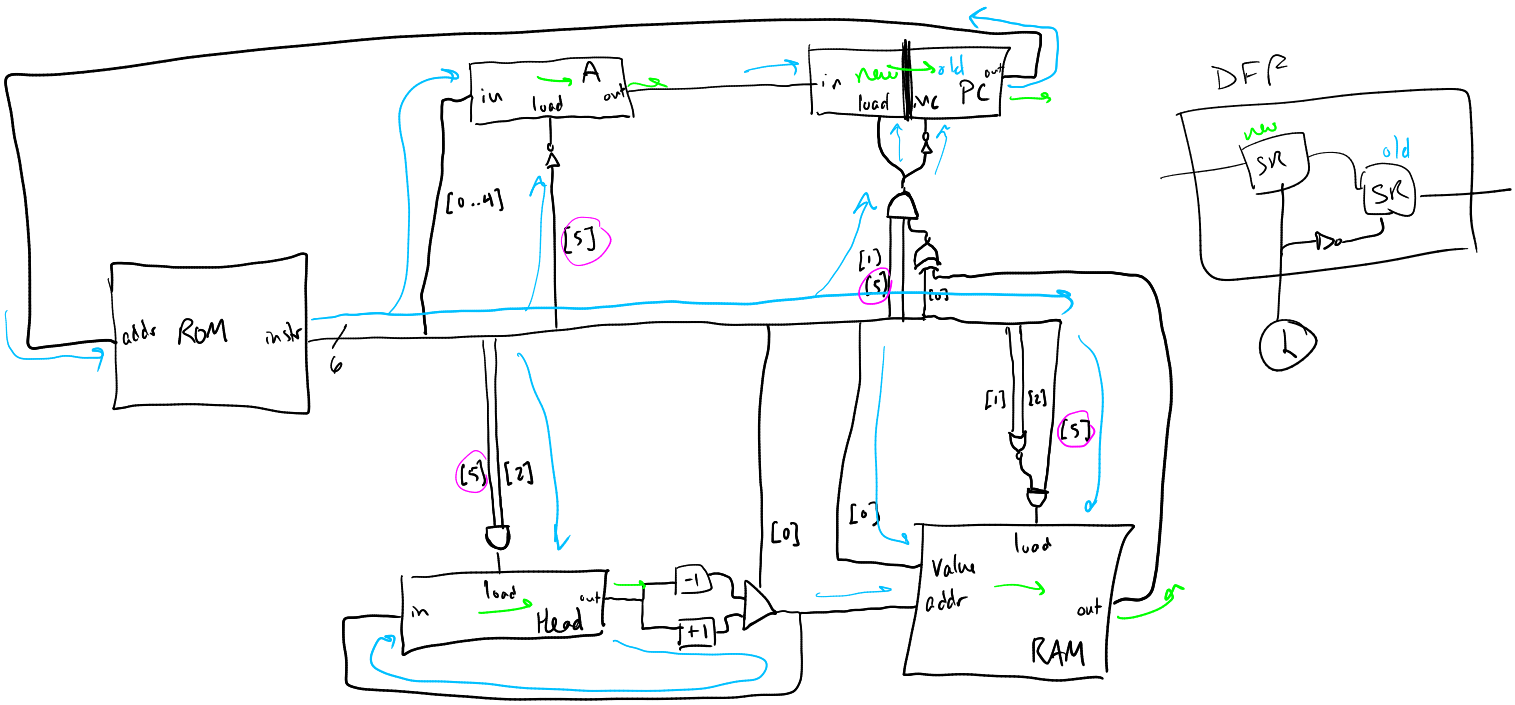


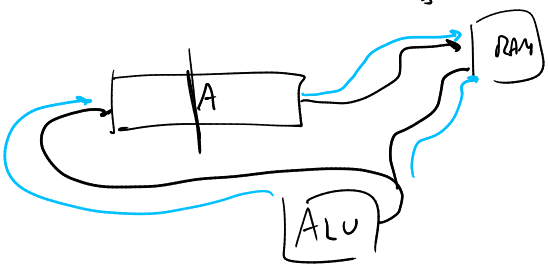
Hack CPU

A-instructions: 0 (15) — load A register when 0. with these bits.

C-instructions: 1 1 1 | ignore | a | c | d | j

- a: Choose which goes into ALU: A or RAM[A].
- c: go into ALU.
- d: d_1 d_2 d_3 go to load inputs for RAM, A, D.
- j: J_1 jump if <0 (ng); J_2 =0 (zr); J_3 >0.

AM=D+1 — I said don't do this — but I was wrong!



History of CPU's

1940's – early 1960's : mainframes = room-sized CPU's.

early 1960's – late 70's : minicomputers = cabinet-sized CPUs (DEC VAX eg.)

mid 1970's : microcomputers = CPU on a chip. (IC = integrated circuit)

8-bit CPUs, 16-bit address.

- Intel 8008 (1972) process size: 10 μm = $\frac{1}{1000^{th}}$ of a cm = 1000 fit across your thumb.
- Intel 8080 (1974) – 2MHz clock speed: 200 – 800 kHz. 6 μm
- MOS 6502 (1975) – ~1MHz.

↳ Atari 2600, Nintendo, Apple II, Commodore 64, BBC Micro

Gordon Moore – CEO of Intel? 1965 – 1975 "Moore's Law" prediction: # of components on an IC x2 every 2 years

80's: 16-bit CPU's.

Intel 8088 → 1st IBM PC. (1979)

Motorola 68000 → early Macs. (1986).

↳ Macs have now switched to Intel chips.

Intel 80286 (1982) ~10MHz (2 μm)
80386 (1985) ~20
80486 ~100
Pentium (90's ~200 (500 nm)
Xeon, Celeron, ... → ~5GHz 14nm, 7nm → dominates desktop market.

RISC = Reduced Instruction Set Computing – 1980's first commercial releases.

benefits: smaller, simpler, less power, etc.

SPARC, ARM

↳ dominates embedded market eg. gaming systems, smartphone, cars, etc.