Propositional Logic
Tutorial-1

Question 1

1. Construct the truth table of
   i. $\sim p \vee q$
   ii. $p \Rightarrow q$

2. Construct the truth table of
   i. $(p \Rightarrow q) \wedge (q \Rightarrow p)$
   ii. $p \Leftrightarrow q$

3. Construct the truth tables of
   i. $\sim(p \Rightarrow \sim q)$
   ii. $\sim(p \wedge q) \vee \sim(q \Leftrightarrow p)$

Question 2

Show that $((p \Rightarrow q) \wedge (q \Rightarrow r)) \Rightarrow (p \Rightarrow r)$ is a tautology.

Question 3

What can you say about the following compound propositions?

i. $p \wedge (q \vee p)$

P	**Q**	$(q \vee p)$	**OUT**
F	**F**	**F**	**F**
F	**T**	**T**	**F**
T	**F**	**T**	**T**
T	**T**	**T**	**T**

Its contingent proportional

ii. $p \wedge \sim(q \Rightarrow p)$

P	Q	$(q \Rightarrow p)$	$\sim(q \Rightarrow p)$	OUT
F	F	T	F	F
F	T	F	T	F
T	F	T	F	F
T	T	T	F	F

It's a contradiction

iii. $(p \Rightarrow q) \Leftrightarrow (\sim p \vee q)$

P	Q	$p \Rightarrow q)$	~P	$(\sim p \vee q)$	OUT
F	F	T	T	T	T
F	T	T	T	T	T
T	F	F	F	F	T
T	T	T	F	T	T

It's a Tautology

iv. $p \wedge (q \vee \sim q)$

P	Q	~Q	$(q \vee \sim q)$	OUT
F	F	T	T	F
F	T	F	T	F
T	F	T	T	T
T	T	F	T	T

It's a Contingent proportional

Question 4

State whether the following compound propositions are tautologies, contradictions or contingent propositions:

i. $p \wedge \sim q \Rightarrow q \vee p$

P	Q	~Q	$p \wedge \sim q$	q ∨ p	OUT
F	F	T	F	F	T
F	T	F	F	T	T
T	F	T	T	T	T
T	T	F	F	T	T

It is a tautology.

ii. $(p \wedge q) \wedge \sim (p \vee q)$

P	Q	(p ∧ q)	(p ∨ q)	~ (p ∨ q)	OUT
F	F	F	F	T	F
F	T	F	T	F	F
T	F	F	T	F	F
T	T	T	T	F	F

It is a contradiction

iii. $\sim (p \wedge r) \Leftrightarrow \sim (r \wedge p)$

P	R	(p ∧ r)	~ (p ∧ r)	~ (r ∧ p)	OUT
F	F	F	T	T	T
F	T	F	T	T	T
T	F	F	T	T	T
T	T	T	F	F	T

It is a tautology.

iv. $p \vee q \vee \sim q$

P	Q	~Q	p ∨ q ∨ ~ q
F	F	T	T
F	T	F	T
T	F	T	T
T	T	F	T

It is a tautology.

i. p ⇔ (~ p ∧ q)

P	Q	~P	(~ p ∧ q)	OUT
F	F	T	F	T
F	T	T	T	F
T	F	F	F	F
T	T	F	F	F

It is a contingent

ii. q ∧ r ∧ ~ r

Q	R	~R	q ∧ r ∧ ~ r
F	F	T	F
F	T	F	F
T	F	T	F
T	T	F	F

It is a contradiction