PERTEMUAN 2
Prak. Logmat D

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Tautologi dan Kotradiksi
EKUIVALENSI SUATU FORMULA

Tautologi & Kontradiksi

- Tautologi adalah pernyataan yang nilainya selalu benar.

- Kontradiksi adalah pernyataan yang nilainya selalu salah.

Tautologi atau Kontradiksi

- $(P \wedge Q) \rightarrow P$
- $(P \wedge Q) \wedge \sim P$
- $P \rightarrow (P \vee Q)$
- $\sim(P \vee Q) \sim P$
- $\sim(P \rightarrow Q) \rightarrow P$
- $\sim(P \wedge Q) \leftrightarrow (\sim P) \vee (\sim Q)$

Ekuivalensi dari Suatu Formula (1)

- Jika seluruh nilai kebenaran dari A sama dengan nilai kebenaran B, maka A dan B adalah ekuivalen.

Ekuivalensi dari Suatu Formula (2)

- Contoh:

  $\neg (\neg P) \equiv P$

  $P \vee P \equiv P$

  $(P \wedge \neg P) \vee Q \equiv Q$

  $P \vee \neg P \equiv Q \vee \neg Q$

Idempotent Law	1a	$P \vee P \equiv P$
	1b	$P \wedge P \equiv P$
Associative Law	2a	$(P \vee Q) \vee R \equiv P \vee (Q \vee R)$
	2b	$(P \wedge Q) \wedge R \equiv P \wedge (Q \wedge R)$
Commutative Law	3a	$P \vee Q \equiv Q \vee P$
	3b	$P \wedge Q \equiv Q \wedge P$
Distributive Law	4a	$P \vee (Q \wedge R) \equiv (P \vee Q) \wedge (P \vee R)$
	4b	$P \wedge (Q \vee R) \equiv (P \wedge Q) \vee (P \wedge R)$
Identity Law	5a	$P \vee F \equiv P$
	5b	$P \wedge T \equiv P$
Relation Law	6a	$P \vee T \equiv T$
	6b	$P \wedge F \equiv F$
Complement Law	7a	$P \vee \sim P \equiv T$
	7b	$P \wedge \sim P \equiv F$
Absorbtion Law	8a	$P \vee (P \wedge Q) \equiv P$
	8b	$P \wedge (P \vee Q) \equiv P$
De Morgan's Law	9a	$\sim(P \vee Q) \equiv \sim P \cap \sim Q$
	9b	$\sim(P \cap Q) \equiv \sim P \vee \sim Q$
Double Complement Law	10	$\sim (\sim P) \equiv P$
Complement T & F	11a	$\sim T \equiv F$
	12b	$\sim F \equiv T$

Rumus Ekuivalensi Tambahan

- $P \rightarrow Q \equiv \sim P \vee Q \equiv \sim Q \rightarrow \sim P$
- $\sim(P \rightarrow Q) \equiv P \wedge \sim Q$
- $P \rightarrow (Q \rightarrow R) \equiv (P \wedge Q) \rightarrow R$
- $\sim(P \leftrightarrow Q) \equiv P \leftrightarrow \sim Q$
- $P \leftrightarrow Q \equiv (P \rightarrow Q) \wedge (Q \rightarrow P)$
- $(P \leftrightarrow Q) \equiv (P \wedge Q) \vee (\sim P \wedge \sim Q)$
- $Q \rightarrow P \equiv \sim P \rightarrow \sim Q$
- $P \rightarrow \sim Q \equiv Q \rightarrow \sim P$
- $Q \leftrightarrow \sim P \equiv P \rightarrow \sim Q$

Soal

$\neg(p \vee \neg q) \vee (\neg p \wedge \neg q) \equiv \neg p$

Penyelesaian

$\neg(p \vee \neg q) \vee (\neg p \wedge \neg q)$

$\equiv(\neg p \wedge \neg(\neg q)) \vee (\neg p \wedge \neg q)$ →dbl.cmplment

$\equiv(\neg p \wedge q) \vee (\neg p \wedge \neg q)$ →distributiv law

$\equiv \neg p \wedge(q \vee \neg q)$ →cmplement law

$\equiv \neg p \wedge T$ →identity law

$\equiv \neg p$

$[(p \rightarrow q) \wedge p] \rightarrow q \equiv 1$ (tautologi)

$[(p \rightarrow q) \wedge p] \rightarrow q$

$\equiv [(\neg p \vee q) \wedge p] \rightarrow q$ →ingat $p \rightarrow q \equiv \neg p \vee q$

$\equiv \neg[(\neg p \vee q) \wedge p] \vee q$ →ingat $p \rightarrow q \equiv \neg p \vee q$

