Model Checking – Exercise sheet 12

Exercise 12.1

Consider the pushdown system below, with stack alphabet $\Gamma = \{a, b\}$ where $\text{push } a \xrightarrow{} 2$, indicates the presence of transitions $1a \leftrightarrow 2aa$ and $1b \leftrightarrow 2ab$, and $\text{pop } a \xrightarrow{} 5$, indicates the presence of transition $4a \leftrightarrow 5$.

(a) Let $L = 7b^* = \{7, 7b, 7bb, 7bbb, \ldots \}$. Construct the $\mathcal{P}$-automaton accepting $\pre^*(L)$.

(b) Give the minimal automaton accepting the language of all stacks $w$ such that $1w \in \pre^*(L)$.

Exercise 12.2

Consider the following recursive program, where $\?$ denotes a nondeterministic Boolean value:

```plaintext
procedure main;
m0:  if ? then
    call a;
else
    call b;
m1:  return;

procedure a;
a0:  if ? then
    call b;
a1:  call b;
else
    call a;
end if;
a2:  return;
```
procedure b;
b0: if ? then
call a;
b1: if ? then
call a;
   end if;
   end if;
b2: return;
(a) Model the program with a pushdown system.
(b) Compute all configurations that can reach the program label m1.

Exercise 12.3
Consider the following recursive program with a global variable g and a local variable l:

    boolean g;

    procedure main(boolean l);
    m0: if l then
        call a;
        end if;
    m1: assert(g == l);
    m2: return;

    procedure a();
    a0: g := not g;
    a1: if not g then
        call a;
        a2: call a;
        end if;
    a3: return;

(a) Model the program with a pushdown system, where the values of g and l are not initialized.
(b) Compute all configurations that can reach the program label m2.
(c) ⭐ Compute all configurations that are reachable from the program label m0.