https://youtu.be/c4bhxylX_jI

Chapter 8

Logic

Contents:

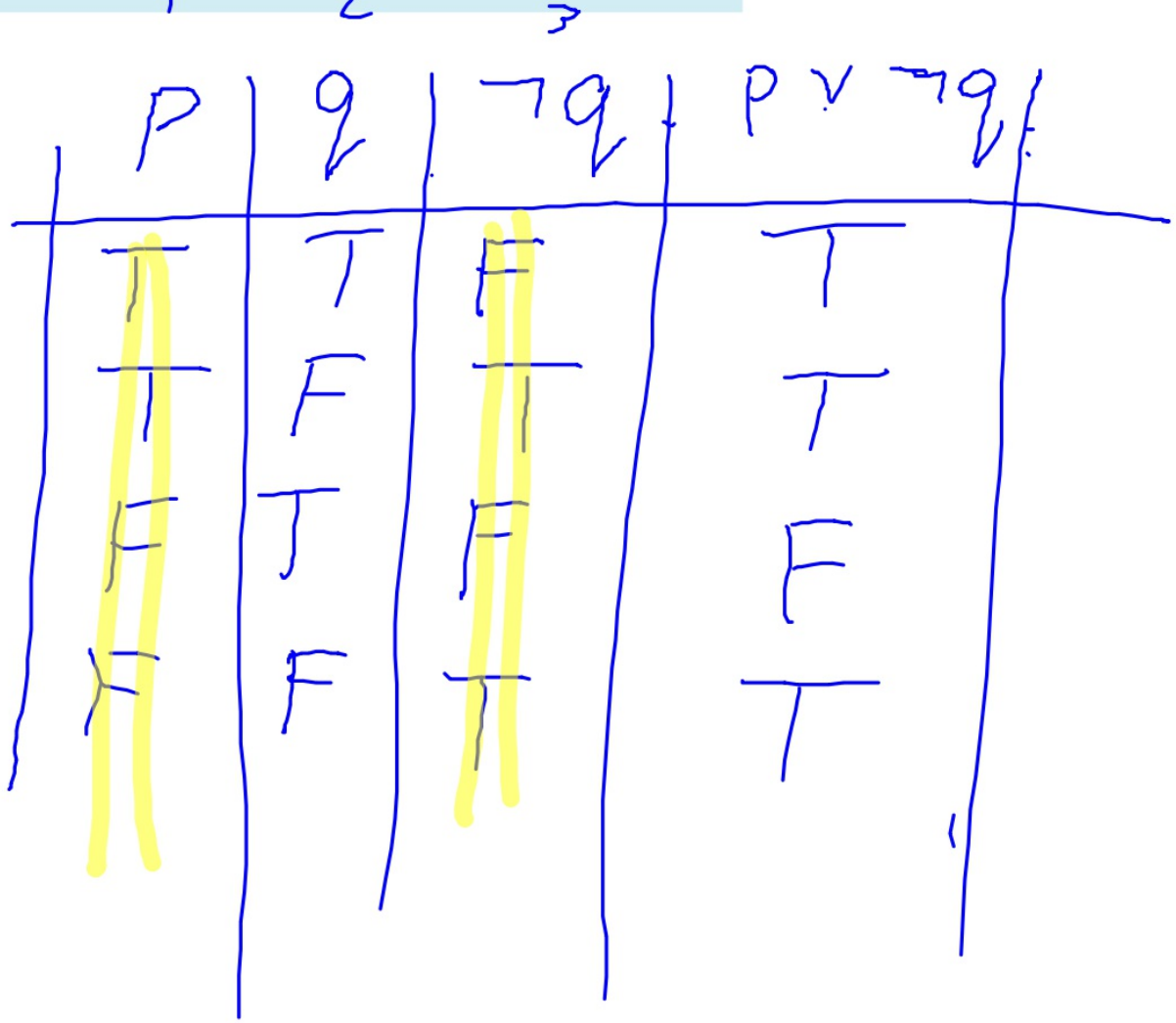
A Propositions
B Compound propositions
C Truth tables and logical equivalence
D Implication and equivalence
E Converse, inverse, and contrapositive
F Valid arguments

Syllabus reference: 3.1, 3.2, 3.3, 3.4

C TRUTH TABLES AND LOGICAL EQUIVALENCE

p	q	Negation $\neg p$	Conjunction $p \wedge q$	Disjunction $p \vee q$	Exclusive disjunction $p \veebar q$
T	T	F	T	T	F
T	F	F	F	T	T
F	T	T	F	T	T
F	F	T	F	F	F

Construct a truth table for $p \vee \neg q$.



