Most real-world hardware design is done using a text-based hardware description language – VHDL, AHDL, etc.

- Schematics can be "compiled" into a text description
- Can use a simulator to test the circuit
- Other back-end tools optimize, perform layout and wire routing, floorplan, etc.
- Final spec is either downloaded onto a programmable device, or etched into silicon

We will be using Logisim for all hardware design
- interactive, graphical schematic editor
- educational use mainly (makes it user-friendly)
SR Latch

- Set-Reset (S-R) Latch
- Q: Stored value and its complement
- S=1 and R=1?
First Attempt

- How does the output behave?
Master-Slave Flip-Flop

- Outputs change only on falling edges
- Data is captured on rising edges
- Delay in outputs – but works out perfectly – data for the next stage is ready half cycle ahead of time
Traffic Light...?
Simple intersection

- One non-red light at a time
- Always transition to yellow before red
- Minimum ~10 seconds on green
- ~5 seconds on yellow
- If car sensed at red light
  … then change directions
- Always complete change-of-direction
- Stay green if no cars sensed
Optimize for minimum effort