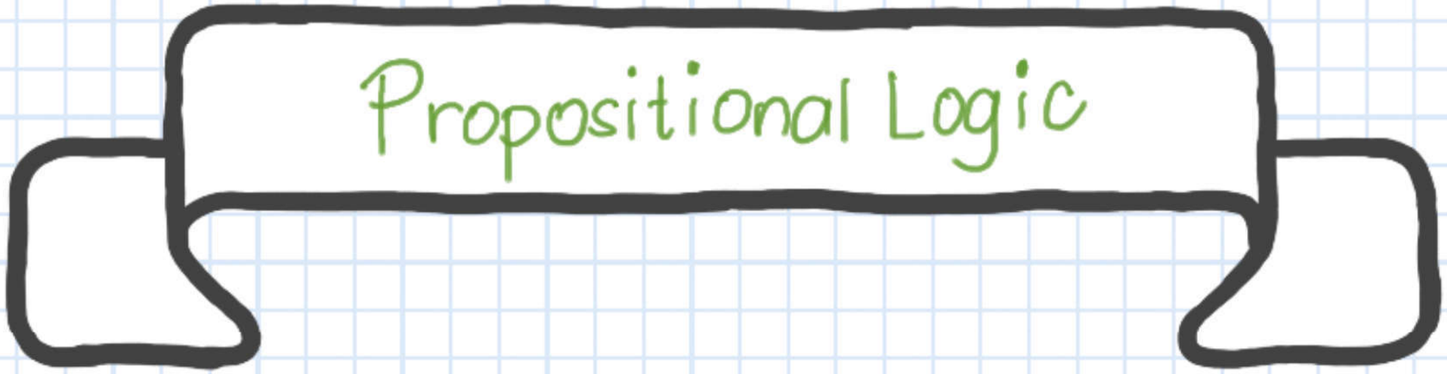
Propositional Logic

Exercise 1. Translate.

1) It is sunny. (s)
Let s be It is sunny.
Translation: s

2) I answered the assignment, but I did not submit it. (a, ∧, ¬, s)
Let a - I answered the assignment.
s - I submitted it.
Translation: a ∧ ¬s

3) I will remember to send you my address only if you send me an email message. (r, →, s)
Let r - I will remember to send you my address.
s - You send me an email message.
Translation: r → s

4) Either I go to school or I go to the mall. (s, ⊕, m)
Let s - I go to school.
m - I go to the mall.
Translation: s ⊕ m

5) I will eat breakfast or I will walk to school, or both. (e, ∨, w)
Let e - I will eat breakfast.
w - I will walk to school.
Translation: e ∨ w

$e \vee w$

e	w	$e \vee w$
T	T	T
T	F	T
F	T	T
F	F	F

$e \vee w \vee (e \wedge w)$

Let $a : e \vee w$
$b : e \wedge w$

e	w	$a: e \vee w$	$b: e \wedge w$	$a \vee b$
T	T	T	T	T
T	F	T	F	T
F	T	T	F	T
F	F	F	F	F

1 –
2 –
3 –

2
4
8 > 2

2 1
2 2
2 3

Exercise 2.

1) # of rows?

1) $p \wedge \neg q$ 2 unique variables $2^2 = 4$
2) $p \vee \neg p$ 1 unique variable $2^1 = 2$
3) $p \vee q \vee (r \wedge p)$ 3 unique variables $2^3 = 8$

2) Truth table

1) $p \; ① \; ⓣ p$ 1 unique var $2^1 = 2$

p	¬p	p ∧ ¬p
T	F	F
F	T	F

2) $p \oplus (p \vee q)$ ② $2^2 = 4$

p	q	p ∨ q	p ⊕ (p ∨ q)
T	T	T	F
T	F	T	F
F	T	T	T
F	F	F	F

3) $(p \vee \neg q) \rightarrow q$ ② $2^2 = 4$

p	q	¬q	p ∨ ¬q	(p ∨ ¬q) → q
T	T	F	T	T
T	F	T	T	F
F	T	F	F	T
F	F	T	T	F

4) $(q \rightarrow \neg p) \leftrightarrow (\neg q \rightarrow \neg p)$ ② $2^2 = 4$

Let a be $q \rightarrow \neg p$, b be $\neg q \rightarrow \neg p$

p	q	¬p	¬q	a: q → ¬p	b: ¬q → ¬p	a ↔ b
T	T	F	F	F	T	F
T	F	F	T	T	F	F
F	T	T	F	T	T	T
F	F	T	T	T	T	T

5) $p \vee q \vee r$ ③ $2^3 = 8$ $\frac{8}{2} = 4$ T, 4 F

Let a be $p \vee q$

p	q	r	p ∨ q	a ∨ r
T	T	T	T	T
T	T	F	T	T
T	F	T	T	T
T	F	F	T	T
F	T	T	T	T
F	T	F	T	T
F	F	T	F	T
F	F	F	F	F