LOGKOM

PROOF METHOD & PROPOTIONAL RESOLUTION

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① Premises :

1) malas ∧ bolos → ~ lulus
2) ~ lulus → marah
3) bolos ∧ ~ marah

Conclusion : ~ malas

Proof :

4) Hypothetical syllogism 1, 2

malas ∧ bolos → ~ lulus
~ lulus → marah
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malas ∧ bolos → marah

5) Simplification 3

bolos ∧ ~ marah

~ marah

6) Modus Tollens 4, 5

malas ∧ bolos → marah
~ marah

~ (malas ∧ bolos)

7) De Morgan's Law 6

~ (malas ∧ bolos) ↔ ~ malas ∨ ~ bolos

8) Simplification 3

bolos ∧ ~ marah
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bolos

9) Disjunctive syllogism 7, 8

~ malas ∨ ~ bolos
bolos

~ malas

∴ proven that the conclusion is correct, ~ malas.

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

a) Validity checking

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

Final

p	q	r	p→q	∧	q→r	→	q→r	→	p→~r	→	~p
T	T	T	T	T	T	T	T	T	F	T	F
F	F	F	T	T	T	T	T	T	T	T	T
T	T	F	T	F	F	T	F	T	T	F	F
F	T	F	T	F	F	T	F	T	T	T	T
T	F	T	F	F	T	T	T	T	F	T	F
F	F	T	T	T	T	T	T	T	T	T	T
T	T	T	T	T	T	T	T	T	F	T	F
F	T	T	T	T	T	T	T	T	T	T	T

↳ valid

Karena hasil $((p \to q) \wedge (q \to r)) \to ((q \to r) \to ((p \to \sim r) \to \sim p))$ bernilai true semua dgn menggunakan validation checking, maka disimpulkan statement tsb valid.

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

b) Unsatisfiability Checking

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

Final

p	q	r	p→q	∧	q→r	∧	q→r	~	→	p→~r	→	~p
T	T	T	T	T	T	F	T	F	T	T	F	F
F	F	F	T	T	T	F	T	F	T	T	T	T
T	T	F	T	F	F	F	F	F	T	T	F	F
F	T	F	T	F	F	F	F	F	T	T	T	T
T	F	T	F	F	T	F	T	F	T	F	T	F
F	F	T	T	T	T	F	T	F	T	T	T	T
T	T	T	T	T	T	F	T	F	T	F	T	F
F	T	T	T	T	T	F	T	F	T	T	T	T

↳ unsatisfiable

Karena hasil $((p \to q) \wedge (q \to r)) \wedge \sim((q \to r) \to ((p \to \sim r) \to \sim p))$ bernilai false semua dgn menggunakan unsatisfiability checking, maka disimpulkan statement tsb unsatisfiable.

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

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② c) Axiom schemata, Rule of Inference (without Deduction Theorems)

$\{p \to q, q \to r\} \vdash (q \to r) \to ((p \to \sim r) \to \sim p)$

Premises : 1) $p \to q$
2) $q \to r$

Conclusion : $(q \to r) \to ((p \to \sim r) \to \sim p)$

Proof :

1)	$p \to q$	Premise
2)	$q \to r$	Premise
3)	$(q \to r) \to (p \to (q \to r))$	Implication introduction 2
4)	$p \to (q \to r)$	Modus Ponen 2, 3
5)	$(p \to (q \to r)) \to ((p \to q) \to (p \to r))$	Implication distribution 4
6)	$(p \to q) \to (p \to r)$	Modus Ponen 4, 5
7)	$p \to r$	Modus Ponen 1, 6
8)	$(p \to r) \to ((p \to \sim r) \to \sim p)$	Contradiction Realization 7
9)	$(p \to \sim r) \to \sim p$	Modus Ponen 7, 8
10)	$((p \to \sim r) \to \sim p) \to ((q \to r) \to ((p \to \sim r) \to \sim p))$	Implication introduction 9
11)	$(q \to r) \to ((p \to \sim r) \to \sim p)$	Modus Ponen 9, 10

$\therefore \{p \to q, q \to r\} \vdash (q \to r) \to ((p \to \sim r) \to \sim p)$

⑤ Use proporitional resolution to show that the following sets of clauses are unsatisfiable.

