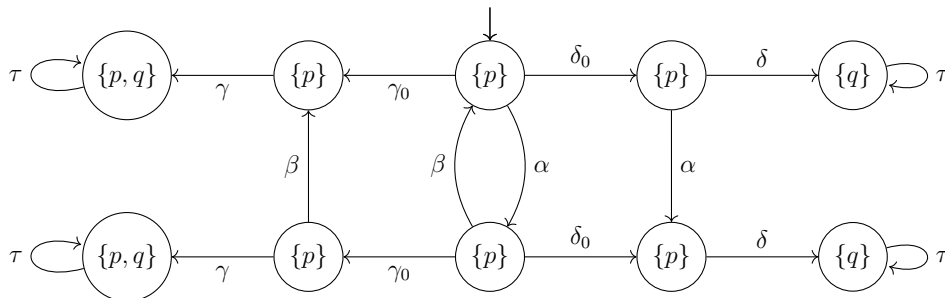


Model Checking – Exercise sheet 7

Exercise 7.1

Consider the transition system TS depicted below. Show that the ample set conditions (C0)-(C3) do not allow for any state reduction, although there is a smaller subsystem \hat{TS} that is stutter equivalent to TS .



Exercise 7.2

Consider the following Promela model

```

1 byte g;
2
3 active proctype m() {
4 byte x;
5 m0: x++;
6 m1: x++;
7 m2: g = x;
8 }
9
10 active proctype n() {
11 byte y;
12 n0: y++;
13 n1: y++;
14 n2: atomic { (g>0) -> g = g-y }
15 }
16
17 active proctype p() {
18 p0: atomic { (g>0) -> g-- }
19 }
    
```

and the following properties:

- a) The value of g will eventually become one.

b) The process n cannot finish before the process m reaches $m1$.

For each property, define a labeled Kripke structure with actions extracted from program statements. Determine the independence relation and the invisibility set, and construct a reduced Kripke structure using the ample sets method.

Exercise 7.3

Which of the following equivalences for CTL^* are correct? Provide a proof or a counterexample.

(a) $\mathbf{AXAG} \phi \equiv \mathbf{AXG} \phi$

(b) $\mathbf{EXEG} \phi \equiv \mathbf{EXG} \phi$

(c) $\mathbf{A} (\phi \wedge \psi) \equiv \mathbf{A} \phi \wedge \mathbf{A} \psi$

(d) $\mathbf{E} (\phi \wedge \psi) \equiv \mathbf{E} \phi \wedge \mathbf{E} \psi$