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Proof Method & Propositional Resolution (Latihan 2)

1) Premis: (malas ∧ bolos) → ~lulus Kesimpulan: ~malas
~lulus → masuk
bolos ∧ ~masuk

Buktikan {(malas ∧ bolos) → ~lulus, ~lulus → masuk, bolos ∧ ~masuk} ⊨ ~malas

dengan: gunakan inferensi

1	(malas ∧ bolos) → ~lulus	(premis)
2	~lulus → masuk	(premis)
3	bolos ∧ ~masuk	(premis)
4	bolos	(simplification 3)
5	~masuk	(simplification 3)
6	lulus → ~(malas ∧ bolos)	(transpotition 1)
7	~masuk → lulus	(transpotition 2)
8	lulus	(modus ponens 5 & 7)
9	~(malas ∧ bolos)	(modus ponens 6 & 8)
10	~malas ∨ ~bolos	(de Morgan's Law 9)
11	~malas ☒	(disjunctive syllogism 10 & 4)

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2) Buktikan $\{p \to q, q \to r\} \models (q \to r) \to ((p \to \sim r) \to \sim p)$

a) $((p \to q) \wedge (q \to r)) \to ((q \to r) \to ((p \to \sim r) \to \sim p))$

p	q	r	$(p \to q)$	$\wedge$	$(q \to r)$	$\to$	$(q \to r)$	$\to$	$((p \to \sim r$	$\to$	$\sim p)$
T	T	T	T	T	T	T	T	T	F	T	F
T	T	F	T	F	F	T	F	T	T	F	F
T	F	T	F	F	T	T	T	T	F	T	F
T	F	F	F	F	T	T	T	F	T	F	F
F	T	T	T	T	T	T	T	T	T	T	T
F	T	F	T	F	F	T	F	T	T	T	T
F	F	T	T	T	T	T	T	T	T	T	T
F	F	F	T	T	T	T	T	T	T	T	T

Karena valid, maka $\{p \to q, q \to r\} \models (q \to r) \to ((p \to \sim r) \to \sim p)$ ☑

b) $(p \to q) \wedge (q \to r) \wedge \sim((q \to r) \to ((p \to \sim r) \to \sim p))$

p	q	r	$(p \to q)$	$\wedge$	$(q \to r)$	$\wedge$	$\sim$	$((q \to r)$	$\to$	$((p \to \sim r)$	$\to$	$\sim p))$
T	T	T	T	T	T	F	F	T	T	F	T	F
T	T	F	T	F	F	F	F	F	T	T	F	F
T	F	T	F	F	T	F	F	T	T	F	T	F
T	F	F	F	F	T	F	T	T	F	T	F	F
F	T	T	T	T	T	F	F	T	T	T	T	T
F	T	F	T	F	F	F	F	F	T	T	T	T
F	F	T	T	T	T	F	F	T	T	T	T	T
F	F	F	T	T	T	F	F	T	T	T	T	T

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Karena unsatisfable, maka $\{p \to q, q \to r\} \models (q \to r) \to ((p \to \neg r) \to \neg p)$ ☑

c) premis $p \to q$, $q \to r$; konklusi $(q \to r) \to ((p \to \neg r) \to \neg p)$

(i) $p \to q$ premis

(ii) $q \to r$ premis

(iii) $(q \to r) \to (p \to (q \to r))$ II (ii)

(iv) $p \to (q \to r)$ modus ponen (ii)(iii)

(v) $(p \to (q \to r)) \to ((p \to q) \to (p \to r))$ ID (iv)

(vi) $(p \to q) \to (p \to r)$ modus ponen (iv),(v)

(vii) $p \to r$ modus ponen (i),(vi)

(viii) $(p \to r) \to ((p \to \neg r) \to \neg p)$ CR(vii)

(ix) $(p \to \neg r) \to \neg p$ modus ponen (vii)(viii)

(x) $(q \to r) \to ((p \to \neg r) \to \neg p)$ II (ix)

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5) Buktikan set klausa berikut bersifat unsatisfiable!

a) $\{p, q\}, \{\neg p, r\}, \{\neg p, \neg r\}, \{p, \neg q\}$

(i) $\{p, q\}$ premis (v) $\{p\}$ (i),(iv)

(ii) $\{\neg p, r\}$ premis (vi) $\{\neg p\}$ (ii),(iii)

(iii) $\{\neg p, \neg r\}$ premis (vii) $\{\ \}$ (v),(vi) ☑

(iv) $\{p, \neg q\}$ premis

b) $\{p, q, \neg r, s\}, \{\neg p, r, s\}, \{\neg q, \neg r\}, \{p, \neg s\}, \{\neg p, \neg r\}, \{r\}$