$\equiv[(p \wedge \neg q) \vee \neg p] \vee q$ →Hk. Negasi ganda dan De Morgan

$\equiv [(p \vee \neg p) \wedge(\neg q \vee \neg p)] \vee q$ →Hk. Distributif

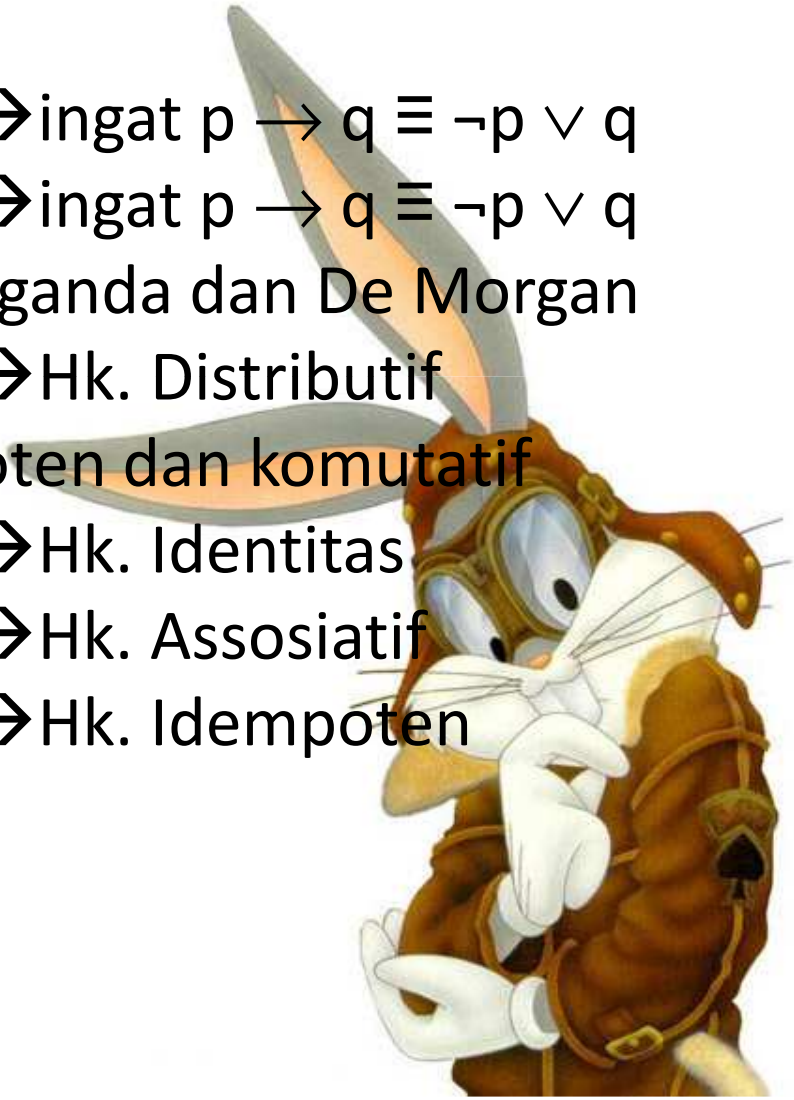
$\equiv [1 \wedge(\neg p \vee \neg q)] \vee q$ →Hk. Idempoten dan komutatif

$\equiv (\neg p \vee \neg q) \vee q$ →Hk. Identitas

$\equiv \neg p \vee(\neg q \vee q)$ →Hk. Assosiatif

$\equiv \neg p \vee 1$ →Hk. Idempoten

$\equiv 1$



$(p \vee q) \wedge [(\neg p) \wedge (\neg q)] \equiv 0$

$(p \vee q) \wedge [(\neg p) \wedge (\neg q)]$

$\equiv (p \vee q) \wedge (\neg p \wedge \neg q)$

$\equiv [(p \vee q) \wedge \neg p] \wedge [(p \vee q) \wedge \neg q]$ →Hk. Distributif

$\equiv [(p \wedge \neg p) \wedge (q \wedge \neg p)] \wedge [(p \wedge \neg q) \vee (q \wedge \neg q)]$ →Hk. Distributif

$\equiv [0 \vee (q \wedge \neg p)] \wedge [(p \wedge \neg q) \vee 0]$ →Hk. Negasi

$\equiv (\neg p \wedge q) \wedge (p \wedge \neg q)$ →Hk. Idempoten

$\equiv (\neg p \wedge p) \wedge (q \wedge \neg q)$ →Hk. Assosiatif

$\equiv 0 \wedge 0$ →Hk. Negasi

$\equiv 0$ →Idempoten

$[(p \vee q) \wedge \neg p)] \rightarrow \neg q \equiv \neg q \vee p$

$\equiv [(p \wedge \neg p) \vee (q \wedge \neg p)] \rightarrow \neg q$ → Hk. Distributif

$\equiv [0 \vee (q \wedge \neg p)] \rightarrow \neg q$ → Hk. Negasi

$\equiv (q \wedge \neg p) \rightarrow \neg q$ → Hk. Identitas

$\equiv \neg(q \wedge \neg p) \vee \neg q$ → ingat $pq \equiv \neg p \vee q$

$\equiv (\neg q \vee p) \vee \neg q$ → Hk. De Morgan

$\equiv (\neg q \vee \neg q) \vee p$ → Hk. Assosiatif

$\equiv \neg q \vee p$ → Hk. Idempoten

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Takes a hand, touches a heart and opens a mind ☺
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