Supervisory Control with Complete Observations

Examples for the Tool Session

Tomáš Masopust and Jan H. van Schuppen

June 3, 2011

Example 1

Given a generator

$$G = (\{1, 2, \ldots, 9\}, \{a, b, c, d\}, f, \{2, 6, 9\}),$$

where f is defined as described in Figure 1.

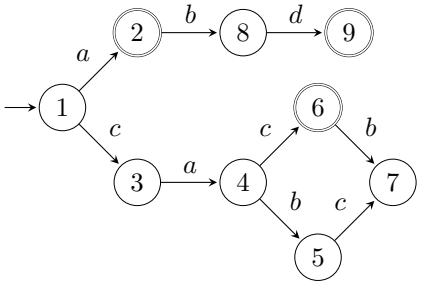

Figure 1: The generator G.

Task 1: Is the plant G nonblocking? If not, compute its trim $Trim(G)$.

Task 2: Let $SPEC = \{a, cac\}$ be a specification, and let $E_c = \{a, d\}$. Decide whether the specification is controllable with respect to the plant G and the set of uncontrollable events E_{uc}. If not, compute the supremal controllable sublanguage $SPEC'$ of the specification.

Task 3: Find the supervisor S such that $L(S/G) = SPEC'$? Is the supervisor nonblocking?

Task 4: Decide whether the specification is controllable with respect to the plant $Trim(G)$ and the set of uncontrollable events E_{uc}. If not, compute the supremal controllable sublanguage $SPEC'_{trim}$ of the specification.

Task 5: Find the supervisor S_{trim} such that $L(S_{trim}/Trim(G)) = SPEC'_{trim}$? Is the supervisor nonblocking?

Example 2

Let $n \in \mathbb{N}$ be a fixed constant. Given n generators

$$G_i = (\{1, 2, 3, 4\}, \{r_i, a_i, e_i\}, f_i, \{4\}),$$

for $i = 1, 2, \ldots, n$, where f_i is defined as described in Figure 2.

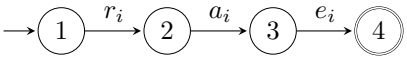

Figure 2: The generators.

Task 1: Compute the parallel composition $G = \|_{i=1}^{n} G_i$. What is the maximal n for which you can compute it in a reasonable time? Is the plant G nonblocking?

Task 2: Let $E_i = \{r_i, a_i, e_i\}$, and define $E = \bigcup_{i=1}^{n} E_i$. Define a generator G_{spec} for the specification language

$$SPEC = \{w \in E^* \mid \text{ for all } i \neq j, \text{ if } a_i x a_j \text{ is a substring of } w, \text{ then } e_i \text{ appears in } x\}.$$

In other words, considering a_i and e_i as a pair of brackets, different for each i, the strings of the specification contains only well-balanced bracket pairs. For instance, $a_1 r_2 r_3 a_2 r_4 e_1$ does not belong to the specification.

Task 3: Decide whether the specification is controllable with respect to the plant G and the set of uncontrollable events $E_{uc} = \cup_{i=1}^{n} \{r_i, e_i\}$. If not, compute the supremal controllable sublanguage $SPEC'$ of the specification.

Task 4: What is the supervisor S such that $L(S/G) = SPEC'$? Is the supervisor nonblocking?