# Model Checking WS 2011: Assignment 2

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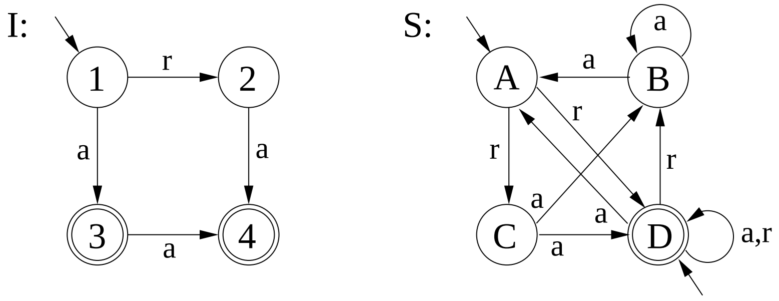
Due 20.10.2011

### Exercise 5

Given two FA $A_I$ and $A_S$ describing an implementation $I$ and specification $S$, respectively. Explain in detail how to check whether $I$ conforms to $S$, given $A_I$ and $A_S$. Illustrate your explanations using set diagrams.

### Exercise 6

Check conformance of implementation $I$ and specification $S$ given as FA on the right.



### Exercise 7

Let $f_1 := (x \vee y \vee z) \wedge (\neg x \vee y \vee z) \wedge (\neg x \vee \neg y \vee \neg z) \wedge (\neg x \vee y \vee \neg z)$ and $f_2 := (\neg x \vee \neg z) \wedge (x \vee y)$ be propositional formulae in conjunctive normal form (CNF) over a set of Boolean variables $V := \{x, y, z\}$. Assume that $f_1$ characterizes an implementation and $f_2$ a specification.

Does $f_1$ conform to $f_2$? Is $f_1 \wedge \neg f_2$ satisfiable? Justify your answers by constructing a truth table.

### Exercise 8

a) Read sections I and III "Software Model Checking" in the survey on software verification[1] and describe the approach of counterexample-guided abstraction refinement (CEGAR).

b) Given variables `i`, `n` $\in \mathbb{Z}$ (integers), the predicate $a \leftrightarrow$ `(i <= n)` and the action $\alpha :=$ `i++`. Predicate $a$ defines two abstract states $a$ and $\neg a$, i.e. $a$ can hold or not. Draw an abstract transition system by adding all possible transitions between states $a$ and $\neg a$ when action $\alpha$ is executed: how does executing $\alpha$ influence the value of predicate $a$? What is the difference when interpreting `i`, `n` and $\alpha$ over 32-bit Java integers with overflow semantics?

[1] V. D'Silva, D. Kroening, G. Weissenbacher: A Survey of Automated Techniques for Formal Software Verification. IEEE TCAD 27(7), 2008. The article can be found in KUSSS.