

## Introduction to Model Checking Winter term 2011/2012

### – Series 4 –

Hand in on November 16<sup>th</sup> before the exercise class.

#### Exercise 1 (2 points)

Let  $P$  be an LT property. Prove:  $\text{pref}(\text{closure}(P)) = \text{pref}(P)$ .

#### Exercise 2 (2 points)

Let LT properties  $P$  and  $P'$  be equivalent, notation  $P \cong P'$ , if and only if  $\text{pref}(P) = \text{pref}(P')$ . Prove or disprove:  $P \cong P'$  if and only if  $\text{closure}(P) = \text{closure}(P')$ .

*Hint:* you may use results from the previous exercise.

#### Exercise 3 (4 points)

Let  $P$  and  $P'$  be liveness properties over  $AP$ . Prove or disprove the following claims:

- (a)  $P \cup P'$  is a liveness property,
- (b)  $P \cap P'$  is a liveness property.

Answer the same question for  $P$  and  $P'$  being safety properties.

#### Exercise 4 (2 points)

Let  $P$  denote the set of traces of the form  $\sigma = A_0A_1A_2\ldots \in (2^{AP})^\omega$  such that

$$\exists k. A_k = \{a, b\} \quad \wedge \quad \exists n \geq 0. \forall k > n. (a \in A_k \Rightarrow b \in A_{k+1}).$$

Consider the following fairness assumptions with respect to the transition system  $TS$  outlined on the right:

- a)  $\mathcal{F}_1 = (\{\{\alpha\}\}, \{\{\beta\}, \{\delta, \gamma\}, \{\eta\}\}, \emptyset)$ .  
Decide whether  $TS \models_{\mathcal{F}_1} P$ .
- b)  $\mathcal{F}_2 = (\{\{\alpha\}\}, \{\{\beta\}, \{\gamma\}\}, \{\{\eta\}\})$ .  
Decide whether  $TS \models_{\mathcal{F}_2} P$ .

Justify your answers!

