Tutorial 2 Solution

Q1

1.	$r \vee s$	Premise (Given)
2.	$s \vee r$	Commutative Law
3.	$\sim s$	Premise (Given)
4.	r	Disjunctive Syllogism using 2 and 3
5.	$\sim t \rightarrow \sim r$	Premise (Given)
6.	$\sim(\sim t)$	Modus tollens using 5 and 4
7.	t	(since $\sim(\sim P) \Leftrightarrow P$)
8.	$t \rightarrow w$	Premise (Given)
9.	w	Modus Ponens using 8 and 7.

Q2

$[(P \vee Q) \wedge \sim(\sim P \wedge (\sim Q \vee \sim R))] \vee (\sim P \wedge \sim Q) \vee (\sim P \wedge \sim R)$

$\equiv [(P \vee Q) \wedge \sim(\sim P \wedge \sim(Q \wedge R))] \vee (\sim(P \vee Q)) \vee \sim(P \vee R)$ (using De Morgan's Law)

$\equiv [(P \vee Q) \wedge (P \vee (Q \wedge R))] \vee \sim((P \vee Q) \wedge (P \vee R))$

$\equiv [(P \vee Q) \wedge (P \vee Q) \wedge (P \vee R)] \vee \sim((P \vee Q) \wedge (P \vee R))$ (using Distributive Law)

$\equiv [((P \vee Q) \wedge (P \vee Q)) \wedge (P \vee R)] \vee \sim((P \vee Q) \wedge (P \vee R))$

$\equiv ((P \vee Q) \wedge (P \vee R)) \vee \sim((P \vee Q) \wedge (P \vee R))$

$\equiv x \vee \sim x$ where $x = (P \vee Q) \wedge (P \vee R)$

$\equiv T$ (complement law)

Q3 $(\sim P \wedge (\sim Q \wedge R)) \vee (Q \wedge R) \vee (P \wedge R) \equiv R$

$(\sim P \wedge (\sim Q \wedge R)) \vee (Q \wedge R) \vee (P \wedge R)$

$\equiv (\sim P \wedge (\sim Q \wedge R)) \vee ((Q \vee P) \wedge R)$ By Distributive Law

$\equiv ((\sim P \wedge \sim Q) \wedge R) \vee ((Q \vee P) \wedge R)$ By Associative Law

$\equiv ((\sim P \wedge \sim Q) \wedge R) \vee ((P \vee Q) \wedge R)$ By Commutative Law

$\equiv (\sim (P \vee Q) \vee (P \vee Q)) \wedge R$ By Distributive Law

$\equiv T \wedge R$ By Negation Law

$\equiv R$ By Identity Law

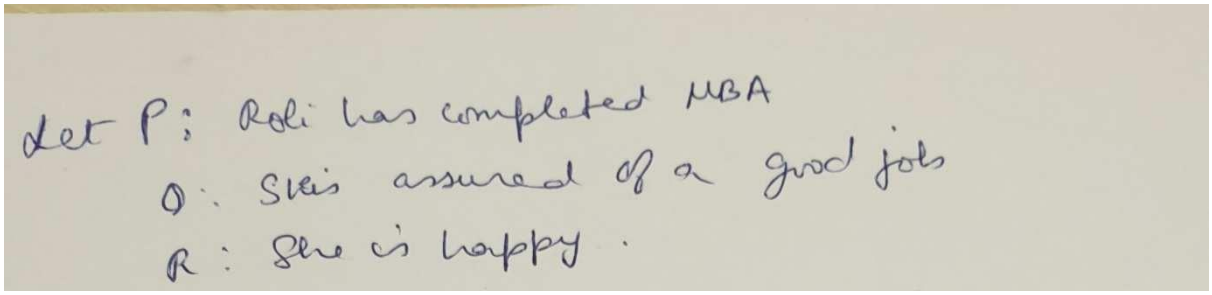
Hence Proved

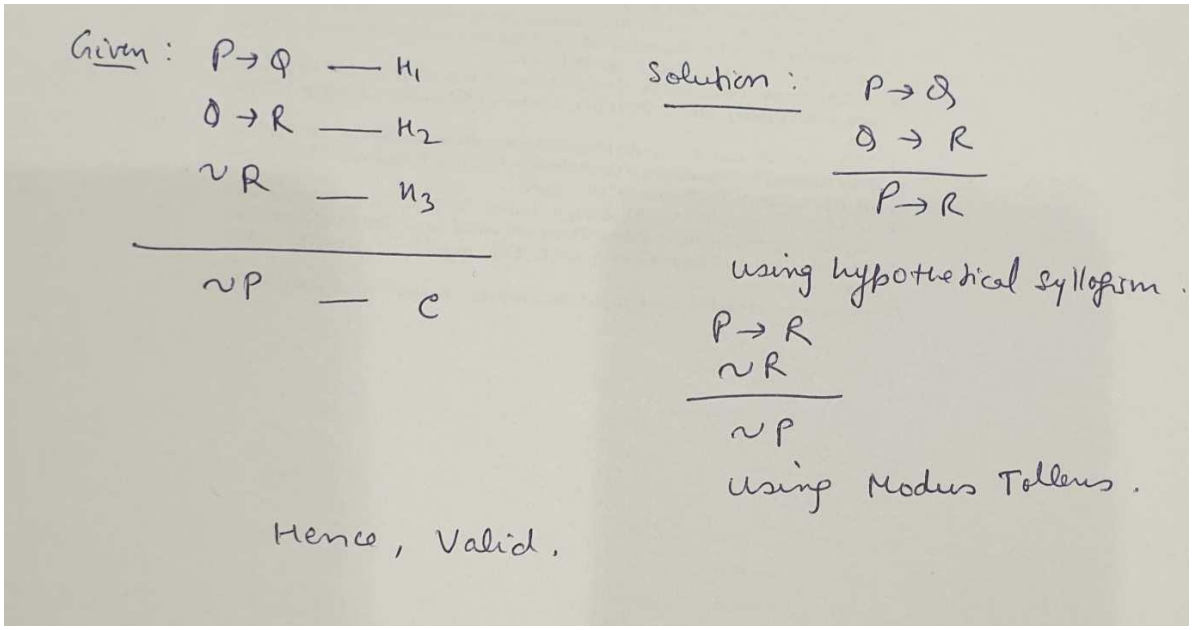
Q4 If we derive a contradiction by using the given premises, then they are inconsistent.

1.	P	Premise (Given)
2.	$P \rightarrow Q$	Premise (Given)
3.	Q	Modus Ponen using 1 and 2
4.	$Q \rightarrow \sim R$	Premise (Given)
5.	$\sim R$	Modus Ponen using 3 and 4.
6.	$P \rightarrow R$	Premise (Given)
7.	R	Modus Ponen using 1 and 6.
8.	$R \wedge \sim R$	Conjunction using 7 and 5
9.	F	

Hence, $P \rightarrow Q$, $P \rightarrow R$, $Q \rightarrow \sim R$ and P are inconsistent

Q5





Q6 Let p be " I study", q be "I fail Mathematics", and r be "I play basketball".
Then the given argument is as follows:

The hypothesis are:

P -> ¬q, ¬ r -> p, q

And the Conclusion is :

r

	Step	Reason
1.	$p \to \neg q$	Hypothesis
2.	q	Hypothesis
3.	$\neg p$	Using Modus Tollens in 1 & 2
4.	$\neg r \to p$	Hypothesis
5.	$\neg(\neg s)$	Using Modus Tollens in 3 & 4
	$\equiv r$	Using Double Negation law
	C	

Hence the given Argument is Valid.