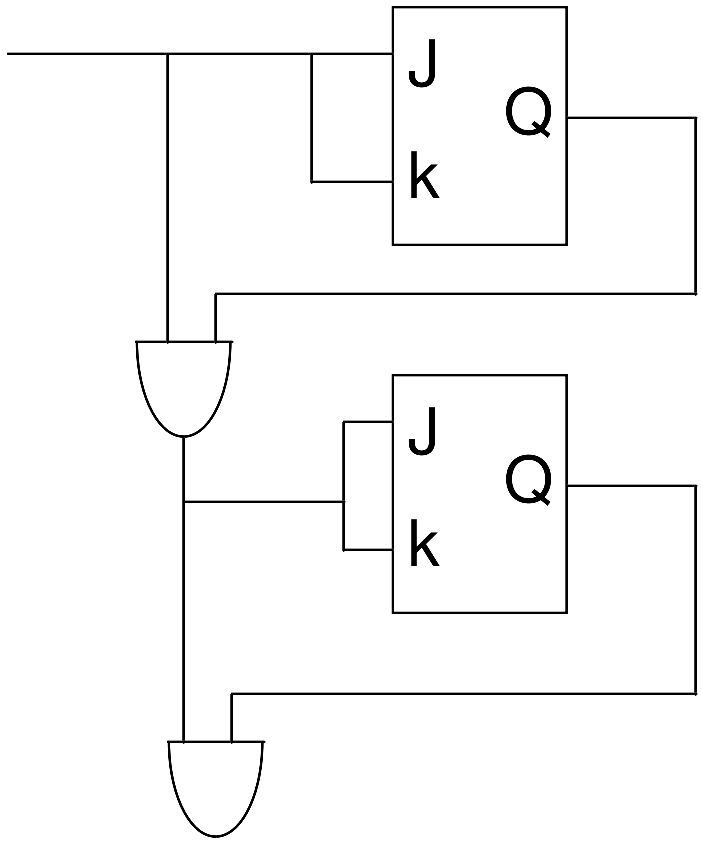
Binary Counter

- Design a simple binary counter using J-K Flip-flops
  - idea is that it works like a speedometer in your car.

