

### Exercises for “Formal Specification and Verification” Exercise sheet 9

#### Exercise 9.1:

Consider a signature with  $\Pi = \{P, Q, S\}$ . Which of the following formulae are CTL formulae? Justify your answer.

- |   |                                      |
|---|--------------------------------------|
| (1) $\bigcirc P$                          | (4) $(A\Diamond P) \vee (\Box(EQ))$  |
| (2) $A(\bigcirc(P \wedge Q) \vee (SUP))$  | (5) $(A\Diamond P) \vee A(\Box(EQ))$ |
| (3) $A(\bigcirc(P \wedge Q)) \vee E(SUP)$ | (6) $(A\Diamond P) \vee A(E\Box Q)$  |

#### Exercise 9.2:

Prove the following equivalences of CTL formulae:

- (1)  $\neg A\Diamond F \equiv E\Box\neg F$
- (2)  $\neg E\Diamond F \equiv A\Box\neg F$
- (3)  $\neg A\bigcirc F \equiv E\bigcirc\neg F$
- (4)  $E(FUG) \equiv G \vee (F \wedge E\bigcirc E(FUG))$
- (5)  $E\Box F \equiv \phi \wedge E\bigcirc E\Box F$
- (6)  $\neg A(FUG) \equiv E(\neg GU(\neg F \wedge \neg G)) \vee E\Box\neg G$

You can also submit the solutions to Exercise 8.5 if you wish.

Please submit your solution until Monday, January 7, 2019 at 14:00. Please do not forget to write your name on your solution.

Submission possibilities:

- By e-mail to [sofronie@uni-koblenz.de](mailto:sofronie@uni-koblenz.de) with the keyword “Homework FSV” in the subject.
- Hand it in to me (Room B225) or drop it in the box in front of Room B224.