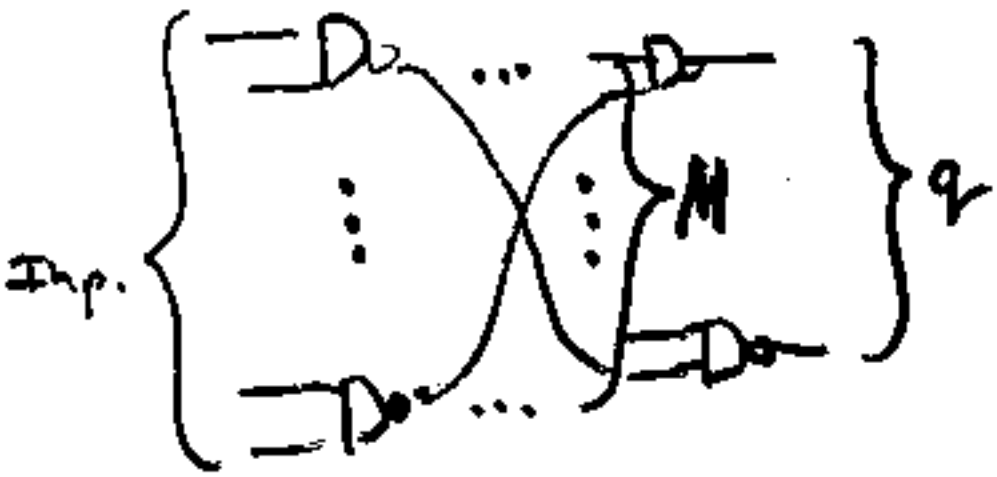
Detection of Multiple Stuck-at Faults by Single Stuck-at Fault Tests (SFT)

Def. A multiple fault f is said to be Guaranteed to Be detected (GTBD) by [redacted] if any SFT detects f regardless of the presence of any other faults.

AND, OR, NAND
NOR gates only



Let q - number of primary outputs;

M - number of input lines for output gates;

L - number of lines in a cut.

(J. Jacob, N. Biswas, Proc. 1987 Int Test Conference) $L \geq M \geq q$

1) Multiple faults which include outputs s/0 or s/1 are GTBD

2) For an AND or NAND output gates s/0 at inputs of this gate are GTBD

Similar for OR or NOR and s/1 at inputs of output gates

T. For a fraction α of multiple faults which will be detectable by SFT we have

$$\alpha \geq 1 - \frac{2^M 3^{L-M-q-1}}{3^L - 1}$$ and

for $L > 5$

$$\alpha \geq 1 - \left(\frac{2}{3}\right)^M 3^{-q}$$

SFT - SINGLE FAULTS TEST

If $q \geq 3$, then $\alpha \geq 99.67\%$.

$q \geq 8 \Rightarrow \alpha \geq 99.99998\%$.

For faults with a given multiplicity ℓ fraction of faults which are detected by SFT is lowerbounded

$$\alpha(\ell) \geq 1 - \binom{L}{\ell}^{-1} 2^{-\ell} \sum_{x=0}^{\ell} \binom{L-M-q}{x} 2^x \binom{M}{\ell-x}$$

Example $L = 10^4$, $M = 20$, $q = 5$

$\ell = 1000$ $\quad \alpha(1{,}000) \geq 78.5\%$

$\alpha(2{,}000) \geq 96\%$

$\alpha(3{,}000) \geq 99.3\%$.