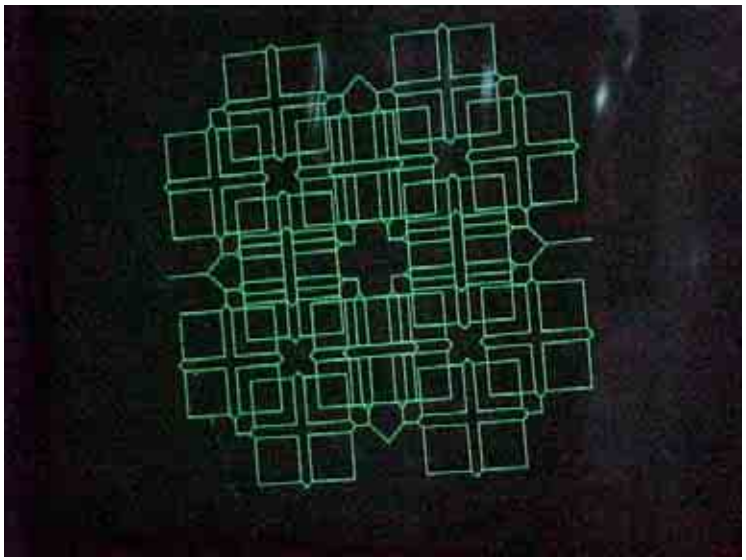
- Computational photography
- 2-D graphics

Today

- A different kind of 2-D graphics
- Intro to the 3-D pipeline

Vector graphics displays

- Stored only the vertices of graphics primitives
- The electron beam would be moved from vertex to vertex to generate the image



Framebuffer

- Chunk of memory that contains the pixel information to be displayed
- In modern graphics systems, it contains other things such as depth buffer, stencil, etc.

Memory was expensive!

- 1979 Atari 2600 – 128B RAM
- 1983 NES – 2KB VRAM
- 1984 Sega Master system – 64KB VRAM
- 1994 Sega Saturn – 1.5 MB video RAM
- 1994 Playstation 1 – 1MB video RAM, 640 x 480 framebuffer
- 1998 Sega Dreamcast – 8MB video RAM

