Automated Reasoning
The University of Edinburgh

Exercise sheet 1:
Propositional Logic

Exercise 1

Represent the following sentences in propositional logic, using the connectives $\neg$, $\longrightarrow$, $\wedge$ and $\vee$ (make clear what your propositional variables stand for):

1. Cats chase mice or birds, but not at the same time.
2. If it rains the beach will be empty.
3. If Jane bought a piano today, she either sold her old one or took out a bank loan.

Also draw the truth tables for each statement.

Exercise 2

Is the proposition $P \wedge (P \longrightarrow Q)$ satisfiable? If so, give an interpretation that satisfies it. Is it valid? Why or why not?

Exercise 3

The truth table for the following NAND expression, $p \mid q$ is:

p	q	$p \mid q$
t	t	f
t	f	t
f	t	t
f	f	t

Show that $\mid$ alone can be used to define the connectives: $\neg$, $\wedge$, $\vee$ and $\longrightarrow$.