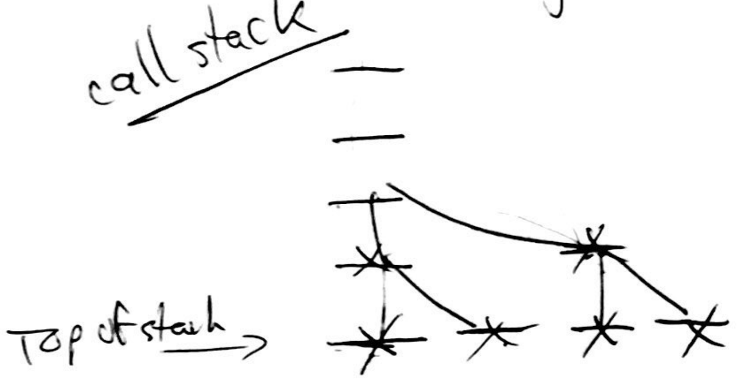
Diagram of call tree



Premise

Possible Conclusions

$\Sigma = \{A \vee B\} \overset{?}{\models} \quad \varphi = C$ NO

A NO

$B \vee A$ Yes

Premise

B

$A \vee B$ Yes

When is a proposed conclusion φ entailed ($\models$) from a set of premises Σ?

We will define exactly when $\Sigma \models \varphi$ next.

Definition $\Sigma \models \varphi$ iff

every model making all the formular of Σ true

also makes φ true.

Example $\{A, B \to C, (A \wedge B) \to (D \vee \neg C), B\} \models$?

D
C
$C \vee D$
etc.

A	B	C	D
0	0	0	0
			1
		1	0
			1
	1	0	0
			1
		1	0
			1

don't make A true

A	B	C	D
1	0	0	0
			1
		1	0
			1
	1	0	0
			1
		1	0
			1

Don't make B true

Don't make $B \to C$ true

Don't make $A \wedge B \to D \vee \neg C$ true

$\Sigma \models \varphi$

<u>Entailment</u>: φ is entailed from Σ iff

every model you believe acceptable when you believe Σ

makes φ true.

A	B	C
~~0~~	~~0~~	~~0~~
		~~1~~
	1	0
		1
1	0	0
		1
	1	0
		1

counter example to $\{A \vee B\} \models A$

$\{A \vee B\} \not\models C$

nor A

$\{A \vee B\} \models B \vee A$

yes

all make $B \vee A$ true so

Entailment fails, consider for instance $A \mapsto 1$ $B \mapsto 1$ $C \mapsto 0$

(Entailment is shown false by giving a counterexample model)

refutes <u>models of premises</u> $\subseteq$ <u>models of conclusion</u>

iff $\Sigma \models \varphi$

Tarski

$\{B\} \models A \vee B$

A	B
~~0~~	~~0~~
	1
~~1~~	~~0~~
	1

$A \vee B$ is true here

so

yes

A tautology is a formula true in every model, (so it is entailed from an empty premise set) $\models \varphi$

example $A \vee \neg A$

A contradiction is a formula true in no model.

$\Rightarrow$ A premise set Σ containing a contradiction will entail every formula φ.

Q. Is there a scalable algorithm taking inputs Σ and φ and accurately deciding $\Sigma \models \varphi$?

A. This question is still open.

(it is equivalent to $P = NP$)