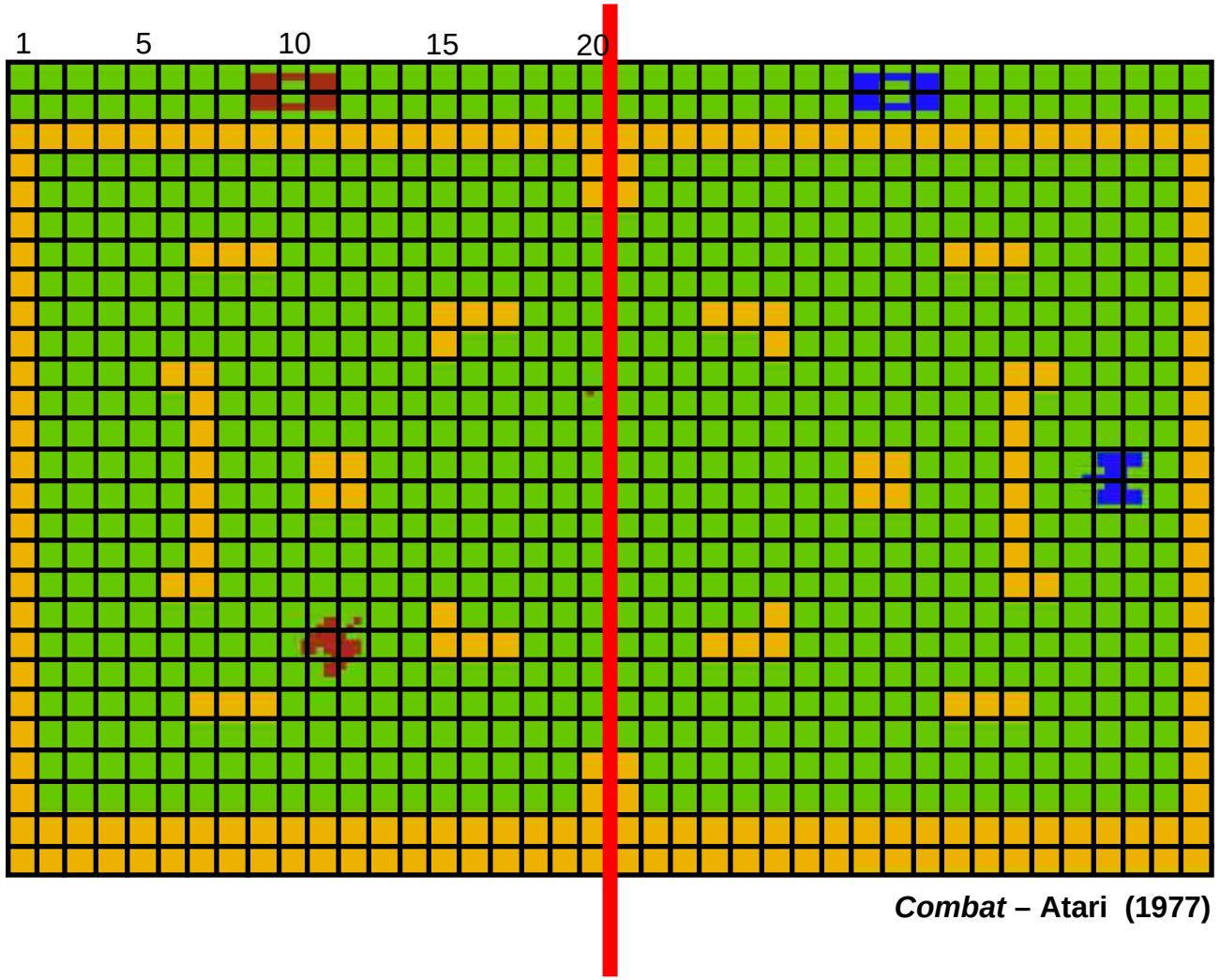
Atari 2600

- 6502-based processor running at 1.19MHz
- Instructions ~4 cycles
- @60Hz, ~ 5000 instructions/frame
- Graphics handled by Stella chip

Atari Stella

- Not DMA, CPU had to draw the lines into the Stella as it draws on the screen
- Register for half a single row in the background (20 columns)
- Could be adjusted on a row by row basis to change the background

Drawing the background

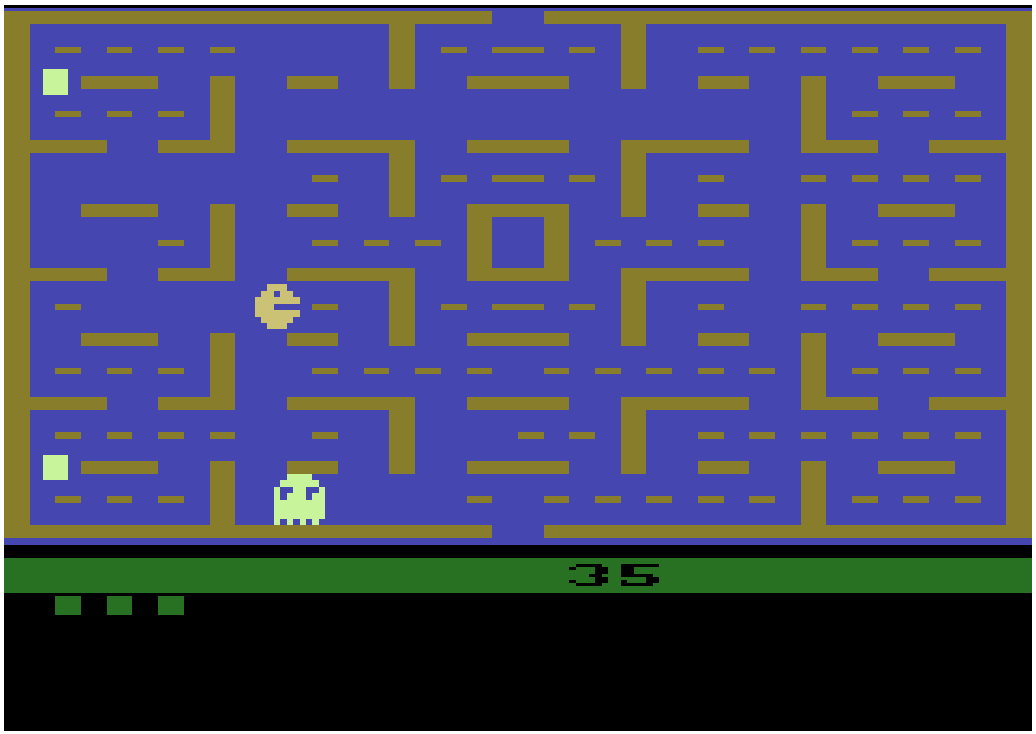


***Combat* – Atari (1977)**

Sample screenshots

***Breakout!* – Atari (1978)**

Sample screenshots



***PacMan* – Atari (1982)**

Sample screenshots

***E.T.* – Atari (1982)**

Nintendo Entertainment System (NES)