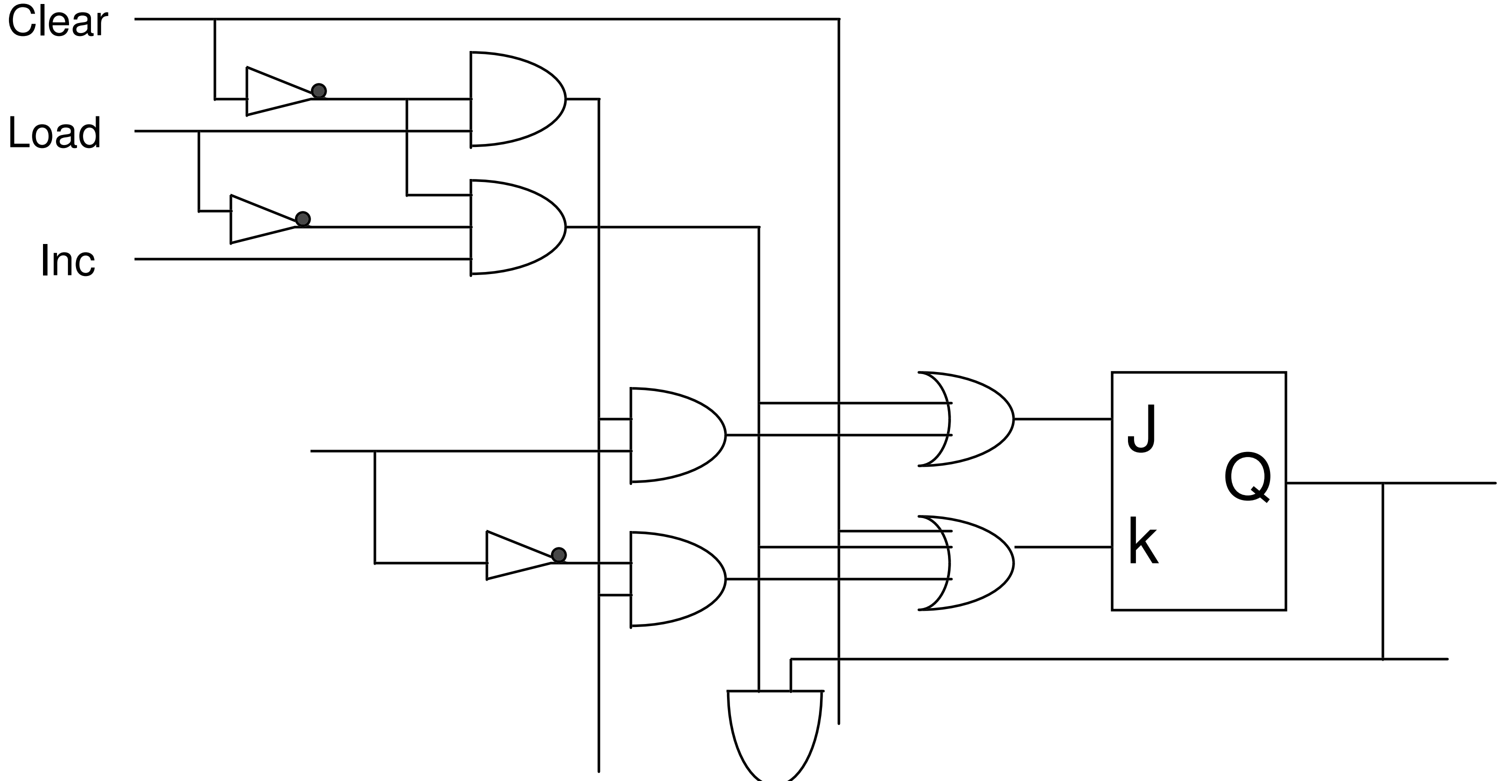


Functions of Counter

Clock	Clear	Load	Inc	Operation
up	0	0	0	No Change
up	0	0	1	Increment by one
up	0	1	x	Load input I’s
up	1	x	x	Clear outputs

Advanced Binary Counter

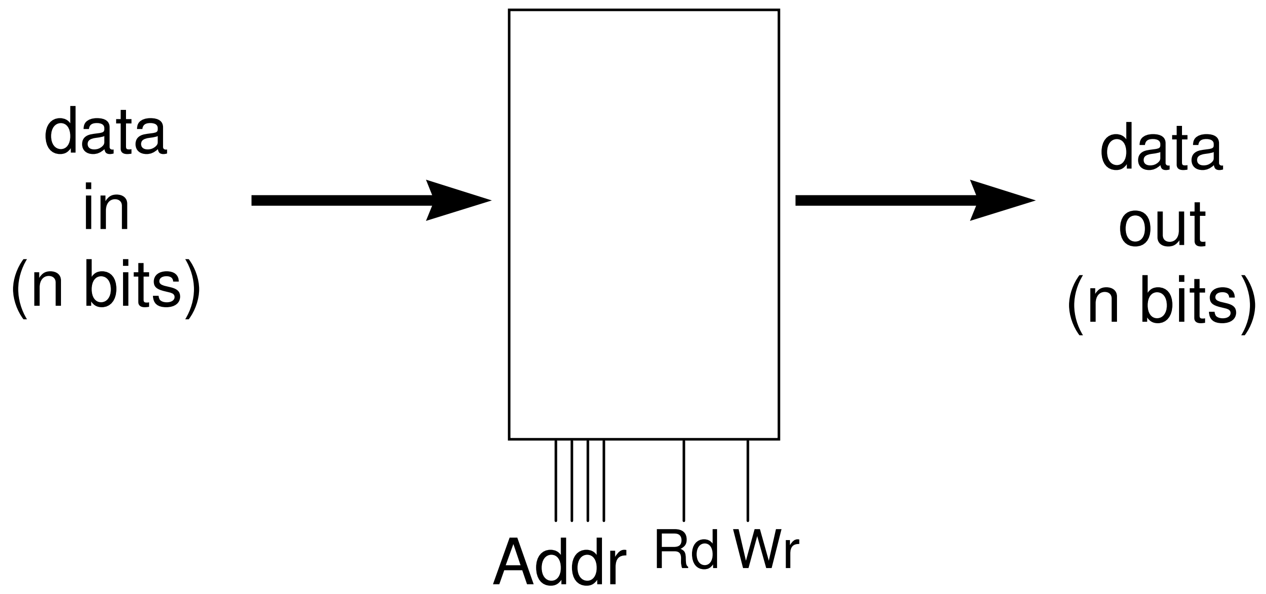
- Add additional features to the binary counter
  - clear (set all F.F. to 0)
  - load (load data into the counter)
  - increment (add one to the counter
  - priority (clear, load, increment)



Memory

- collect of cells to store 0's and 1's
- cells have a fixed number of bits (called a word)
  - meaning of what is stored in a word depends on situation
  - 8 bits are a byte
- each memory word is assigned a specific address
- There are several types of memory
  - RAM (Random Access Memory) - read/write
  - ROM (Read Only Memory)
- Read Only memory comes in several types
  - ROM (wired at factory)
  - PROM (write once memory)
  - EPROM (erasable PROM)
  - EEPROM (electronically erasable PROM)

