

ASM

Abstract State Machines

Verification of ASM

Three methods:

1. Reviews
2. Testing
3. Formal Proofs

Review of ASMs

- Similar to code reviews
- Natural to the system
- Knowledge base

Testing ASMs

- ASMs can be executed
 - AsmL
 - XASM
- Earlier testing

Formal Proofs of ASMs

- ASMs are a Formal Description
- Verification of ASMs

Example

Prove the definition of Kruskal's algorithm for finding a minimum spanning tree terminates.

Example: Kruskal's

- Prove the algorithm finds a spanning tree
 - Graph of n nodes
 - Algorithm creates edges between nodes
- Termination:
 - All nodes with the same label
 - $n - 1$ edges

Example: Kruskal's

- At each state:
 - Label $\rightarrow p$
 - Set of nodes labelled $p \rightarrow L_p$
 - Number of nodes in $L_p \rightarrow n_p$
 - Edges connected to nodes in $L_p \rightarrow t_p$
- Each set of nodes in a non-empty L_p
 - $t_p = n_p - 1$
- Loop until only one non-empty L_p

Example: Kruskal's

- Now prove the claim by induction
- At the first step each node is separately labelled
 - $n_p = 1$
 - $t_p = 0$
 - Claim holds true so far.

Example: Kruskal's

- Edge e chosen between two labels
 - (p and q)
- All nodes labelled p are re-labelled q
- L'_q is the new set of nodes labelled q
 - $t'_q = n_q + n_p - 1$
- The proof holds true
 - L'_p is now empty
 - All other labels remain the same
- Number of non-empty labels decreases by 1

Final Thoughts

- ASMs not limited to software
- Multi-agent ASMs
 - Distributed Systems
 - Real-time Systems