(i) $\{p, q, \neg r, s\}$ premis (vii) $\{q, s\}$ (i),(ii)

(ii) $\{\neg p, r, s\}$ premis (viii) $\{\neg q\}$ (iii),(vi)

(iii) $\{\neg q, \neg r\}$ premis (ix) $\{\neg r, \neg s\}$ (iv),(v)

(iv) $\{p, \neg s\}$ premis (x) $\{\neg s\}$ (vi),(ix)

(v) $\{\neg p, \neg r\}$ premis (xi) $\{s\}$ (vii),(viii)

(vi) $\{r\}$ premis (xii) $\{\ \}$ (x),(xi) ☑

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6) Premis $p \to q$, $\sim p \to \sim t$, $\sim s \to \sim r$, $q \to r$; kesimpulan : $t \to s$

Buktikan dengan propusisional resolusi!

$\Delta \cup \{\sim P\}$ unsatisfiable

$\Delta = \{p \to q, \sim p \to \sim t, \sim s \to \sim r, q \to r\}$ $\quad \{\sim P\} = \{\sim(t \to s)\}$

I $\{\sim p \vee q, p \vee \sim t, s \vee \sim r, \sim q \vee r\}$ $\quad$ I $\{\sim(\sim t \vee s)\}$

O $\{\{\sim p, q\}, \{p, \sim t\}, \{s, \sim r\}, \{\sim q, r\}\}$ $\quad$ N $\{t \wedge \sim s\}$

O $\{\{t\}, \{\sim s\}\}$

$\Delta \cup \{\sim P\} = \{\{\sim p, q\}, \{p, \sim t\}, \{s, \sim r\}, \{\sim q, r\}, \{t\}, \{\sim s\}\}$

(i) $\{\sim p, q\}$ premis (v) $\{t\}$ premis (ix) $\{q\}$ (i), (viii)

(ii) $\{p, \sim t\}$ premis (vi) $\{\sim s\}$ premis (x) $\{\sim q\}$ (iv), (viii)

(iii) $\{s, \sim r\}$ premis (vii) $\{p\}$ (ii), (v) (xi) $\{\}$ (ix), (x)

(iv) $\{\sim q, r\}$ premis (viii) $\{\sim r\}$ (iii), (vi)

Karena $\Delta \cup \{\sim P\}$ unsatisfiable maka $\{p \to q, \sim p \to \sim t, \sim s \to \sim r, q \to r\} \models t \to s$

9) a : Ang tidak bersalah ; b : Beg tidak bersalah ; c : Cing tidak bersalah

a) $\sim b \wedge c$, $\sim a \to \sim c$, $c \wedge (\sim a \vee \sim b)$

b) Premis : a, b, c ; Cari kalimat yang benar dan tidak benar pada poin a.

a	b	c	$\sim b \wedge c$	$\sim a \to \sim c$	$c \wedge (\sim a \vee \sim b)$
T	T	T	F	T	T F F

Kalimat benar. $\sim a \to \sim c$: Beg jujur

Kalimat tidak benar : $\sim b \wedge c$, $c \wedge (\sim a \vee \sim b)$: Ang dan Cing berbohong

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c) Premis : $a \leftrightarrow (\neg b \wedge c)$, $b \leftrightarrow (\neg a \rightarrow \neg c)$, $c \leftrightarrow (c \wedge (\neg a \vee \neg b))$

a	b	c	a	↔	(¬b	∧	c)	b	↔	(¬a	→	¬c)	c	↔	(c	∧	(¬a	∨	¬b))
T	T	T	T	T	F	F	T	T	T	F	T	F	T	T	T	T	F	T	F
T	T	F	T	F	F	F	F	T	T	F	T	T	F	T	F	F	F	F	F
T	F	T	T	T	T	T	T	F	F	F	T	F	T	T	T	T	F	T	T
T	F	F	T	F	T	F	F	F	F	F	T	T	F	T	F	F	F	T	T
F	T	T	F	T	F	F	T	T	F	T	F	F	T	T	T	T	T	T	F
F	T	F	F	T	F	F	F	T	T	T	T	T	F	T	F	F	T	T	F
F	F	T	F	F	T	T	T	F	T	T	F	F	T	T	T	T	T	T	T
F	F	F	F	T	T	F	F	F	F	T	T	T	F	T	F	F	T	T	T

Ketika seluruh premis benar, a bernilai salah, b bernilai benar, dan c bernilai salah.

Selainnya yang tidak bersalah adalah Bang