OL Academy

ITCS254

Discrete Structures I

Chapter 1 - Proposional Logic

Proposition: Facts عبارة.

* Manama is the capital city of Bahrain → proposition

* where are you going? → Not proposition

* $y + 3x = 7z$ → not proposition

* Hamad twon is the capital of Bahrain → proposition

in 254 we have 2 ways of Representation

- Symbolic
- English

*negation ⟶ العكس

Symbolic : ¬

English : Not

I live in Bahrain

"it is not the case that I live in Bahrain"

≡ I do not live in Bahrain

p = Today I will go out for dinner

¬p = Today I will Not be going out for dinner

"without using it is not the case that"

Conjunction

English : And

Symbolic : $\wedge$

P = I have two sisters

q = I have one brother

= Ihave two sisters and I have one brother

= I have two sisters and one brother

⇓ English

Symbolic = $P \wedge q$

disjuction "or"

Symbolic : $\vee$ ⇒ "original"

English : OR

P = I will take MATH 102 this semester

q = I will take ITCS 254 this semester

I will take Math 102 or ITCS 254 this semester ⇒ English

Symbolic ⇒ $p \vee q$

Exclusive OR

English: OR

Symbolic: $\oplus$

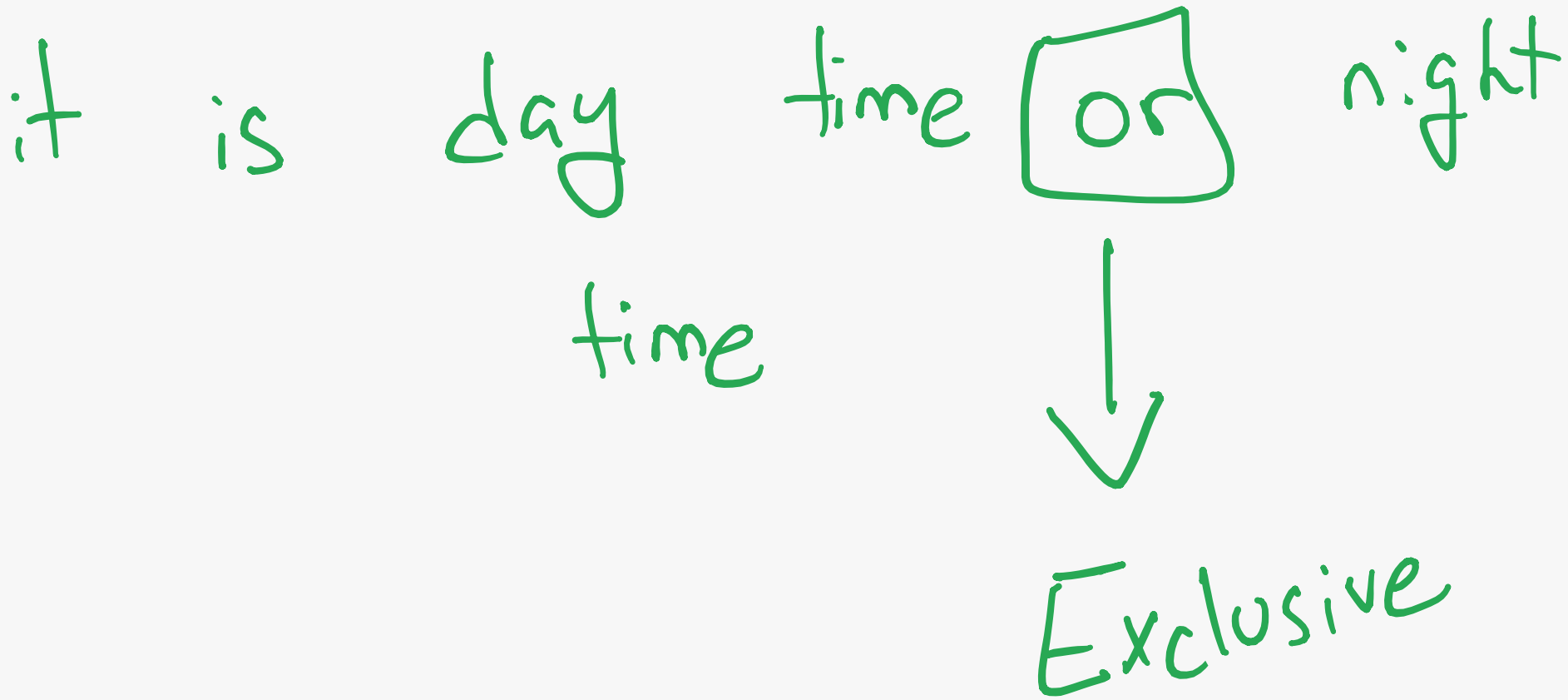
Today is Sunday or Monday

↳ Exlusive

I can go to school or stay at home

I have buy mangos or strawberries

↳ original


it is day time
time
or
night
Exclusive

English	Symbolic
negation "Not"	$\neg$
disjuction "Or"	$\vee$
"And" "Conjuction"	$\wedge$
Exclusive or	$\oplus$

Conditional Statements

$\rightarrow$

"if p, then q"	"p implies q"
"if p, q"	"p only if q"
"p is sufficient for q"	"a sufficient condition for q is p"
"q if p"	"q whenever p"
"q when p"	"q is necessary for p"
"a necessary condition for p is q"	"q follows from p"
"q unless $\neg p$"	

$p \rightarrow q$

P = premises

q = conclusion

q

I will not be happy if I didn't Pass my course

symbolic =

$q \rightarrow p$

q = I will not be happy

p = I didn't pass my courses

if p then q

if I didn't pass my courses

then I will not be happy

bio conditional statements

— "p is necessary and sufficient for q"
— "if p then q, and conversely"
— "p iff q."

