

## Serie 2 - Java, Concurrency, FSP, LTS

### Exercise 1

Answer the following questions:

- What are traces, and what do they model?
- What states can a Java thread be in?
- How can it change state?
- What is the Runnable interface good for?
- How would you specify an FSP that repeatedly performs hello, but may stop at any time?

```
HELLO = (hello -> HELLO | stop -> STOP) .
```

- How can concurrency invalidate a class invariant?
- What happens if you call wait or notify outside a synchronized method or block?

Lets consider example bellow. It might happen that take check the condition, but before wait(); is called, the put() puts new value and take wait()s for ever.

```
take() {  
    if(isEmpty())  
        wait();  
}  
put() {  
    notify();  
}
```

- When is it better to use synchronized blocks rather than methods?

### Exercise 2

Download LTSA from <http://www.doc.ic.ac.uk/~jnm/book/ltsa/download.html>. For each of the following processes shown in Figure 1, give the Finite State Process (FSP) description of the corresponding Labeled Transition System (LTS) graph. You may verify the FSP descriptions by generating the corresponding state machines using the analysis tool.

### Exercise 3

Consider the full Race5K FSP from the lecture, i.e. for five steps.

- How many states and how many possible traces does it have?
- Can you indicate the number of states and traces in the general case, i.e. for  $n$  steps?
- Check your solution using the LTSA tool.

#### Exercise 4

A miniature portable FM radio has three controls. An on/off switch turns the device on and off. Tuning is controlled by two buttons scan and reset which operate as follows. When the radio is turned on or reset is pressed, the radio is tuned to the top frequency of the FM band (108 MHz). When scan is pressed, the radio scans towards the bottom of the band (88 MHz). It stops scanning when it locks on to a station or it reaches bottom (end). If the radio is currently tuned to a station and scan is pressed then it starts to scan from the frequency of that station towards bottom. Similarly, when reset is pressed the receiver tunes to top.

— Task: Using the alphabet {on, off, scan, reset, lock, end} model the FM radio as an FSP process called RADIO.

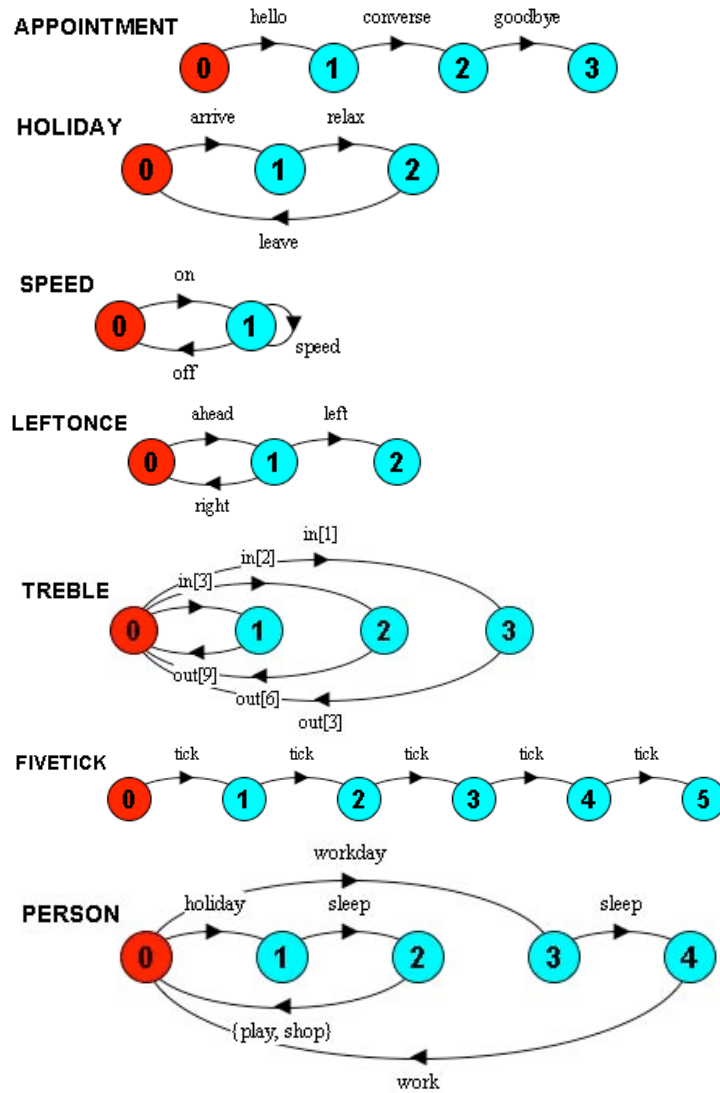


Figure 1: LTSA graphs.