

COMP310: Legacy Game Systems

2: De-make culture











NES hardware





► Released in 1983



- ► Released in 1983
- Sold as the Famicom (Family Computer) in Japan



- ► Released in 1983
- Sold as the Famicom (Family Computer) in Japan
- Nearly 62 million units sold worldwide



- ► Released in 1983
- Sold as the Famicom (Family Computer) in Japan
- Nearly 62 million units sold worldwide
- Biggest selling game: Super Mario Bros



- ► Released in 1983
- Sold as the Famicom (Family Computer) in Japan
- Nearly 62 million units sold worldwide
- Biggest selling game: Super Mario Bros
- Credited with reviving the games industry after the video game crash of the early 80s









► CPU: Ricoh 2A03 (closely based on MOS 6502)



- ► CPU: Ricoh 2A03 (closely based on MOS 6502)
- ► Picture Processing Unit (PPU): Ricoh RP2C02 or RP2C07



- ► CPU: Ricoh 2A03 (closely based on MOS 6502)
- ▶ Picture Processing Unit (PPU): Ricoh RP2C02 or RP2C07
- ► RAM: 2 kilobytes for CPU + 2 kilobytes for PPU



- ► CPU: Ricoh 2A03 (closely based on MOS 6502)
- Picture Processing Unit (PPU): Ricoh RP2C02 or RP2C07
- ► RAM: 2 kilobytes for CPU + 2 kilobytes for PPU
- Cartridge ROM: up to 1 megabyte, but typically less



- ► CPU: Ricoh 2A03 (closely based on MOS 6502)
- Picture Processing Unit (PPU): Ricoh RP2C02 or RP2C07
- ► RAM: 2 kilobytes for CPU + 2 kilobytes for PPU
- Cartridge ROM: up to 1 megabyte, but typically less
- ► Screen resolution: 256 × 240

► Around 2270 CPU cycles per frame

- ► Around 2270 CPU cycles per frame
- ► Only 2 kilobytes of writable memory to work with

- ► Around 2270 CPU cycles per frame
- Only 2 kilobytes of writable memory to work with
- ► 6502 instruction set is limited

- Around 2270 CPU cycles per frame
- Only 2 kilobytes of writable memory to work with
- ► 6502 instruction set is limited
 - 8-bit integers only

- ▶ Around 2270 CPU cycles per frame
- Only 2 kilobytes of writable memory to work with
- 6502 instruction set is limited
 - 8-bit integers only
 - Addition, subtraction, bitwise operations, bit-shifts

- Around 2270 CPU cycles per frame
- Only 2 kilobytes of writable memory to work with
- ► 6502 instruction set is limited
 - 8-bit integers only
 - Addition, subtraction, bitwise operations, bit-shifts
- The following are possible but need implementing as subroutines:

- Around 2270 CPU cycles per frame
- Only 2 kilobytes of writable memory to work with
- ▶ 6502 instruction set is limited
 - 8-bit integers only
 - Addition, subtraction, bitwise operations, bit-shifts
- The following are possible but need implementing as subroutines:
 - ► > 8 bit numbers

- Around 2270 CPU cycles per frame
- Only 2 kilobytes of writable memory to work with
- ▶ 6502 instruction set is limited
 - 8-bit integers only
 - Addition, subtraction, bitwise operations, bit-shifts
- The following are possible but need implementing as subroutines:
 - ► > 8 bit numbers
 - Multiplication

- Around 2270 CPU cycles per frame
- Only 2 kilobytes of writable memory to work with
- ▶ 6502 instruction set is limited
 - 8-bit integers only
 - Addition, subtraction, bitwise operations, bit-shifts
- The following are possible but need implementing as subroutines:
 - ► > 8 bit numbers
 - Multiplication
 - Division

- Around 2270 CPU cycles per frame
- Only 2 kilobytes of writable memory to work with
- 6502 instruction set is limited
 - 8-bit integers only
 - Addition, subtraction, bitwise operations, bit-shifts
- The following are possible but need implementing as subroutines:
 - ► > 8 bit numbers
 - Multiplication
 - Division
 - Fractional numbers

Display is made up of sprites and background

- Display is made up of sprites and background
- Sprites:

- Display is made up of sprites and background
- Sprites:
 - Maximum 64 on screen

- Display is made up of sprites and background
- Sprites:
 - Maximum 64 on screen
 - Maximum 8 on the same scanline (horizontal line)

- Display is made up of sprites and background
- Sprites:
 - Maximum 64 on screen
 - Maximum 8 on the same scanline (horizontal line)
 - ightharpoonup 8 imes 8 pixels, 3 colours + transparency

- Display is made up of sprites and background
- Sprites:
 - Maximum 64 on screen
 - Maximum 8 on the same scanline (horizontal line)
 - ▶ 8 × 8 pixels, 3 colours + transparency
 - Can flip horizontally or vertically

- Display is made up of sprites and background
- Sprites:
 - Maximum 64 on screen
 - Maximum 8 on the same scanline (horizontal line)
 - ▶ 8 × 8 pixels, 3 colours + transparency
 - Can flip horizontally or vertically
 - ► No rotation, scaling etc.

