

CSE460 : Lecture 15 :

State Identification; Homing, Synchronizing, & Distinguishing Sequences

Washington University
Spring 2006

<http://www.arl.wustl.edu/~lockwood/class/cse460/>

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State Identification

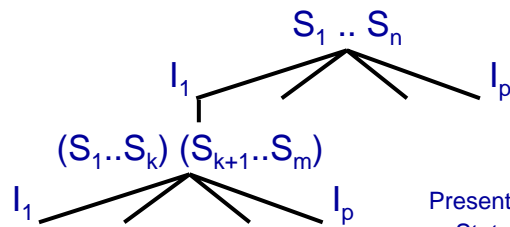
- Consider some machine, M
- Probe the system
 - Apply Inputs
 - Observe Output
 - Determine
 - Initial State
 - Final State
- Example:
 - Apply: 01
 - Apply: 011

Present State	Next state/ Output with X=0	Next state/ Output with X=1
A	C / 0	D / 1
B	C / 0	A / 1
C	A / 1	B / 0
D	B / 0	C / 1

State Uncertainties

- States
 - $S_1 \dots S_n$
- Input
 - I_i
- Successor
 - Resulting States after input
 - Eg: 1-successor: Resulting state(s) after input of “1”
- Uncertainty Vector
 - $(S_1 \dots S_k) (S_{k+1} \dots S_n) \dots$
 - Homogeneous Vector
 - (Single State) or (Same states)

Successor Tree



Present State Next state/
Output with X=0 Next state/
Output with X=1

A	C / 0	D / 1
B	C / 0	A / 1
C	A / 1	B / 0
D	B / 0	C / 1

- Result is homogeneous if Uncertainty vector contains single state

Homing Sequence

- **Input Sequence = Homing Sequence**
 - Final state can be determine by response to input
- **Uncertainty Vector**
 - $(S_1 \dots S_k) (S_{k+1} \dots S_m) \dots$
 - (Components)
- **Terminate On**
 - Homogeneous Vector
 - Uncertainly appears earlier
- **Example:**

Present State	Next state/ Output with X=0	Next state/ Output with X=1
	A	B / 0
B	A / 0	B / 0
C	D / 1	A / 0
D	D / 1	C / 0

Example 2

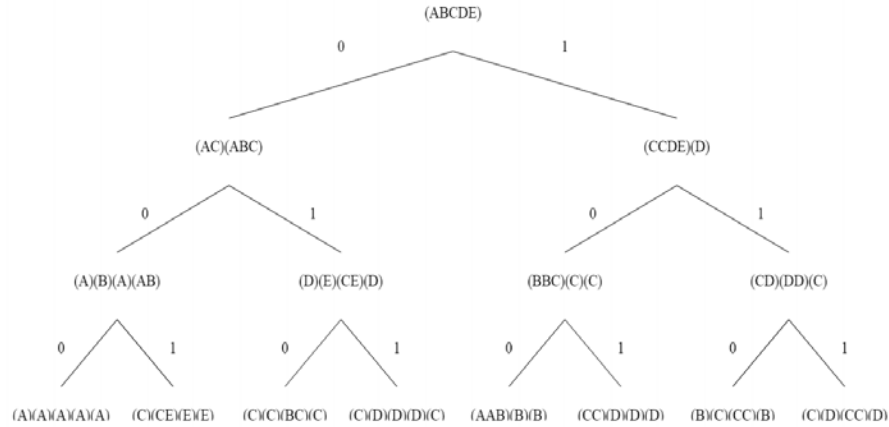
Consider the following Moore state machine

PS	NS, z	
	x=0	x=1
A	A,1	E,0
B	A,0	C,0
C	B,0	D,1
D	C,1	C,0
E	C,0	D,0

(a) Develop a homing tree.

Example 2 - Continued

Solution:



Example 2 - Continued

Find the shortest homing sequences.

Solution: The shortest homing sequences are 000, 011, 101, 110, and 111

Find the shortest synchronizing sequences

Solution: The shortest synchronizing sequence is 000

Which homing sequences are also distinguishing sequences?

Solution: The distinguishing sequences are 000 and 011

Synchronizing Sequence

- Takes machine to a specified state independent of initial state or output.
 - Ignores output
 - Ignores requested state
 - Terminate when:
 - Uncertainty seen earlier
 - Uncertainly contains one state

Present State	Next state/ Output with X=0	Next state/ Output with X=1
A	B / 0	D / 0
B	A / 0	B / 0
C	D / 1	A / 0
D	D / 1	C / 0

- Example:

Distinguishing Sequence

- Identifies Initial State
- Input Sequence = Distinguishing Sequence if
 - Output is unique for each possible initial state

Present State	Next state/ Output with X=0	Next state/ Output with X=1
A	C / 0	D / 1
B	C / 0	A / 1
C	A / 1	B / 0
D	B / 0	C / 1