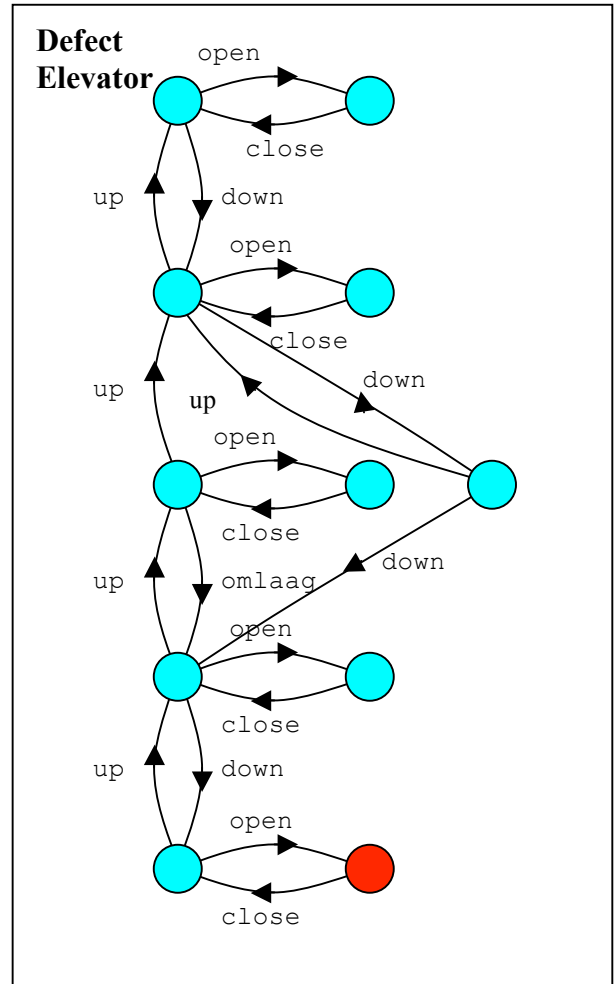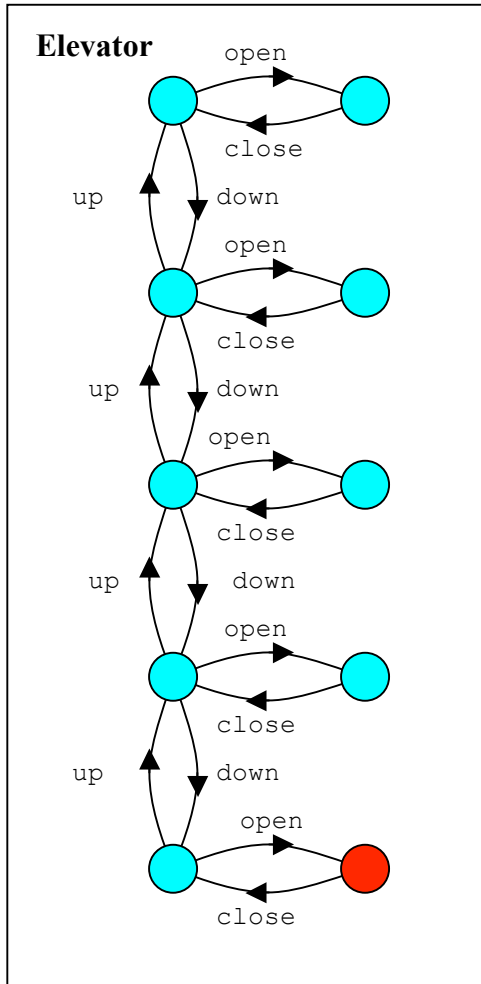# Solutions exercise werkcollege 4

## Exercise 1

a)  See the Elevator automaton below.
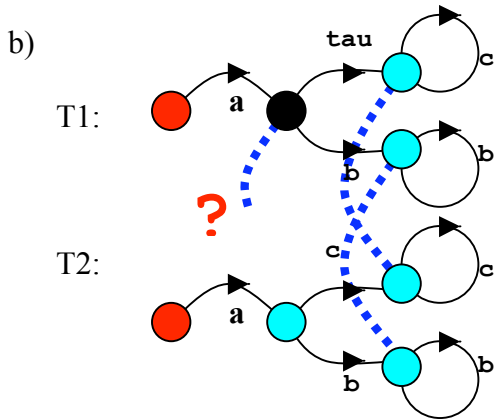


b)  Traces with length ≤3:
  - Traces with length 0: ε
  - Traces with length 1: `close`
  - Traces with length 2: `close->open,close->up`
  - Traces with length 3: `close->open->close,`    `close>up>down,` `close->up->up, close->up->open.`

c)  See the above automaton Defect Elevator.

