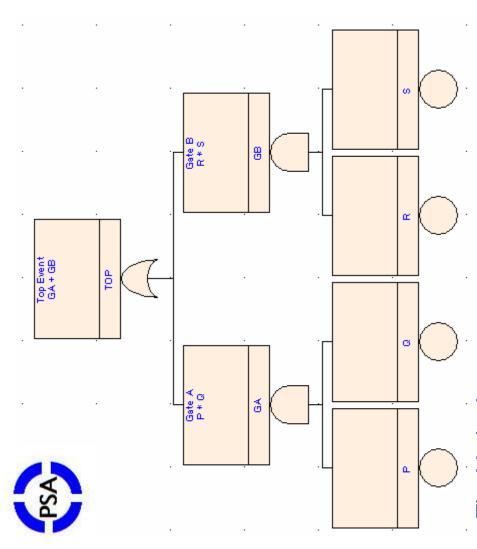


The Destructive Truth Table Method with Truncation



			Pmin
	ь	TRUE	P(p) * P(q)
	notq	FALSE	P(p) *(1- P(q))
notp	ь	FALSE	(1-P(p)) * P(q)
notp	notq	FALSE	(1-P(p)) *(1- P(q))
GA		IRUE	P(p) * P(q)
		FALSE	P(p) *(1- P(q)) + (1-P(p)) * P(q) + (1-P(p)) *(1- P(q))
	s	TRUE	P(r) * P(s)
	nots	FALSE	P(r) *(1- P(s))
notr	S	FALSE	(1-P(r)) * P(s)
notr	nots	FALSE	(1-P(r)) *(1- P(s))
GB		TRUE	P(r) * P(s)
		FALSE	P(r) *(1-P(s)) + (1-P(r)) * P(s) + (1-P(r)) *(1-P(s))
GA	GB	TRUE	P(p) * P(q) + P(r) * P(s)
GA	notGB	TRUE	P(p) * P(q) + (1-(P(r) * P(s)))
not GA	GB	TRUE	(1-(P(p) *P(q))) +P(r) *P(s)
not GA	not GB	FALSE	(1-(P(p) * P(q))) + (1-(P(r) * P(s)))
TOP		TRUE	(P(p) * P(q) + P(r) * P(s)) + (P(p) * P(q) + (1-(P(r) * P(s)))) + (1-(P(p) * P(q))) + P(r) * P(s)
		FALSE	(1-(P(p) * P(q))) + (1-(P(r) * P(s)))

The Method

- Start at the bottom of the tree with an empty truth table;
- 2. At each gate, add its inputs to the truth table;
- If a line in the truth table is lower than the truncation limit, add it to Delta and eliminate from the table;
- . Solve the probability for the gate;
- Collapse the truth table by substituting the gate name for its inputs;
- 6. Continue up the tree.

The Claim Ptop <= Pexact <= Ptop+Delta

Example #1 sent to us ...

100 17 17 17 17 17 17 17					
Pr d	x+x=	ď		0.01	
A	=a/(p+q)	ď	٩	0.01	
d	p=	ď	Б	0.01	
d					
d	h(d)	р	0.01	TRUE	
Y		p/	0.99	FALSE	
A			-		
A	o apse for y	^	10.0		
A		ý	0.99	\perp	
Y	(lo + (l) and location				
10	observed to the object	>	0.01	┸	
bid 0.0001 TRUE bid 0.0001 TRUE bid 0.0009 TRUE bid		Ņ	000	┸	
bid 0.0099 TRUE bid 0.00990 TRUE bid bid		2	0.000	┸	
Dec		3 4	00000	-	
brd 0.9991 FALSE PASE		D Pol	0.0000	-	
10		DQ.	0.0088	- 1	
10		D/O/	0.800	TALSE	
10	(hard) and accelled	>	0.01		
(b + d)	compact for (or o)	,	000		
10 Z Z 0.0901 FALSE 10 Z Z 0.0901 FALSE 2 0.0901 FALSE 3 0.00901 FALSE 4 0.00901 FALSE 4 0.00901 FALSE 5 0.0090199 FALSE 5 0.0090199 FALSE 5 0.0090199 FALSE 5 0.00990199 FALSE 6 0.00990199 FALSE 7		6+6	0.000		
10 Z 2		(F. 4)	0.000		
10 Z Z 0.0199 TRUE Z Y 0.0199 TRUE Z Y 0.0199 TRUE Z 0.0901 FALSE Z 0.00901 FALSE X 0.00901 TRUE X 0.00901 TRUE X 0.00901 FALSE X 0.009019 FALSE X 0.00		(D+0)	0.800	LALSE	
TRUE	7 of (hard) amena	_	00100		
2	Total (page) parameter	10	0.0100	1	
2		į		1000	
W	xoand for a /Z	>	0.01		
Z		Ņ	0.99		
Z		2	0.0199		
A		2/	0.9801		
A		es	0.01		
AZ		e/	0.99		
AZ		32	0.000199		
NaZ		a/Z	0.009801		
Na/Z		/aZ	0.019701		
Y		Ja/Z	0.970299	ΙI	
Y					
Y	ollapse for x	٨	0.01		
X		λ	0.99		
X		×	0.009801	TRUE	
Y		X/	0.990199	FALSE	
Y				_	
y	xpand for x+y	>	0.01		
X		ķ	0.99		
X		×	0.009801		
Xy 0.00008801 TRUE Xry 0.00070289 TRUE Xry 0.008029701 FALSE Xry 0.008028701 FALSE TRUE		×/	0.990199		
xiy 0.00970299 TRUE Xy 0.00970299 TRUE Xiy 0.00980199 TRUE Xiy 0.08029701 FALSE TRUE TRUE		xy	0.000009801		
/xy 0.00990199 TRUE / T T 0.019702901 FALSE / T T T 0.01970299 TRUE / T 0.01970290 TRUE / T 0.019702901 FALSE		ΑįX	0.00970299		
1 0.0197029701 FALSE TRUE TAUSE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRU		/x/	0.00990199		
T 0.01970299 TRUE		V/x/	0.98029701		The true value for T as calculated by
T T 0.01970299 TRUE					A colic ice 4 00042 00
T 0.98029701	ollapse for T	_	0.01970299		Araila IS: 1.9801e-02.
		L	100000000		_

