What does this circuit do?

(Your response)
How’s it going?

(1) The pace of this class is...
   1 = way too slow; 4 = just right; 7 = way too fast

(2) I’m learning a lot in CS 42.
   1 = strongly disagree; 4 = neither agree nor disagree; 7 = strongly agree

(3) CS 42 is interesting.
   1 = strongly disagree; 4 = neither agree nor disagree; 7 = strongly agree

(4) I know I can get help / support from (e.g., Prof. Ben, the grutors, Piazza), if I need it.
   1 = strongly disagree; 4 = neither agree nor disagree; 7 = strongly agree

(5) When it comes to workload, so far, this is my hardest course this semester.
   1 = strongly disagree; 4 = neither agree nor disagree; 7 = strongly agree
What does this circuit do?

(Your response)
Levels of abstraction

Stored-program computers

Random-access memory (RAM)

Registers

1-bit memory: flip-flops

Logic gates

Transistors / switches

today

Tuesday

next week
I'm here 0
I'm not here 0
Come over
Set-Reset (S/R) latch

A simple, one-bit memory
Data (D) latch

Remembers a particular moment in time
Random-access memory (RAM)

A 512K x 8 RAM (About 4.2 million bits)
A small piece of RAM

Interface

2 address bits

3 data bits (in)

Read Write

0 1 0
1 1 1
0 0 0
0 0 1

3 data bits (out)
A small piece of RAM

Implementation
A small piece of RAM

Addressing: select which “line”
A small piece of RAM

Write mode
A small piece of RAM
A *small* piece of RAM

Wire data bits to corresponding memory bits
A small piece of RAM

Wire data bits to corresponding memory bits
A small piece of RAM

Wire data bits to corresponding memory bits
Transistors are current switches:

A low voltage here
allows current here
otherwise it’s blocked

A high voltage here
allows current here
otherwise it’s blocked

voltage here

allows current here

SET transistor
single-electron tunneling

30 nm
Which gate is this?

Transistors are current **switches**:

A low voltage here

allows current here
otherwise it's blocked

A high voltage here

allows current here
otherwise it's blocked

Diagram of a gate with inputs, outputs, power, and signal connections.
Mechanical relays

How to build a NOT gate with a magnet

![Diagram of a mechanical relay](image)

- **Power (6v)**
- **Signal Input, A**
- **Output Q**
Which gate is this?