d) The models are NOT equivalent.The next trace is a trace of the model of a), but not of the model of c):
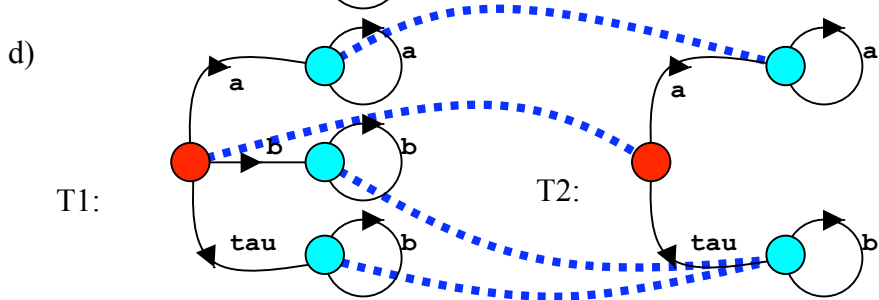```
close->up->up->up->down->open
```
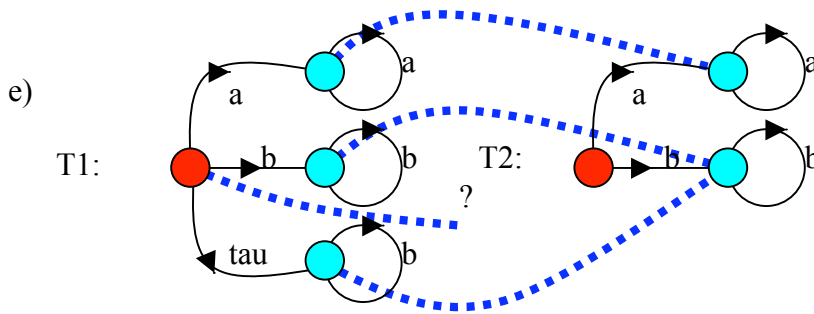
# Exercise 2
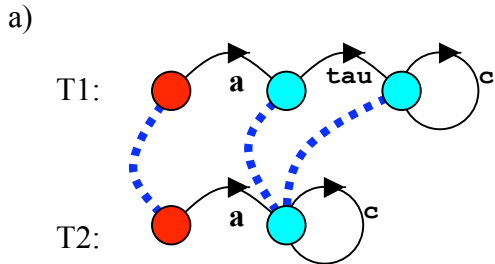
a)



b)
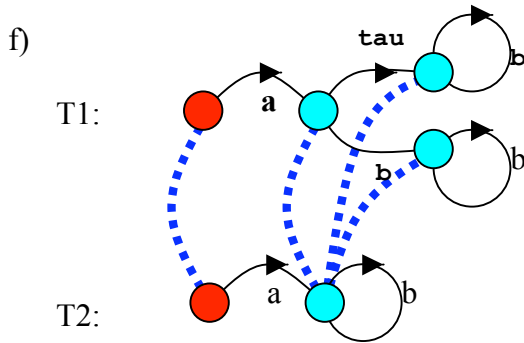


The black state can do b and also silently go to a state that can only do c's; such a state cannot be found in T2.

c)



The black state can do b and also silently go to a state that can only do c's; such a state cannot be found in T2.

d)
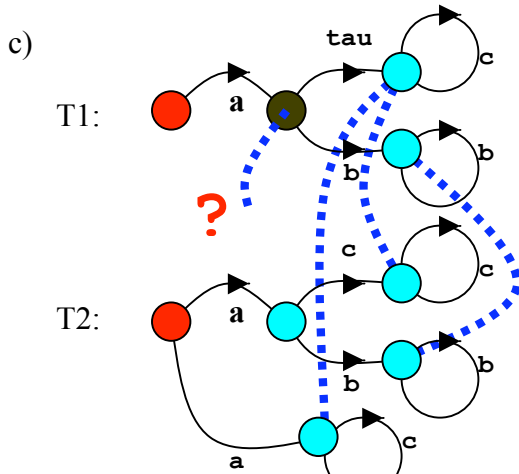
e) T1, T2

The initial state of T1 can do a and silently go to a state that can only do b; such a state does not exist in T2.

f) T1, T2

## Exercise 3

SYSTEM has both trace `get->a.copy->b.copy` and `get->b.copy-> a.copy`; DCOPY has only the first trace. So the processes are not trace equivalent, and therefore certainly not observation equivalent.

## Exercise 4

a) We adapt the definition of `BUFFER`:

```
BUFFER = (get[b:B] -> put[b] -> BUFFER
|get[b:B] -> put[b] -> put[b] -> BUFFER
|get[b:B] -> BUFFER).
```

b) We define the extra process `DBUFFER` and use that in the definition of `MEDIUM`:

```
||DBUFFER = (a:BUFFER||b:BUFFER)
/{get/a.get,mid/a.put,mid/b.get,put/b.put}
@{get,put}.

||MEDIUM = (a:DBUFFER||b:DBUFFER).
```