Solutions exercises werkcollege 5

Exercise 1

```
VARIABLE(N=2) = (write[x:0..N]->STORE[x]),
STORE[x:0..N] = (write[y:0..N]->STORE[y]
                |read[x]->STORE[x]).
```

Exercise 2
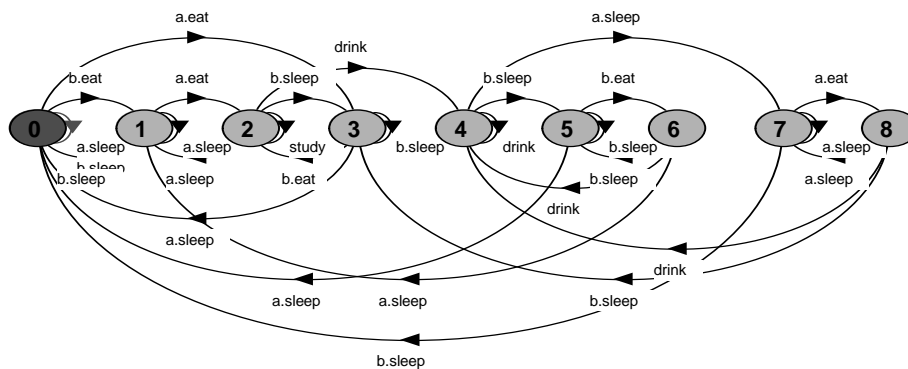
```
SENSOR = LEVEL[5],
LEVEL[n:0..9] = (level[k:0..9] -> LEVEL[k]
                |when(n<2) low -> LEVEL[n]
                |when(2<=n<=8) normal -> LEVEL[n]
                |when(n>8) high -> LEVEL[n]).
```

Exercise 3

```
a)
STUDENT = SLEEP,
SLEEP = (sleep -> SLEEP
        |eat -> STUDY),
STUDY = (study -> STUDY
        |sleep -> SLEEP
        |drink -> DRINK),
DRINK = (drink -> DRINK
        |sleep -> SLEEP).

b) ||FRIENDS = {a,b}:STUDENT
    /{study/{{a,b}.study},drink/{{a,b}.drink}}.
```

```
c)
    S0 = (a.eat->S3|b.eat->S1|a.sleep->S0|b.sleep->S0),
    S1 = (a.eat->S2|a.sleep->S1|b.sleep ->S0),
    S2 = (a.sleep->S1|b.sleep->S3|study->S2|drink->S4),
    S3 = (a.sleep->S0|b.sleep->S3|b.eat->S2),
    S4 = (a.sleep->S7|b.sleep->S5|drink->S4),
    S5 = (a.sleep->S0|b.sleep->S5|b.eat->S6),
    S6 = (a.sleep->S1|b.sleep->S5|drink->S4),
    S7 = (a.sleep->S7|b.sleep->S0|a.eat->S8),
    S8 = (a.sleep->S7|b.sleep->S3).
```

Exercise 4

```
ELEMENT = (up -> down -> ELEMENT).

||S2=v[i:1..4]:ELEMENT/{down/v[1..4].down}.
```

Exercise 5

Define the TEST process:

```
TEST = TEST[0],
TEST[i:R] = ({{east,west}.v[V].leave} -> TEST[i-1]
            |{{east,west}.v[V].enter} -> TEST[i+1]
            |{{east,west}.get[j:i-1..i+1]} -> TEST[i]
            |{{east,west}.get[i-2]} -> ERROR
            |{{east,west}.get[i+2]} -> ERROR
          ).
```

And adapt the definitions of COUNTER and CORRECT as follows:
U = -2..MAX+2

```
COUNTER = COUNTER[0],
COUNTER[n:R] = (get[n] -> COUNTER[n]
               |when (n>0) decr -> COUNTER[n-1]
               |when (n<MAX) inc -> COUNTER[n+1]
                  )+{get[U]}.
```

to make sure that TEST synchronizes with COUNTER on all get values.

```
||CORRECT = (OPENMUSEUM2 || TEST).
```

Because the labeling has already been taken care of in the definition of TEST.

When checking CORRECT we find that ERROR states are reached, i.e. the counter can be wrong by more than 1 person (indicating too many persons). This can be corrected by also locking the counter when people leave the museum.