$p \longleftrightarrow q$

= Conditional statements $p \rightarrow q$

bio condition statements $p \leftrightarrow q$

Converse of $p \rightarrow q$ $q \rightarrow p$

Inverse of $p \rightarrow q$ $\neg p \rightarrow \neg q$

contrapositive of $p \rightarrow q$ $\neg q \rightarrow \neg p$

if the sky is rainning then it is winter season

$p \rightarrow q$

Contrapositive

$\neg q \rightarrow \neg p$

p = the sky is rainning

q = it is winter season

write the converse in English

$q \rightarrow p$

if it is winter season then the sky is rainning

Truth table

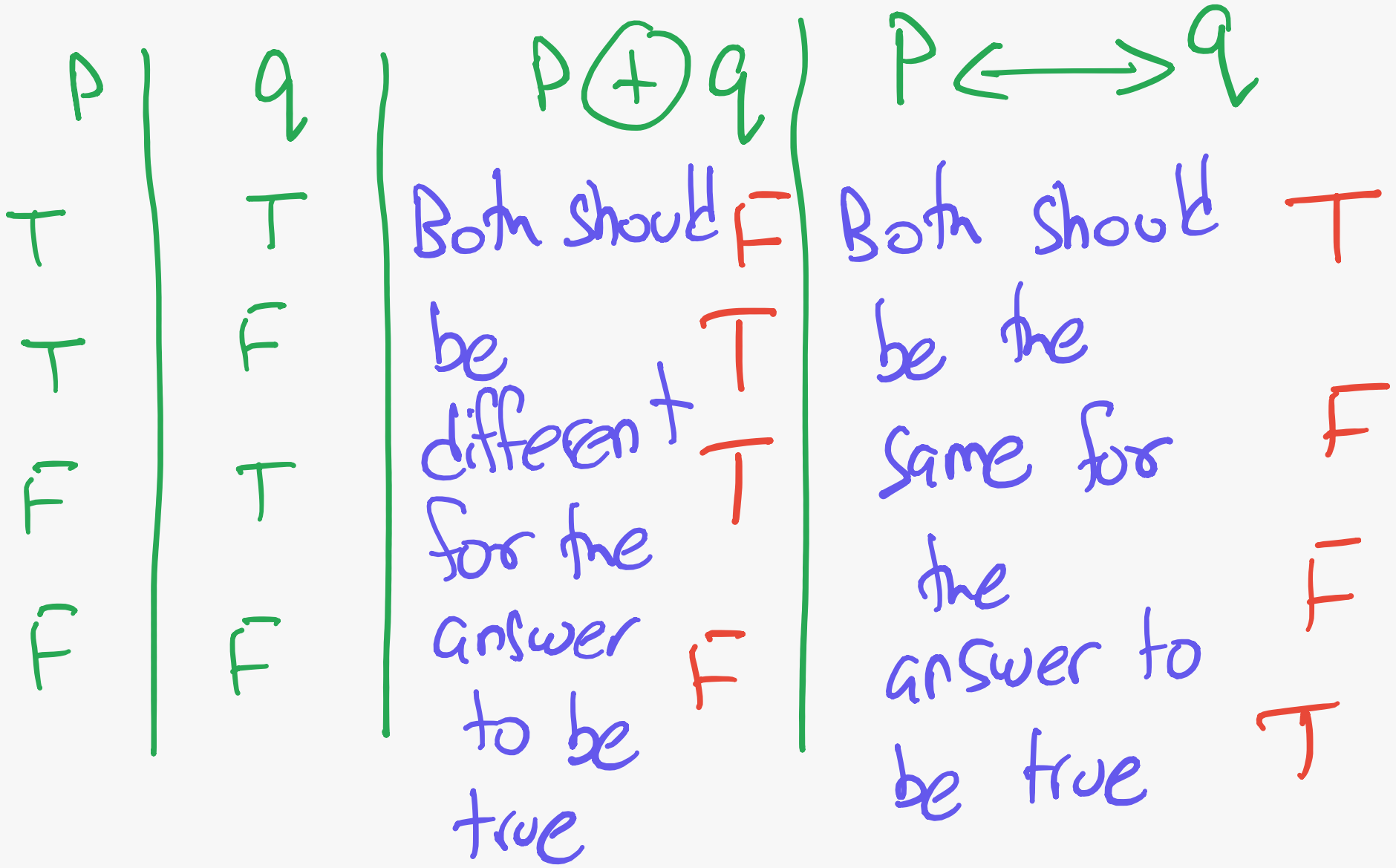
p	q	¬p	¬q	p ∧ q	p ∨ q	p → q
T	T	F	F	T	T	T
T	F	F	T	F	T	F
F	T	T	F	F	T	T
F	F	T	T	F	F	T

p and q should both be true for the answer to be true

if there is "T" in either p or q then it is true

if p is "F" then it is directly "T"

if p is "T" then q should be "T"


P
q
P ⊕ q
P ⟷ q
T
T
Both should be different for the answer to be true
F
Both should be the same for the answer to be true
T
T
F
T
T
F
F
T
F
F
F
F
T

$2^n \Rightarrow$ the number of variables in the question

$p, q \Rightarrow 2^2 = 4$

p q r s t

$2^5 = 32$

p	q	r
T	T	T
T	T	F
T	F	T
T	F	F
F	T	T
F	T	F
F	F	T
F	F	F

$$2^3 = 8$$

$$p = \frac{8}{2} = 4$$

$$q = \frac{4}{2} = 2$$

$$r = \frac{2}{2} = 1$$