Software Validation and Verification
Sixth Exercise Sheet – On fair CTL

Exercise 1

We consider the incomparable expressiveness of CTL and LTL.

(a) Using a theorem from the lecture, prove that there does not exist an equivalent LTL-formula for the CTL-formula $\Phi_1 = \forall\Diamond(a \wedge \exists\bigcirc a)$.

(b) Now prove directly (i.e. without the above theorem), that there does not exist an equivalent LTL-formula for the CTL-formula $\Phi_2 = \forall\Diamond\exists\bigcirc\forall\Diamond\neg a$.
   Hint: Argument by contraposition, think about trace inclusion vs. CTL-equivalence!

Exercise 2

Consider the CTL-formula $\Phi = \forall\square\bigl(a \rightarrow \forall\lozenge(b \wedge \neg a)\bigr)$ together with the following CTL fairness assumption

$$fair = \square\lozenge\forall\bigcirc (a \wedge \neg b) \rightarrow \square\lozenge\forall\bigcirc (b \wedge \neg a)$$
$$\wedge\ \lozenge\square\exists\lozenge b \rightarrow \square\lozenge b.$$

Check that $TS \models_{fair} \Phi$!