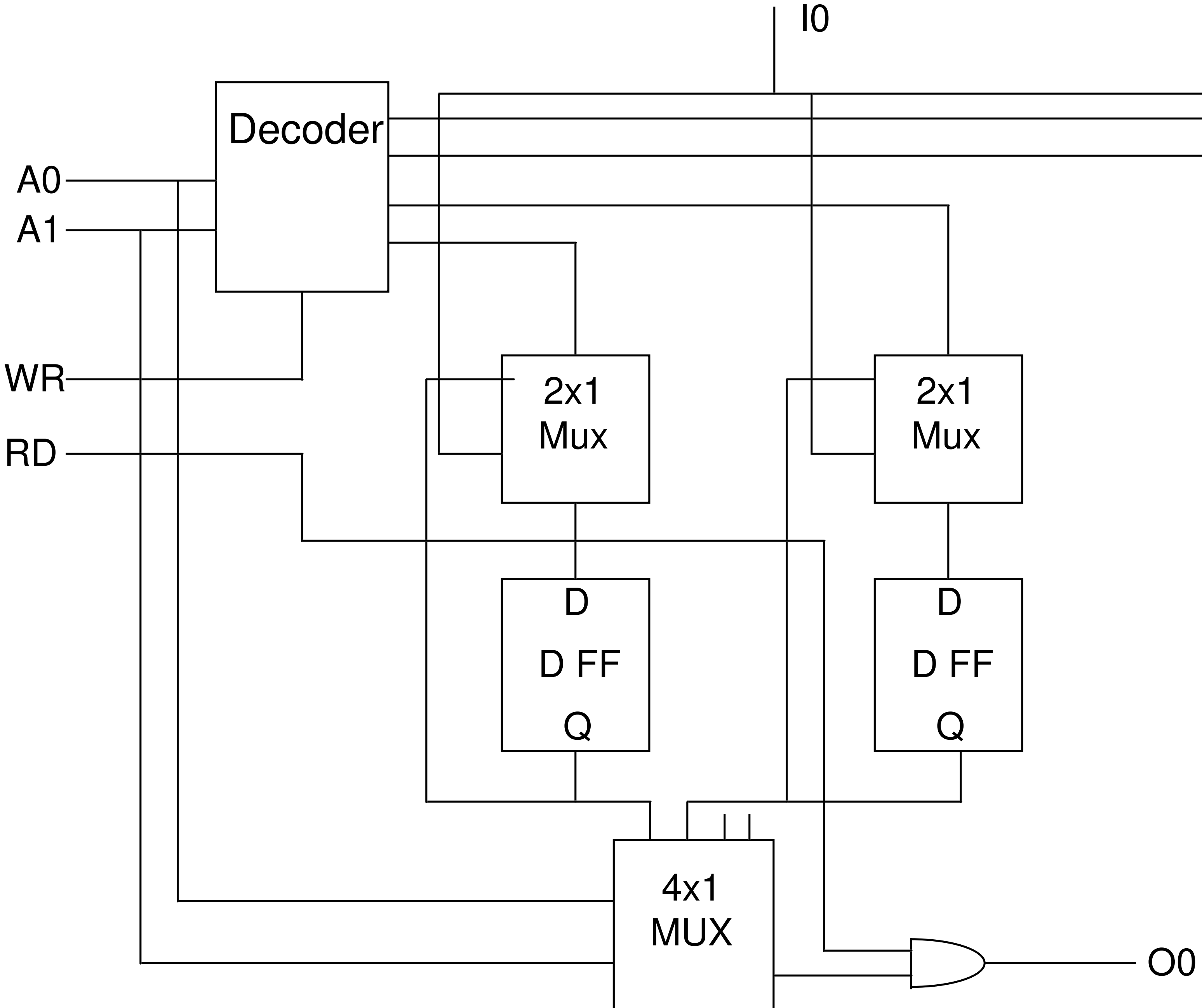
Using Ram



- Write
  - Apply Address
  - Apply Bits to be Stored
  - Activate Write line
- Read
  - Apply Address
  - Active Read Line

Design a RAM

- 1 bit word
- 4 words
- Use D Flip-flops
- What are the inputs and outputs?
  - 1 data input
  - 1 data output
  - read and write control lines
  - 2 address lines


I0
Decoder
A0
A1
WR
RD
2x1
Mux
2x1
Mux
D
D FF
Q
D
D FF
Q
4x1
MUX
O0