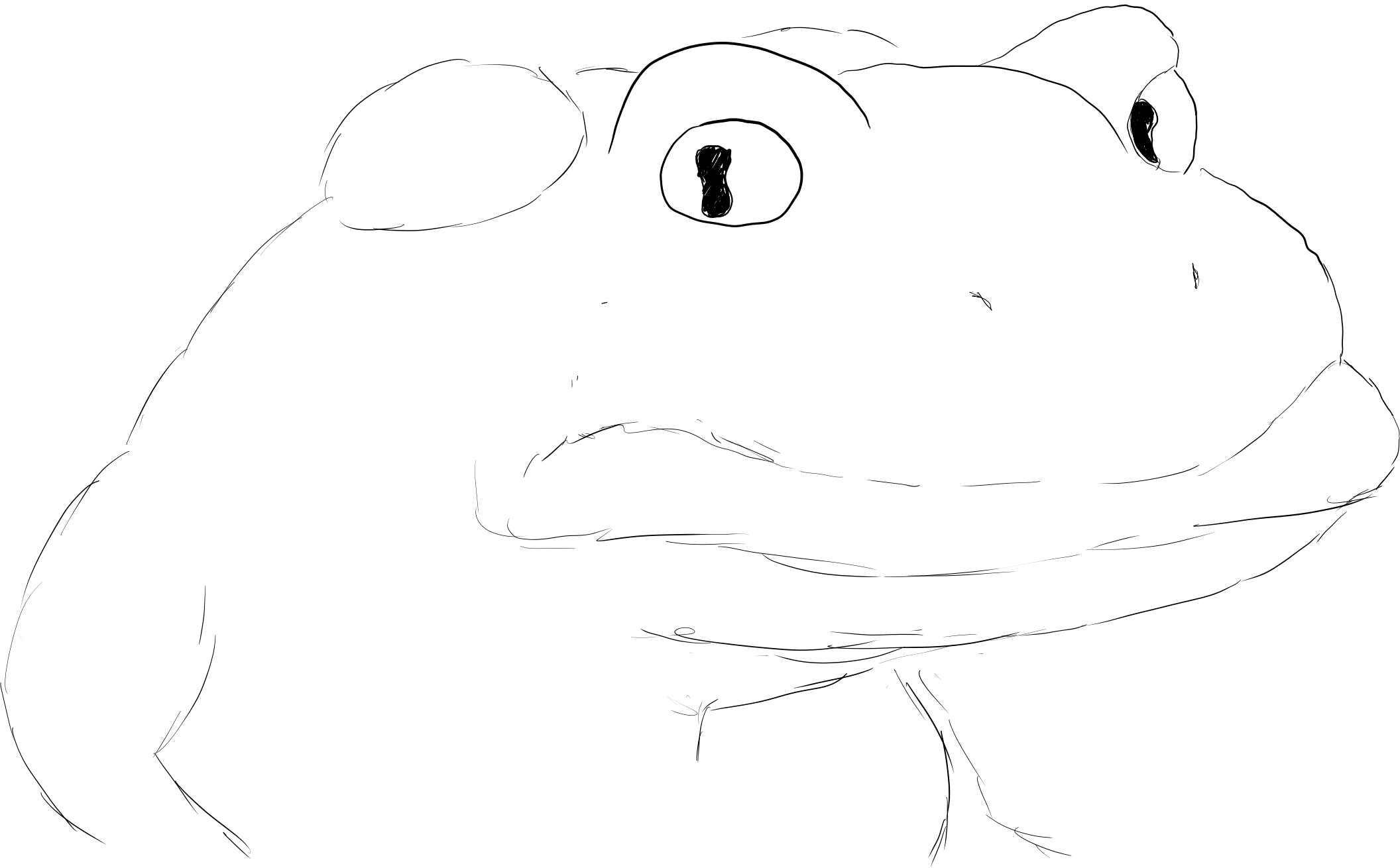

T $x \vee \neg x$

Equivalences

equiv

x	$\neg x$	$\neg\neg x$
0	1	0
1	0	1

tautology
logical Exp that is always true

$x \leftrightarrow \neg\neg x$
1
1

Contradiction
log Exp that is always false

$x \oplus \neg\neg x$
0
0

1. if exp A

$\neg\neg(\neg\neg\neg x \vee \neg\neg y)$

$\neg(\neg x \vee y)$

equivalent

equivalent

$\neg\neg\neg\neg x \equiv x$

one

$\top \wedge x \equiv x$

zero

$\top \vee x \equiv \top$

zero

$\bot \wedge x \equiv \bot$

one

$\bot \vee x \equiv x$

x	y
$\bot$	$\top$

$$(\neg \bot \wedge \top) \wedge (\bot \vee \neg \top)$$

$\top$ over $\neg \bot \wedge \top$; $\neg \top$ over $\bot \vee \neg \top$

Associative

&

parentheses not matter

Commutative

order does not matter

$(3+4)+5$

$3+(4+5)$

$3+4$

$4+3$

$3/(4/5)$

$(3/4)/5$

not yet in this class

$\wedge$ associativ and commutativ

$\vee$ assoc and commutativ

$$(a \wedge b) \wedge c \equiv a \wedge (b \wedge c)$$

$$a \wedge b \equiv b \wedge a$$

$$(a \vee b) \vee c \equiv a \vee (b \vee c)$$

$$a \vee b \equiv b \vee a$$

$$\overline{a \wedge b} \equiv \bar{a} \vee \bar{b}$$

$$\overline{a \vee b} \equiv \bar{a} \wedge \bar{b}$$

De Morgan's Laws

a	b	$a \rightarrow b$	$\equiv$	$(\neg a)$	$\vee$	b
⊥	⊥	⊤		⊤	⊤	
⊥	⊤	⊤		⊤	⊤	
⊤	⊥	⊥		⊥	⊥	
⊤	⊤	⊤		⊥	⊤	

$X \vee \neg Y$

$\neg Y \vee X$

$Y \rightarrow X$

$A \vee B$

$B \vee A$

$\neg\neg B \vee A$

$\neg B \rightarrow A$