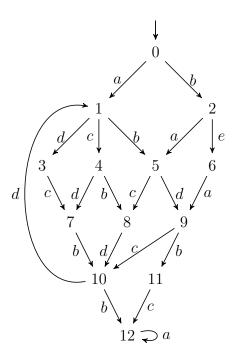
Model Checking – Exercise sheet 7

Exercise 7.1

Consider the following Kripke structure $\mathcal{K} = (S, A, \rightarrow, 0, AP, \nu)$, where $A = \{a, b, c, d, e\}$, $AP = \{p\}$, $\nu(6) = \{p\}$, and $\nu(s) = \emptyset$ if $s \neq 6$.



- (a) Write down the independence relation $I \subseteq A \times A$.
- (b) Write down the invisibility set $U \subseteq A$.
- (c) Compute a reduction function red that satisfies the ample set conditions C0–C3. Whenever possible, choose red(s) such that it is a proper subset of en(s), for each state s.
- (d) Use red to construct a reduced Kripke structure \mathcal{K}' that is stuttering equivalent to the original Kripke structure \mathcal{K} .

Exercise 7.2

Consider the following Promela model

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