k-Complete Test Suite

What if $k > 0$?

- We should detect up to k extra states.
- $A \cdot I^{\leq k}$ reaches all implementation states!
- replace A in the 0-complete test suite by $A \cdot I^{\leq k}$

An k-complete test suite:
$(A \cdot I^{\leq k}) \cdot I^{\leq 1} \cdot C$

or simply
$\mathbf{T} = \mathbf{A} \cdot \mathbf{I}^{\leq \mathbf{k}+1} \cdot \mathbf{C}$

Special (Smaller) Characterisation Sets

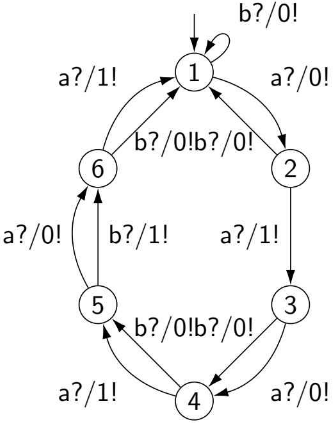
- A sequence $c \in C$ is a Unique Input Output sequence (UIO) for some state q if:
  - for all other states q' of S: $\lambda^*(q, c) \neq \lambda^*(q', c)$
- Hence, a characterisation set of UIOs needs only $|S| - 1$ elements.

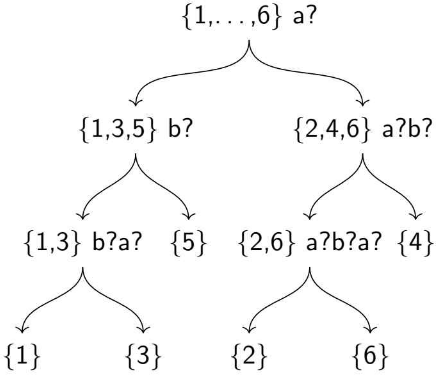
- A sequence $c \in C$ is a Distinguishing Sequence (DS) for S if:
  - For all states q, q' (with $q \neq q'$) of S: $\lambda^*(q, c) \neq \lambda^*(q', c)$
- Hence, a DS gives a singleton characterization set!

- Note:
  - A distinguishing sequence is for an entire specification
  - UIOs are per state
  - Separating sequences are per pair of states
- UIOs and DSs do not always exist...

Algorithm for Finding Separating Sequences

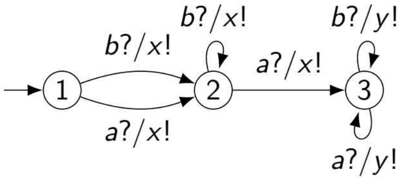
Use a splitting tree:

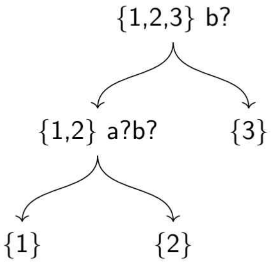




$C = \{\cancel{a?}, \cancel{b?}, \cancel{a?b?}, b?a?, a?b?a?\}$

Splitting node: Separate States by Input





$\{1, 2\}$ can be split based on $a?$ and the split of $\{1, 2, 3\}$, because

- $\delta(1, a?) = 2$ and $\delta(2, a?) = 3$, and
- states 2 and 3 are already split in node $\{1, 2, 3\}$ (they are in different children of $\{1, 2, 3\}$)

$C = \{b?,\ a?b?\}$