1. [**Marks: 4**] Use the logical laws method to show that $(\neg p \wedge (p \vee q)) \Leftrightarrow (\neg p \wedge q)$.

2. [**Marks: 4**] Find a truth table for the statement form

$$(((p \rightarrow q) \wedge (q \rightarrow \neg p)) \rightarrow (p \rightarrow \neg r)),$$

and say whether the statement form is a tautology, is a contradiction or is contingent. (When you make a truth table, order rows as in the slides. In the first row assign 0 to all variables. Then proceed lexicographically, such as in 00, 01, 10, 11.)

3. [**Marks: 4**] Suppose the second commutative law is removed from the list of logical laws.

Is the resulting system still sound? Is it still adequate?

4. [**Marks: 4**] Determine whether or not the argument form

$$r, (p \vee (q \rightarrow \neg r)) \therefore (q \rightarrow p)$$

is valid.