

COMPUTER SCIENCE TRIPOS Part IB – 2023 – Paper 6

7 Logic and Proof (mj201)

- (a) Exhibit a model for the following set of formulas, or prove that none exists. Briefly explain your work in each step.

$$P \quad P \rightarrow (R \rightarrow Q) \quad P \vee \neg Q \vee \neg P \quad Q \rightarrow S \wedge \neg T \quad S \rightarrow Q \vee T$$

[6 marks]

- (b) For each of the following sets of formulas, either exhibit an interpretation in S4 modal logic that satisfies them simultaneously at a particular world, w , or show through a formal proof that they cannot be satisfied.

(i) $\diamond \Box P, \quad Q, \quad \Box \diamond \Box \neg Q, \quad \Box(P \rightarrow \diamond R \wedge \diamond \neg R), \quad \Box(\Box \neg Q \vee \neg \diamond P)$

[8 marks]

(ii) $\Box(P \vee Q), \quad \diamond \neg P, \quad \neg \diamond Q$

[6 marks]