

Chapter 2 - solutions

2.1

I. MEETING = (hello->converse->goodbye-> STOP).

II. JOB = (arrive->work->leave-> JOB).

III. GAME = ({one,two}-> WIN | three -> LOSE),
 WIN = (win -> GAME),
 LOSE = (lose-> GAME).

(Note: your solution may not produce exactly the LTS diagram in the question. Use minimise in LTSA to see if it is equivalent.)

IV. MOVE = (ahead->(left->STOP|right->MOVE)).

V. DOUBLE = (in[i:1..3]->out[i+i]->DOUBLE).

VI. FORTICK = TICK[0],
 TICK[i:0..4] = (when(i<4) tick->TICK[i+1]).
 or
 FORTICK = TICK[0],
 TICK[i:0..3] = (tick->TICK[i+1]),
 TICK[4] = STOP.

VII. PERSON = (weekday -> WORK | weekend-> PLAY),
 WORK = (sleep -> work -> PERSON),
 PLAY = (sleep ->(shop -> PERSON
 | play -> PERSON)
).

2.2 Variable:

```
const N=2
range R = 0..N

VARIABLE = VARIABLE[0],
VARIABLE[i:R] = ( read[i] -> VARIABLE[i]
                  | write[j:R] -> VARIABLE[j]
                  ).
```

2.3 Bistable digital circuit:

```
BISTABLE = ZERO,
ZERO = (trigger -> [0] -> ONE),
ONE = (trigger -> [1] -> ZERO).

MENU = (trigger -> MENU).
```

2.4 Sensor:

```
range Level = 0..9

SENSOR = (level[i:Level]->LEVEL[i]),
LEVEL[i:Level] = (when i<2 low -> SENSOR
                  |when i>=2 && i<=8 normal
                    -> SENSOR
                  |when i>8 high -> SENSOR
                  ).
```

2.5 Drinks dispensing machine:

```
DRINKS = CREDIT[0],
CREDIT[0] = (in.coin[5] -> CREDIT[5]
             |in.coin[10] -> CREDIT[10]
             |in.coin[20] -> CHANGE[5]
             ),
CREDIT[5] = (in.coin[5] -> CREDIT[10]
             |in.coin[10] -> CHANGE[0]
             |in.coin[20] -> CHANGE[10]
             ),
CREDIT[10]= (in.coin[5] -> CHANGE[0]
             |in.coin[10] -> CHANGE[5]
             |in.coin[20] -> CHANGE[15]
             ),
CHANGE[0] = (can -> DRINKS),
CHANGE[5] = (can -> out.coin[5] -> DRINKS),
CHANGE[10] = (can -> out.coin[10] -> DRINKS),
CHANGE[15] = (can -> out.coin[5]
              -> out.coin[10] -> DRINKS).
```

2.6 A miniature portable FM radio:

```
RADIO      = OFF,
OFF        = ( on -> TOP ),
TOP        = ( scan -> SCANNING
              | reset -> TOP
              | off -> OFF ),
SCANNING   = ( scan -> SCANNING
              | reset -> TOP
              | off -> OFF
              | lock -> TUNED
              | end -> BOTTOM ),
TUNED      = ( scan -> SCANNING
              | reset -> TOP
              | off -> OFF ),
BOTTOM     = ( scan -> BOTTOM
              | reset -> TOP
              | off -> OFF ).
```