

## Philosophy 2/3 FOL

### Assignment 2. [30 marks]

#### Question 1. (6 marks each)

In which normal modal logics of Chapter 3, composed using the constraints  $\rho$ ,  $\sigma$ ,  $\tau$ ,  $\eta$ , do the following hold:

(i)  $\models \Box p \supset \Box \Diamond p$ .

(ii)  $\models \Box(p \vee \Diamond q) \equiv (\Box p \vee \Diamond q)$ .

Use tableaux and produce a counter-model in a logic in which it fails to hold (if there is such a logic). Is this logic the strongest logic in which the formula is invalid?

#### Question 2. (3 marks each)

In the stated temporal logic, do the following hold?:

(i)  $\models [F]p \supset [F]<F>p$ . ( $K^t_\tau$ )

(ii)  $\models [P](p \supset q) \supset (\sim <P>q \supset <P>\sim p)$ . ( $K^t_\tau$ )

(iv)  $\models ([F]p \& (p \& [P]p)) \supset [P][F]p$ . ( $K^t_\tau \phi \beta$ )

(v)  $\models <F>(p \supset p)$ . ( $K^t_\tau \eta \eta'$ )

Use tableaux, and produce a counter-model in the semantics of the logic, if it fails to hold.

#### Question 3. (2 marks each)

Put the following English sentences into the symbolism of modalized tense logic:

(i) Jones could have won the race.

(ii) Jones would have won the race, if he had not been cut off.

(iii) Jones had to win the race.

Explain your answer.

Assignments should be placed in the Philosophy Essay and Assignment Shute in the Philosophy Office (Humanities 2 building Level 3), by **Wednesday, 23th September**.