- Another 8-bit console
- 6502 running @ 1.79MHz

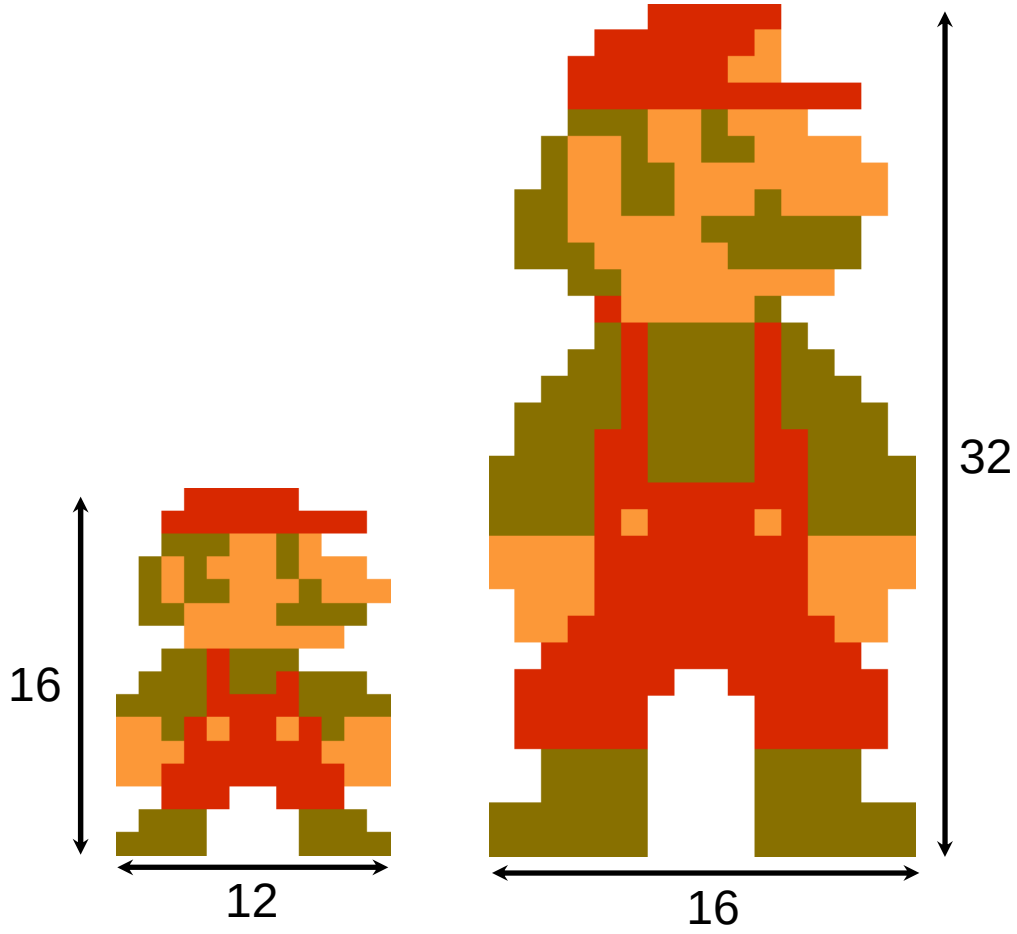
Picture Processing Unit (PPU)

- Ricoh RP2C02 @ 5.37MHz
- Effective resolution of 256 x 240
- 48 colors and 5 grays
- 8kB of tiles for background
- 64 sprites at one time on screen

Sprites

- Player, enemy elements
- Sizes 8 x 8 or 8 x 16
- 256 bytes of sprite positioning

Mario sprites



***Super Mario Bros.* – Nintendo (1984)**

2-D transformations

- We need a way to move objects around the screen

Reading

- Angel, through Ch. 5