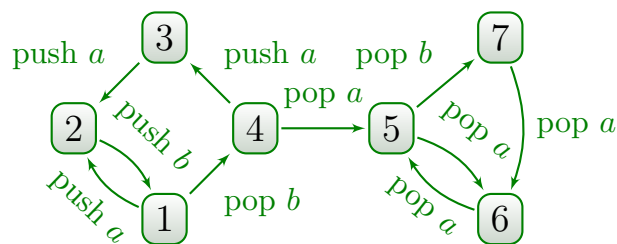


Model Checking – Exercise sheet 13

Exercise 13.1

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



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

Exercise 13.2

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

```

    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 13.3

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`.