- Display is made up of sprites and background
- Sprites:
 - Maximum 64 on screen
 - Maximum 8 on the same scanline (horizontal line)
 - ▶ 8 × 8 pixels, 3 colours + transparency
 - Can flip horizontally or vertically
 - ▶ No rotation, scaling etc.
- Background:

- Display is made up of sprites and background
- Sprites:
 - ► Maximum 64 on screen
 - Maximum 8 on the same scanline (horizontal line)
 - ▶ 8 × 8 pixels, 3 colours + transparency
 - Can flip horizontally or vertically
 - ▶ No rotation, scaling etc.
- ▶ Background:
 - ► Made of 8 × 8 pixel tiles

Graphical limitations

- Display is made up of sprites and background
- Sprites:
 - ► Maximum 64 on screen
 - Maximum 8 on the same scanline (horizontal line)
 - ▶ 8 × 8 pixels, 3 colours + transparency
 - Can flip horizontally or vertically
 - ▶ No rotation, scaling etc.
- ▶ Background:
 - ► Made of 8 × 8 pixel tiles
 - \blacktriangleright 32 imes 32 blocks must share the same 4-colour palette

Graphical limitations

- Display is made up of sprites and background
- Sprites:
 - ► Maximum 64 on screen
 - Maximum 8 on the same scanline (horizontal line)
 - ▶ 8 × 8 pixels, 3 colours + transparency
 - Can flip horizontally or vertically
 - ▶ No rotation, scaling etc.
- ▶ Background:
 - ► Made of 8 × 8 pixel tiles
 - ▶ 32 × 32 blocks must share the same 4-colour palette
 - Limitations on types of scrolling



https:

//wiki.nesdev.com/w/index.php/Limitations

Examples of NES games

https://youtu.be/um-GMygsRg4





De-makes

De-makes

"purposedly built as an interpretation of how the game may have been, were it conceived and produced during a previous hardware or software generation"

https://tvtropes.org/pmwiki/pmwiki.php/Main/VideogameDemake

Develop a NES de-make of a "modern" game

- ▶ Develop a NES de-make of a "modern" game
- ► **Next week**: give a 5-minute pitch for your de-make

- Develop a NES de-make of a "modern" game
- Next week: give a 5-minute pitch for your de-make
- Make sure you consider scope and technical limitations carefully

- Develop a NES de-make of a "modern" game
- Next week: give a 5-minute pitch for your de-make
- Make sure you consider scope and technical limitations carefully
- ▶ Focus on a single key mechanic

- Develop a NES de-make of a "modern" game
- Next week: give a 5-minute pitch for your de-make
- Make sure you consider scope and technical limitations carefully
- ▶ Focus on a single key mechanic
- ► Focus on gameplay, not graphics or content





Developing for the NES

► An **emulator**

- ► An emulator
 - ► Recommended: FCEUX
 - ► http://www.fceux.com/

- ► An emulator
 - ► Recommended: FCEUX
 - ► http://www.fceux.com/
- ► An assembler

- An emulator
 - ▶ Recommended: FCEUX
 - ▶ http://www.fceux.com/
- ► An assembler
 - Recommended: NESASM
 - ▶ https://github.com/edpowley/nesasm/releases

- ► An emulator
 - ▶ Recommended: FCEUX
 - ▶ http://www.fceux.com/
- ► An assembler
 - Recommended: NESASM
 - ► https://github.com/edpowley/nesasm/releases
- ► A sprite editor

- ► An emulator
 - Recommended: FCEUX
 - ▶ http://www.fceux.com/
- An assembler
 - Recommended: NESASM
 - ▶ https://github.com/edpowley/nesasm/releases
- ► A sprite editor
 - Recommended: YY-CHR
 - ▶ https://www.romhacking.net/utilities/119/

- An emulator
 - Recommended: FCEUX
 - ▶ http://www.fceux.com/
- An assembler
 - Recommended: NESASM
 - https://github.com/edpowley/nesasm/releases
- ► A sprite editor
 - ► Recommended: YY-CHR
 - ▶ https://www.romhacking.net/utilities/119/
- A text editor

▶ bit.ly/comp310

- ▶ bit.ly/comp310
- ► I expect you to work through these in your own time

- ▶ bit.ly/comp310
- I expect you to work through these in your own time
- Timetabled workshops are mostly for working on your projects and getting support (although there will also be a bit of taught material)

Let's jump in!

Let's jump in!

http://nintendoage.com/forum/messageview. cfm?catid=22&threadid=7974

Let's jump in!

- ▶ http://nintendoage.com/forum/messageview. cfm?catid=22&threadid=7974
- ► Download controller.zip

Exercise

Modify controller.asm so that all of Mario moves left and right, not just the back of his head...