**COMPUTER SCIENCE TRIPOS Part IB – 2013 – Paper 6**

## 5 Logic and Proof (LCP)

(*a*) In the context of clause methods in theorem proving, define and discuss the concept of a *pure literal*. [3 marks]

(*b*) Use the DPLL method to find a model satisfying the following set of formulas or to prove that no such model exists.

$$(P \wedge R) \rightarrow Q$$
$$\neg(P \wedge Q \wedge R)$$
$$(R \vee \neg Q) \rightarrow P$$
$$P \rightarrow R$$

[5 marks]

(*c*) For each of the following formulas, either exhibit a formal proof (in a sequent or tableau calculus) or exhibit a falsifying interpretation.

(*i*)

$$\forall x(P(x) \rightarrow Q(x)) \rightarrow (\exists x P(x) \rightarrow \exists x Q(x))$$

[6 marks]

(*ii*)

$$\exists x(P(x) \rightarrow Q(x)) \rightarrow (\forall x P(x) \rightarrow \forall x Q(x))$$

[6 marks]