Homework 1
F17LP Logic and proof

This homework will contribute 10% to your final course grade. Your solutions should be **stapled together** *with a signed and completed* **coursework submission form**. *These forms can be found in the corridor joining CM and EM on the first-floor — ask in the School Office if you cannot find them. Your solutions should be* **posted in the Mathematics postbox** *between CM and EM* **by 3.30 pm Friday 20th October**. **Late work will not be marked and you will automatically receive zero.** *You will be marked on the clarity of your solutions and the accuracy of your reasoning.*

(1) (a) Construct truth tables for $\neg p$, $p \wedge q$, $p \vee q$, $p \to q$ and $p \leftrightarrow q$. [5 marks]
(b) Construct the parse tree and truth table of $(p \wedge q) \vee (p \to \neg r)$. [5 marks]
(c) Construct a wff in disjunctive normal form that has the following truth table. [2 marks]

p	q	r	A
T	T	T	F
T	T	F	T
T	F	T	T
T	F	F	F
F	T	T	T
F	T	F	T
F	F	T	F
F	F	F	F

(d) Prove that $\neg(p \vee (q \vee r))$ is logically equivalent to $\neg p \wedge (\neg q \wedge \neg r)$. [3 marks]

(2) Show that $p \leftrightarrow q$ is logically equivalent to a wff in which **the only connective that appears** is **nand**. [2 marks]

(3) Construct a wff with atoms p, q, r, s which is true when exactly two of p, q, r, s are true. [3 marks]

Set Friday 6th October 2017