

C340 Concurrency Tutorial1 - Answer Sheet

Exercise 1:

```
const BRIDGE_CAPACITY=5
range T=0..BRIDGE_CAPACITY

DIRECTION=DIRECTION[0],
DIRECTION[i:T]=(when (i<BRIDGE_CAPACITY) enter->DIRECTION[i+1]
                 |when (i>0)leave->DIRECTION[i-1]
                 |going[i]->DIRECTION[i]
                ).

BRIDGE_CONTROLLER=(south.going[s:T] ->
                  north.going[n:T] -> (
                    when (n==0) south.enter -> BRIDGE_CONTROLLER
                    |when (s==0) north.enter -> BRIDGE_CONTROLLER
                  )+{south.enter,south.going[T],
                   north.enter,north.going[T]}).

||BRIDGE = (north:DIRECTION || south:DIRECTION || BRIDGE_CONTROLLER ).
```

Exercise 2:

```
BRIDGE_DIRECTION = (south.going[s:T]-> north.going[n:T] ->
                   (when (s>0 && n>0) unsafe -> ERROR
                    |when (s==0 || n==0) safe ->BRIDGE_DIRECTION)).

BRIDGE_WEIGHT = (south.going[s:T]-> north.going[n:T] ->
                (when (s+n>BRIDGE_CAPACITY) unsafe -> ERROR
                 |when (s+n<=BRIDGE_CAPACITY) safe ->BRIDGE_WEIGHT)).

||BRIDGE_CHECK = (BRIDGE_DIRECTION || BRIDGE_WEIGHT || BRIDGE).
```

Exercise 3:

The BRIDGE would become a monitor class and the safety properties determine the monitor invariants.