a traffic light with cars
an intersection with 2 lights
A traffic light with lights RAG, and a car sensor, C.

The transitions here show cars arriving at any time and leaving only when the light is green.
if we omit the dotted arrow, the light will not move from red to green until a car is waiting.

Should we also model drivers that break the rules?
How should we combine two sets of lights?

Which combinations of states should we avoid/allow?

We certainly don’t want both lights green.

\[ \neg \text{ewG} \lor \neg \text{nsG} \]

Is this enough?
We certainly don’t want both lights green.

$\neg ewG \lor \neg nsG$

Is this enough?

A safer idea?

$ewA \lor ewG \rightarrow nsR$

$nsA \lor nsG \rightarrow ewR$
A safer idea?
\[ \text{ew}A \lor \text{ew}G \rightarrow \text{ns}R \]
\[ \text{ns}A \lor \text{ns}G \rightarrow \text{ew}R \]

What about transitions?
synchronous v. asynchronous

synchronous: take one step in each machine
asynchronous: interleave steps each choosing a transition from one or other machine
A safer idea?

\[ \text{ewA} \lor \text{ewG} \rightarrow \text{nsR} \]

\[ \text{nsA} \lor \text{nsG} \rightarrow \text{ewR} \]

What about transitions?

asynchronous interleaving

Our machines take turns.

The only times we have a choice of whose turn is next are when both lights are red.
A safer idea?
\[ \text{ewA} \lor \text{ewG} \rightarrow \text{nsR} \]
\[ \text{nsA} \lor \text{nsG} \rightarrow \text{ewR} \]

How should we interleave the transitions?

Maybe these transitions should only happen when there is a car waiting at the other light.
A safer idea?

$$ewA \lor ewG \rightarrow nsR$$

$$nsA \lor nsG \rightarrow ewR$$

The only times we have a choice of whose turn is next are when both lights are red.

When both lights are red we can only make one of these transitions.

How do we decide which one?

Is the system fair?

What might that question mean?
A safer idea?

\[ \text{ewA} \lor \text{ewG} \rightarrow \text{nsR} \]
\[ \text{nsA} \lor \text{nsG} \rightarrow \text{ewR} \]

The only times we have a choice of whose turn is next are when both lights are red.

Can you argue that, however we make this choice, this system is safe, assuming drivers follow the rules?
Should we also model drivers that break the rules?

Will this system still be safe if some drivers leave on amber as shown in grey?