Solution proposal to selected exercises from Lecture 5

Jens Chr. Godskesen
IT University of Copenhagen

Exercise 3, (Semaphore and Dining Philosophers)

```
agent Semaphore0(u,d) = ...

agent Forks(g1,g2,g3,g4,g5,p1,p2,p3,p4,p5) = ...

agent Phil(getL,putL,getR,putR,eat,u,d) =
      'd.'getL.'getR.eat.'putL.'putR.'u.Phil<getL,putL,getR,putR,eat,u,d>
agent Phils(g1,g2,g3,g4,g5,p1,p2,p3,p4,p5,e1,e2,e3,e4,e5,u,d) =
        Phil(g1,p1,g5,p5,e1,u,d) | Phil(g2,p2,g1,p1,e2,u,d)
        | Phil(g3,p3,g2,p2,e3,u,d) | Phil(g4,p4,g3,p3,e4,u,d)
        | Phil(g5,p5,g4,p4,e5,u,d)

agent Table(e1,e2,e3,e4,e5) =
      (^ g1,g2,g3,g4,g5,p1,p2,p3,p4,p5)
        ( Forks(g1,g2,g3,g4,g5,p1,p2,p3,p4,p5)
          | (^ u,d)( Semaphore4(u,d) |
                     Phils(g1,g2,g3,g4,g5,p1,p2,p3,p4,p5,e1,e2,e3,e4,e5,u,d) ) )
```

Exercise 4, (Safety Proterty Dining Philosophers)

State that two neighbouring philosophers, say 1 and 2, cannot eat at the same time. MWB confirms this as demonstrated by

```
MWB>prove Table<e1,e2,e3,e4,e5>
            nu X.(([e1]FF | [e2]FF)
                  & ([t]X & [e1]X & [e2]X & [e3]X & [e4]X & [e5]X))
Model Prover says: YES!
```

The more general variant stating that no two neighbouring philosophers eat concurrently is specified (and proved) by

```
MWB>prove Table<e1,e2,e3,e4,e5>
            nu X.( ([e1]FF | [e2]FF) & ([e1]FF | [e5]FF) & ([e2]FF | [e3]FF)
                     & ([e3]FF | [e4]FF)& ([e4]FF | [e5]FF)
                   & ([t]X & [e1]X & [e2]X & [e3]X & [e4]X & [e5]X))
Model Prover says: YES!
```

Exercise 5, (Weak Safety Proterty)

$$\nu X.(\phi \wedge (\bigwedge_{a \in \mathcal{A}} [a]ff \vee \bigvee_{a \in \mathcal{A}} \langle a \rangle X))$$

means that ϕ holds in the current state and

- either there are no transitions leaving the current state (the path ends),
- or there is (a least one) transition leaving the current state where the formula holds recursively