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

1)	$\{p, q\}$	premise
2)	$\{\sim p, r\}$	premise
3)	$\{\sim p, \sim r\}$	premise
4)	$\{p, \sim q\}$	premise
5)	$\{p\}$	1, 4
6)	$\{\sim p\}$	2, 3
7)	$\{\}$	5, 6

Karena terbentuk himpunan kosong, maka terbukti clauses tsb unsatisfiable.

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⑤ b) {p, q, ~r, s}, {~p, r, s}, {~q, ~r}, {p, ~s}, {~p, ~r}, {r}

1) {p, q, ~r, s}	premise
2) {~p, r, s}	premise
3) {~q, ~r}	premise
4) {p, ~s}	premise
5) {~p, ~r}	premise
6) {r}	premise
7) {~q}	3, 6
8) {p, ~r, s}	1, 7
9) {p, ~r}	4, 8
10) {~r}	5, 9
11) { }	6, 10

Karena terbentuk himpunan kosong, terbukti clauses trb unsatisfiable.

⑥ Premises
1) $p \rightarrow q$
2) $\sim p \rightarrow \sim t$
3) $\sim s \rightarrow \sim r$
4) $q \rightarrow r$

conclusion : $t \rightarrow s$

Negated conclusion : $\sim (t \rightarrow s)$

Proof (Implications)

6) $\sim p \vee q$	premise
7) $p \vee \sim t$	premise
8) $s \vee \sim r$	premise
9) $\sim q \vee r$	premise
10) $\sim (\sim t \vee s)$	negated conclusion

Proof (Negations)

11) $\sim p \vee q$	premise
12) $p \vee \sim t$	premise
13) $s \vee \sim r$	premise
14) $\sim q \vee r$	premise
15) $t \wedge \sim s$	negated conclusion

Proof (Distribution)

16) $\sim p \vee q$	premise
17) $p \vee \sim t$	—"—
18) $s \vee \sim r$	—"—
19) $\sim q \vee r$	—"—
20) $t \wedge \sim s$	negated conclusion

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⑥ Proof (Operators)

21)	{~p, q}	premise
22)	{p, ~t}	—"—
23)	{s, ~r}	—"—
24)	{~q, r}	—"—
25)	{t}, {~s}	negated conclusion

Proporsional Resolution

1)	{~p, q}	premise
2)	{p, ~t}	premise
3)	{s, ~r}	premise
4)	{~q, r}	premise
5)	{t}	negated conclusion
6)	{~s}	negated conclusion
7)	{p}	2 5
8)	{q}	1, 7
9)	{r}	4, 8
10)	{s}	3, 9
11)	{ }	6, 10

∴ Krn diperoleh himpunan kosong, terbukti bahwa konklusi dr premis2 tsb benar.

⑨ a) Premises :

1) $\sim b \wedge c$: Ang
2) $\sim a \rightarrow \sim c$: Beng
3) $c \wedge (\sim a \vee \sim b)$: Cing

b) Ang, Beng, Cing tdk berralah → a, b, c True

Tabel Kebenaran

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

Perkataan Ang & Cing faire, maka Ang & Cing berbohong.
—"— Beng True, maka Beng jujur.

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⑨ c) tdk berralah → jujur
berralah → bohong

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

final

True hanya 1

Nilai true dihasilkan dari a = F, b = T, c = F ;
maka disimpulkan bahwa Ang & Ceng berbohong, Beng jujur.

Perkataan Beng adlh jika Ang berralah, maka Cing juga. Krn Beng jujur, maka Beng tdk berralah. Dan krn perkataan Beng benar, maka disimpulkan bahwa Ang & Cing berralah.