Assignment 1

This assignment consists of 3 problems, and should be handed in at the latest by Friday, Feb. 1. Work in pairs.

Problem 1 In the below figures you find three suggestions for action systems that are intended to implement mutual exclusion between two processes. In all action systems, locations $l_1$ and $m_1$ are intended to represent the section of a process which is not interested in the critical section, locations $l_2$ and $m_2$ are intended to represent the section where the process is interested in entering the critical section, and locations $l_3$ and $m_3$ represent the critical sections themselves. The purpose of a mutual exclusion algorithm is to ensure that

1. At most one process is in its critical section at any time
2. A process that intends to enter its critical section should be allowed to do so eventually, or after some reasonable waiting time

For each of the action systems you should determine how well it satisfies these two criteria. You are also welcome to criticize some of the solutions on other grounds, and possibly improve them (this last part is not required).

**Action System mutex1**

```plaintext
declare s: integer
initially s = 1

end
```

1
**Action System** mutex2

**declare** $y_1, y_2 : \text{integer}$

**initially** $y_1 = y_2 = 0$

![Transition System for mutex2]

**Action System** mutex3

**declare** $t : \text{integer}$

**initially** $t = 1$

![Transition System for mutex3]

**Problem 2.** Construct the transition system corresponding to the action system mutex2 in the previous problem.

**Problem 3.** Make a Promela model of the Dining Philosophers Problem. Use a version where there are (say) five philosophers who alternatively think and eat. The philosophers are seated at a large round table on which are a large number of Chinese foods. Between each pair of philosophers is one
chopstick. In order to eat food, a philosopher needs two chopsticks: the one on his left and the one on his right. Thus, when a philosopher stops thinking and starts eating, he picks up both the chopstick on his left and the chopstick on his right. When a philosopher stops eating and starts thinking, he puts down both his chopsticks in their original positions on the table. Make a model which is as compact as possible.