Welcome and Recap of Models

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Abstractions for behavioral level modeling

• Message-passing programming in CHP
  ❖ Parallel collection of sequential programs
  ❖ Communication channels for information exchange

• Dataflow graphs
  ❖ Fine-grained parallel components
    ‣ Can be viewed as “simple subset of CHP”
  ❖ Easy to think about pipelines
  ❖ Communication channels for information exchange

• Links and joints
  ❖ Separation of state and actions
  ❖ Information exchanged via links
    ‣ Abstraction that captures common features of different ways to implement communication between two components
Gate-level modeling

• Digital logic
  ❖ All variables must be mapped into Booleans (0/1)
    ‣ If we already have a Boolean variable, direct mapping
    ‣ N-bit integers: use N one-bit variables
  ❖ Circuit often includes signal + complement
    ‣ Sometimes made explicit by having two variables for a Boolean

• Gates manipulate Boolean values

\[
\begin{align*}
  a & \land b | c & \rightarrow & x + \\
  \text{condition (guard)} & & \text{assignment}
\end{align*}
\]

production rule
Syntax for gates in ACT

### Combinational Gates

- **a** \(\rightarrow\) **x**
  - \(\sim a\) \(\rightarrow\) **x**
  - \(a \rightarrow x\)

- **a** \& **b** \(\rightarrow\) **x**
  - \(\sim a\ |\ \sim b\) \(\rightarrow\) **x**
  - \(a \& b \rightarrow x\)

- **a** | **b** \(\rightarrow\) **x**
  - \(\sim a\ &\ \sim b\) \(\rightarrow\) **x**
  - \(a \ |\ b \rightarrow x\)

### State-Holding Gates

- **a** \(\rightarrow\) **c** \(\rightarrow\) **x**
  - \(\sim a\ &\ \sim b\) \(\rightarrow\) **x**
  - \(a \& b \rightarrow x\)

- **a** \(\rightarrow\) **x**
  - \(\sim a\) \(\rightarrow\) **x**
  - \(a \rightarrow x\)

### Short Cuts

- **a** \(\rightarrow\) **x**
  - \(a \rightarrow x\)

- **a** \& **b** \(\rightarrow\) **x**
  - \(a \& b \rightarrow x\)

- **a** \& **b** \(\rightarrow\) **x**
  - \(a \& b \rightarrow x\)

- **a** \& **b** \(\rightarrow\) **x**
  - \(a \& b \rightarrow x\)

- **a** \& **b** \(\rightarrow\) **x**
  - \(a \& b \rightarrow x\)
Going from channels to signals/Booleans

• Two parts of a channel
  ❖ Synchronization [blocking send and receive]
  ❖ Data transfer from sender to receiver

• Basic idea
  ❖ Two signals: request and acknowledge
    ‣ One end asserts request
    ‣ Other end asserts acknowledge
  ❖ It is possible to have one signal
    ‣ One end asserts the signal
    ‣ The other end de-asserts the signal

• Many variations of this idea in the literature
  ❖ We will describe some popular approaches today