TAUTOLOGY AND LOGICAL CONTRADICTION

A compound proposition is a **tautology** if all the values in its truth table column are **true**.
A compound proposition is a **logical contradiction** if all the values in its truth table column are **false**.

Show that $p \vee \neg p$ is a tautology.

p	$\neg p$	$p \vee \neg p$
T	F	T
F	T	T

$\therefore$ tautology

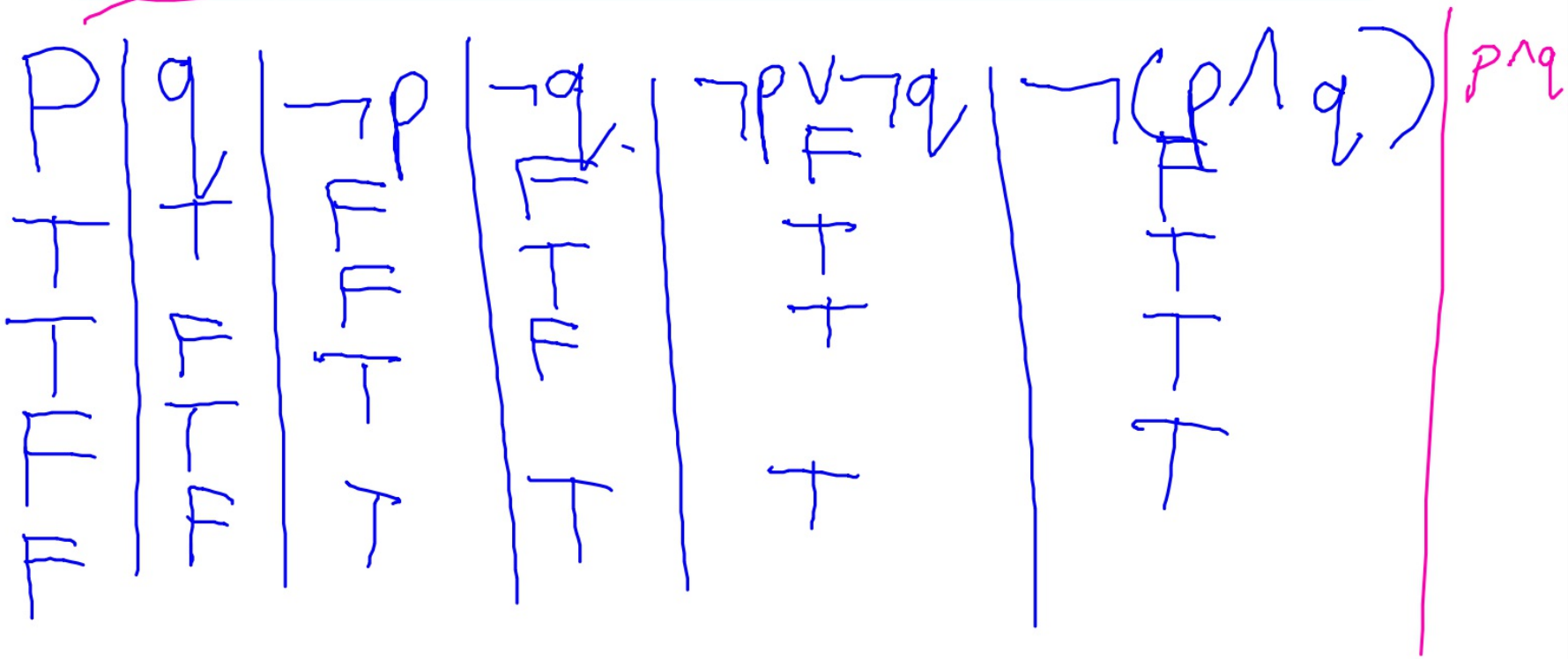
Show that $(\neg q \wedge p) \wedge (q \vee \neg p)$ is a logical contradiction.

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

LOGICAL EQUIVALENCE

Two propositions are **logically equivalent** if they have the same truth table column.

Show that $\neg(p \wedge q)$ and $\neg p \vee \neg q$ are logically equivalent.



TRUTH TABLES FOR THREE PROPOSITIONS

Construct a truth table for the compound proposition $(p \vee q) \wedge r$.

p	q	r	$(p \vee q)$	$(p \vee q) \wedge r$
T	T	T	T	T
T	T	F	T	F
T	F	T	T	T
T	F	F	T	F
F	T	T	T	T
F	T	F	T	F
F	F	T	F	F
F	F	F	F	F

Assignment:

Exercises:

C.1 # 2, 6

C. 2 # 5, 6