2) Propositional logic

[1/2] If it is known that propositions $p \to q$, $\sim p \to r$, $r \to (p \vee q)$ are true, can we determine the logic value of propositions p, q, r?

[2/2] Assuming that
(a) $\sim p \wedge q$ is false, what can be said about compound propositions: $(p \vee \sim q) \wedge (q \to p) \wedge (q \to (\sim p \to p))$
(b) $(p_1 \to (p_2 \to (p_3 \to \ldots (p_n \to q)\ldots)))$ if false, do we know the logic value of propositions $p_1, p_2, .., p_n, q$?

[3/2] Find compound propositions S, R, with logic variables p, q, r for which $w(S)$ $w(R)$ are given with the truth table:

$w(p)$	$w(q)$	$w(r)$	$w(S)$	$w(R)$
0	0	0	0	1
0	0	1	0	0
0	1	0	1	1
0	1	1	0	1
1	0	0	1	0
1	0	1	1	1
1	1	0	1	1
1	1	1	0	0

[4/2] Prove that operator NAND ($(p$ NAND $q) \leftrightarrow \sim(p \wedge q)$) is sufficient to express ale the remaining basic operators.

[5/2] Can the exercise [3/2] be completed using only NAND operator of arbitrary combination of 01?

[6/2] Use CNF to solve [3/2]

[7/2] Prove 3 laws from the lecture using true table.

[8/2]* Give an algorithmic technic of solving set algebra lows with additional logic operators. Test your solution on examples:
(a) $A \subseteq B \wedge B \subseteq C \to A \cap C = A$
(b) $A \cap B = \varnothing \to A \setminus B = A$

[9/2]* Prove that there are only two logic operators that alone suffice to express all the remaining logic operators.

[10/2]* Prove that using only negation and equivalence it is impossible to express conjunction.

[11/2]* Prove that each compound proposition composed only of $\sim$, $\leftrightarrow$ is a tautology if and only if each variable is used even number of times and each operator is used even number of times.