In this example, if 0 <= Delta <= 1e-4, then Pexact lies outside the upper bound: Ptop = (Ptop+Delta) <= Pexact





example #2 sent to us

	Truth Table	Truth Table Method for Solving	- -[= x + y
	•		č	
= x + y	Σó	e -	0.01	
x = 3/(p + d)	-		0.0	
y = /d	ī	В	IO.U	
D _P (d)	7	0.01	┸	
(8)	P	0.99	FALSE	
Collapse for y	y	66:0	TRUE	
	λ	66:0		
expand for (b + d)			- 1	
	۸	88:0	TRUE	
	У	0.89		
	8	0.0001	IRUE	
	þ/q	0.0099	- 1	
	/bd	0.0089		
	p/q/	0.9801		
			- 1	
Collapse for (b+d)	У	0.01	- 1	
	γ	0.80	FALSE	
	(p+q)	0.0188	- 1	
	(p+q)	0.9801	FALSE	
			- 1	
Hename (b+d) to 2	7	0.0199	IKUE	
	7/	0.9801	- 1	
Expand for a /Z	y	0.99		
	W	0.99		
	7	0.0199	IKUE	
	Z	0.9801		
	m .	0.01	- 1	
	e/	0.99	- 1	
	37	0.000189		
	3/2	0.009801	- 1	
	/aZ	0.019701	- 1	
	Ja/Z	0.970299		
		000		
CONSIDER FOR X	, 6,	88:0	10 IV	
	,	0.000		
	Α.	0.00000	_	
	X	ARLOAR:O		
Europed for east		0.00		
EADSHILD TOT ATTY	, v	000		
	×	1080010		
	į,	0.990199		
	XV	0.00970299		
	ΑįX	0.00970299		
	(x)	0.98029701		
	A/x/	0.98029701	FALSE	The true value for T as calculated by
				Aralia ia 0 00000 04
Collapse for T	_	0.99970299	TRUE	Aralla IS: 9.9000e-01
	П	0.00029701	FALSE	

In this example, with any Delta, Pexact lies below Ptop by 9e-2: Pexact < Ptop <= (Ptop+Delta)



So why does this happen?

Consider the two simple cases:

1) F+F where p(F)=0.1: With the method you get (even without a Delta) p(F+F) = p(F)+p(F)-p(F).p(F) = 0.19 which is an overestimation

2) F.F where p(F)=0.1: with the method you get p(F.F)=p(F).p(F)=0.01which is an underestimation.

hide it by taking two formulae F and F' that are structurally close, but not the You could argue that one can detect this repeated F case. But it is easy to same, and very far apart in the tree.

This developer has not followed the "Gate Collapse Rule" to be sure that all such cases are eliminated.



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Gate Collapse Rule

A gate g can be collapsed iff:

- I. All other gates which share at least one of its inputs are in the truth table;
- 2. Gate g has all inputs resolved in expanded form;
- 3. All gates which share inputs fulfill the above two conditions.

||a|



algorithm, but, rather, to show that an attempt We don't present this example to criticize the must be made to PROVE the algorithm's correctness and limits.

We have had techniques for over 40 years to demonstrate algorithm and program correctness.

- Floyd (1967, Assigning Meanings to Programs)
- Hoare (1969, An Axiomatic Basis for Computer **Programs**)
- Scott & Strachey (1972, Denotational Semantics)



Algorithm development is a branch of mathematics.

concerning ourselves with speed. Remember, We must concern ourselves with **accuracy** of calculations and the proof of such before good cooking takes the time it takes.