Lab 3

1) Complete

a) $p \wedge \neg p$ = ___________
b) $p \vee \neg p$ = ___________
c) $p \vee T$ = ___________
d) $p \wedge F$ = ___________
e) $p \vee p$ = ___________
f) $\neg (p \vee q)$ = __________

2) the propositions p NAND q and p NOR q are denoted by p|q and p↓q respectively,

a) construct a TT for the logical operator NAND and for NOR
b) show that p|q is logically equivalent to $\neg(p\wedge q)$
c) show that p↓q is logically equivalent to $\neg(p\vee q)$
d) show that p↓p is logically equivalent to $\neg p$
e) show that (p↓q) ↓ (p↓q) is logically equivalent to $p\vee q$
f) show that p|q and q|p are logical equivalent
g) show that p|(q|r) and (p|q)|r are not equivalent

It is possible to define PL using signs '¬' and 'v'.

- (α &β) would be defined as ¬(¬α v ¬β),
- (α →β) would be defined as (¬α v β),
- (α ↔ β) would be defined as
  ¬(¬(¬α v β) v ¬(¬β v α)).

Similarly, we could instead use '¬' and '&'.

- (αvβ) would be defined as ¬(¬α & ¬β),
- (α→β) would be defined as ¬(α & ¬β),
- (α ↔ β) would be defined as

(¬(α & ¬β) & ¬(β & ¬α).

Another way, PL" is defined using '↓', *Sheffer dagger*(NOR).

- ¬α is defined as (α ↓ α);
- (α v β) is defined as ((α ↓ β) ↓ (α ↓ β));
- (α & β) is defined as ((α ↓ α) ↓ (β ↓ β));
- and so on for the other operators

Answer of lab 3

1) Complete

a) $p \wedge \neg p$ = ____F___
b) $p \vee \neg p$ = ____T_____
c) $p \vee T$ = _____T_____
d) $p \wedge F$ = _____F_____
e) $p \vee p$ = _____P_____

f) $\neg (p \vee q)$ = _____$\neg p \wedge \neg q$______

2) the propositions p NAND q and p NOR q are denoted by p|q and p↓q respectively,

a) construct a TT for the logical operator NAND and for NOR

p	q	p|q	p↓q
T	T	F	F
T	F	T	F
F	T	T	F
F	F	T	T

b) show that p|q is logically equivalent to $\neg(p\wedge q)$

p	q	p|q	p∧q	¬(p∧q)	(p|q) ⇔ ¬(p∧q)
T	T	F	T	F	T
T	F	T	F	T	T
F	T	T	F	T	T
F	F	T	F	T	T

c) show that p↓q is logically equivalent to $\neg(p\vee q)$

p	q	p↓q	p∨q	¬(p∨q)	(p↓q) ⇔ ¬(p∨q)
T	T	F	F	F	T
T	F	F	F	F	T
F	T	F	F	F	T
F	F	T	T	T	T

d) show that p↓p is logically equivalent to ¬p

p	p↓p	¬p	p↓p⇔¬p
T	F	F	T
F	T	T	T

e) show that (p↓q) ↓ (p↓q) is logically equivalent to p∨q

p	q	p↓q	(p↓q) ↓ (p↓q)	p∨q	(p↓q) ↓ (p↓q) ⇔ p∨q
T	T	F	T	T	T
T	F	F	T	T	T
F	T	F	T	T	T
F	F	T	F	F	T

f) show that p|q and q|p are logical equivalent

p	q	p|q	q|p	(p|q) ⇔ (q|p)
T	T	F	F	T
T	F	T	T	T
F	T	T	T	T
F	F	T	T	T

g) show that p|(q|r) and (p|q)|r are not equivalent

p	q	r	(p|q)	(p|q)|r	(q|r)	p|(q|r)	p|(q|r) ⇔ (p|q)|r
T	T	T					T
T	T	F					T
T	F	T					T
T	F	F					T
F	T	T					T

F	T	F					T
F	F	T					T
F	F	F					T