University of Konstanz

Chair for Software and Systems Engineering

Prof. Dr. Stefan Leue, Raffael Senn

System Specification Using TLA$^+$

Winter Term 2023/24

Issued: 25.11.2023

Assignment 4

Deadline: Friday **01.12.2023** 23:55

Notes:

- Solve the assignment **on your own** — no groups allowed.

- Hand-written solutions will not be accepted, except for graphs and diagrams.

- If you hand in non-pdf files or multiple files, name your submission as `stla23_04_SURNAME.zip`, replacing `SURNAME` with your surname. Otherwise `stla23_04_SURNAME.pdf`. Also include your full name in the submitted PDF.

- Submit your solution via **Ilias**.

Exercise 4.1 Checking Liveness Properties   4 Points

Run TLC to check the *LiveHourClock* and *LiveInternalMemory* specifications, using the files attached. Use TLC to find a counterexample to show that the specification *LISpec* of *LiveInternalMemory* does not satisfy the following property

$$\forall\, p \in Proc : (ctl[p] = "\text{rdy}") \rightsquigarrow (ctl[p] = "\text{req}")$$

Hand in modified tla files, cfg files and the output of TLC.

Exercise 4.2 Tautologies   16 Points

Show which of the following formulas are tautologies. For each that isn't, give a counterexample. You can use all tautologies from chapter 8 of the book.

a) $\Diamond\Box\Diamond F \Leftrightarrow \Box\Diamond F$

b) $\neg\,\Box(F \vee G) \Rightarrow \Diamond\neg\, F \wedge \Diamond\neg\, G$

c) $\Box[A \wedge B]_v \Leftrightarrow \Box[A]_v \wedge \Box[B]_v$

d) $\Box\Diamond\langle A \wedge B\rangle_v \Leftrightarrow \Box\Diamond\langle A\rangle_v \wedge \Box\Diamond\langle B\rangle_v$

Total: 20 Points