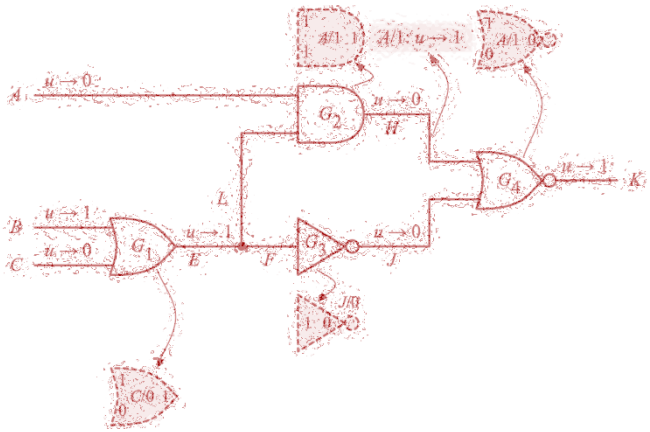
Fault Simulation

- Introduction
- Fault simulation techniques
- Alternatives to fault simulation
- **Issues of fault simulation**
- **Conclusion**

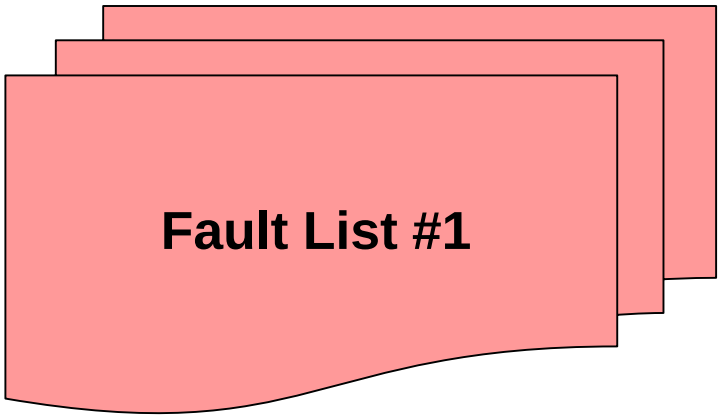


Issues of Fault Simulations

- Long CPU time
  - Distributed computing, or Fault sampling
- Large memory requirement
  - Partition faults into multiple simulation passes
- Potentially detected faults
- Compatibility with logic simulation

Speed and Memory Solutions

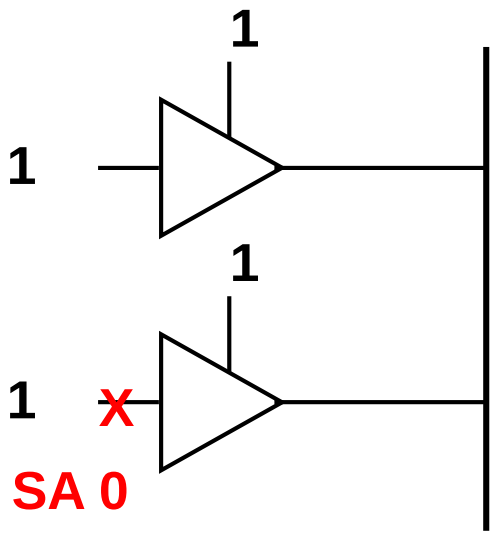
- 1. *Multiple-pass* fault simulation
  - Run only small portion of faults per pass
- 2. *Distributed* fault simulation
  - Distribute faults to more than one computers
- 3. Emulation
  - Use hardware emulator, like FPGA

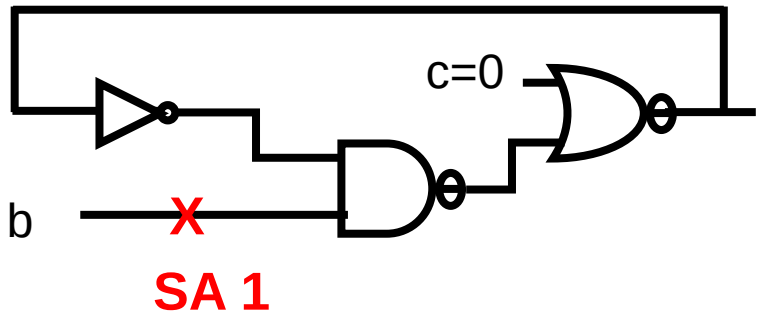


- *A *simulation pass* is a single simulation run
  - from beginning to end of test patterns

Potentially Detected Faults

- DEF: faults that may or may not be detected in practice
  - Detection cannot be determined by fault simulation
- Possible reasons for potentially detected faults
  - Bus contention, Oscillation, High impedance, Unknown
- Examples:





Fault detected?

- Different tools have different ways to calculate FC
  - Please see tool manual for details

Compatibility with Logic Simulation

- To speed up fault simulation, many tools requires circuits to be represented in a library models pre-defined by tools
- Functional verification logic simulations often involve mixed-level codes, which make such modeling very difficult
  - Circuit delay
  - RTL behavior description
  - *User Defined Primitives* (UDP)
    - DFF, MUX

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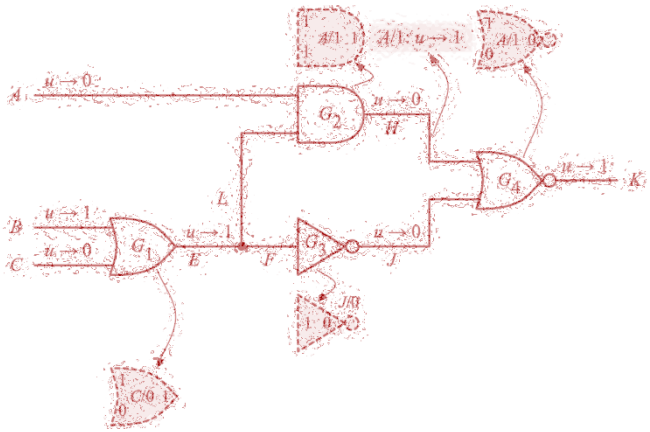

Quiz: Comparison of Techniques

Items	Serial	PPSFP	Deductive	Concurrent	Differential
unknown logic value	☺	☺	☹	☺	☺
Delay model					
Run time					
Sequential circuits					
Memory					

Conclusion

- Usage of fault simulation
  - ATPG, fault grading, diagnosis
- Techniques
  - Serial, parallel, PPSFP, deductive, concurrent, differential
- Most popular technique in industry now
  - PPSFP is simple for comb. ckt (or seq. ckt with full scan)
  - Concurrent and differential good for both comb./seq. ckt

Commercial Tools

- Cadance
  - Verifault
- Mentor Graphic:
  - Fastscan, flextest
- Synoopsys
  - Tetramax
- Syntest
  - Turboscan
  - TurboFault

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