State Minimization of Incompletely Specified Machines

Lecture Notes # 8

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Digital Systems
ECE 465
Step 1: Find the maximal compatible groups selected in the above step is the set of new compatible groups. The set of max compatible groups selected in the above step is the set of new compatible groups.

Step 2: Find the maximal incompatibles using the implication table and merger diagram.

Step 3: Find the bounds on the # of reqd. states, and # of original states where # of max compatible groups, # = \( \bigcap \{ \text{max compatible} \} \), and # = \( \bigcap \{ \text{max compatible} \} \).

Step 4: Obtain the closure table for all max compatible groups.

Step 5: Obtain the covering table in which the rows are the max compatible groups, and the columns are each original state and each distinct next-state-group. There is an X at the intersection of row i and col j if the states in col j are all contained in the ith max compatible group.

Step 6: Find the minimum # of max compatible groups that cover all the columns.

Step 7: The set of max compatible groups selected in the above step is the set of new states of the FSM that satisfy completeness and consistency and should be near-minimal in most cases.
Example

(f) Covering Table

\[ \{\text{ACD}, \text{ACE}\} \]

Minimal cover (selected max compatible)

Max incompatible groups = \{(BE), (ED)\}

\[ U = \min\{3, 2\} = 2 \]

Max incompatible groups:

(b) Implication Table

\[ \begin{array}{c|ccc}
\text{A} & \text{B} & \text{C} & \text{D} \\
\hline
\text{A} & \text{X} & \text{X} & \text{X} & \text{X} \\
\text{B} & \text{X} & \text{X} & \text{X} & \text{X} \\
\text{C} & \text{X} & \text{X} & \text{X} & \text{X} \\
\text{D} & \text{X} & \text{X} & \text{X} & \text{X} \\
\end{array} \]

(c) Merger diagram for max compatibles

(d) Merger diagram for max incompatibles

(e) Closure Table

\[ \begin{array}{c|c|c|c|c}
\text{A} & \text{B} & \text{C} & \text{D} & \text{E} \\
\hline
\text{A} & 0 & 1 & 1 & 1 \\
\text{B} & 1 & 0 & 0 & 0 \\
\text{C} & 1 & 0 & 0 & 0 \\
\text{D} & 1 & 0 & 0 & 0 \\
\text{E} & 1 & 0 & 0 & 0 \\
\end{array} \]

Minimal cover (selected max compatible groups) = \{(ABD), (ACE)\}

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