CSCI910 – Software Requirements, Specifications and Formal Methods

Tutorial 9

Objectives

- Get familiar with Coloured Petri Net and CPN IDE

Design (Coloured) Petri Nets to model the oven system, and try to implement it with the CPN IDE.

Information about the CPN IDE:

- Official Website of CPN IDE: https://cpnide.org/
- CPN Tools online Tutorials: https://www.youtube.com/watch?v=38g1jMvNi6Q&list=PL24010632B8286DBC&index=4

NOTE: CPN IDE is only for Windows, but you can use it in a virtual environment if you use Mac or Linux. Here is the link to the free version of VirtualBox (https://www.virtualbox.org/).

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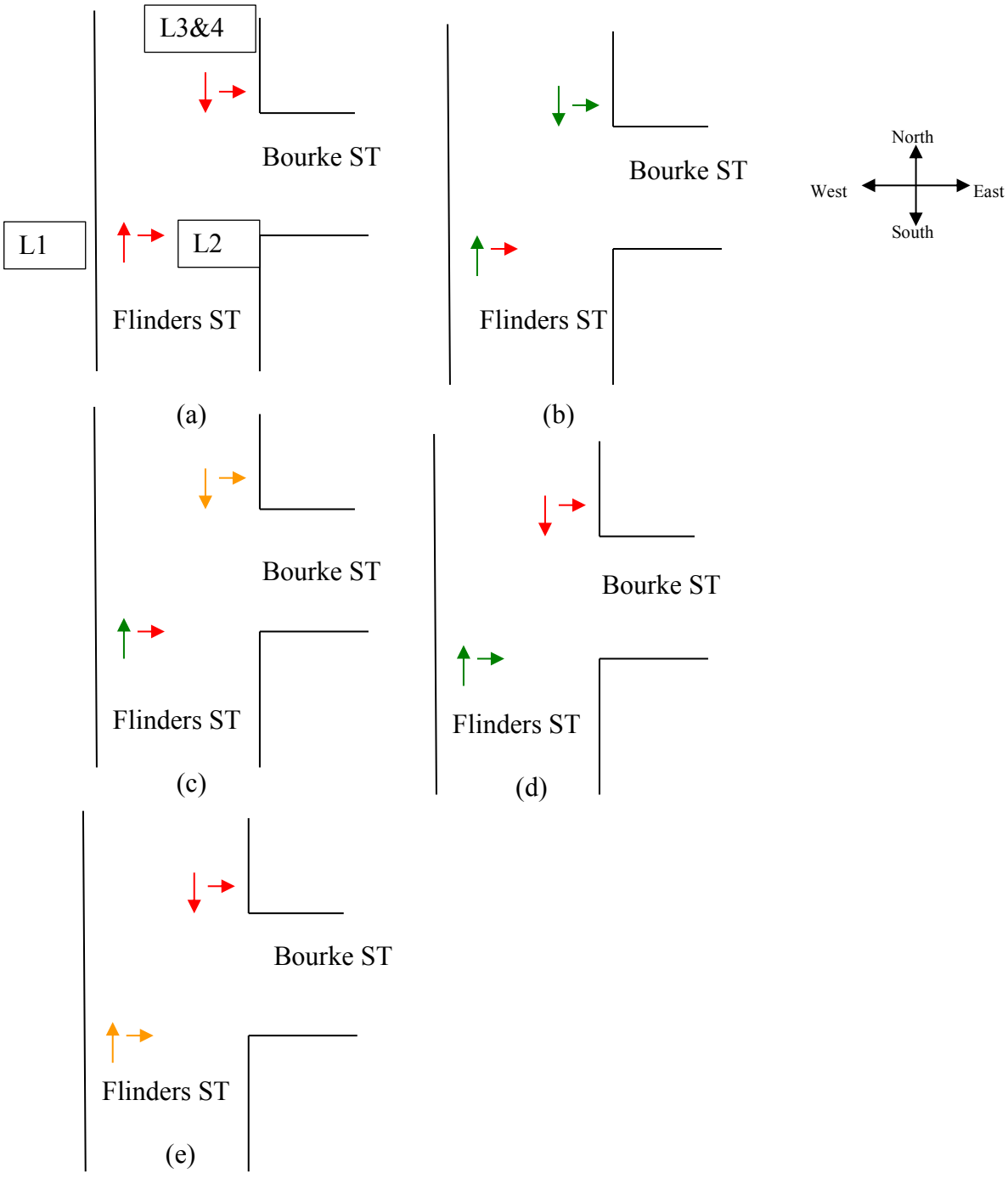
1. Problem Description:

Use a Petri Net to model the following two indicators for controlling cars across the street or turn to another street in an intersection based on the following requirements.

There is an intersection between Flinders Street and Bourke Street near North Wollongong Train Station. There are two traffic lights installed on Flinders Street to control the cars of the street to drive across the intersection, stop, or turn right/left to Burke Street. The statuses of the traffic lights are shown from Figure (a) to Figure (e). The transition sequence of the statuses is:

Figure (a) →Figure (b) →Figure (c) →Figure (d) →Figure (e) →Figure (a)

Please construct a Petri Net to model the two traffic lights on Flinders Street. You need to put the initial markings in your Petri Net to let two traffic lights be in the status of Figure (a).



Descriptions of Status (a) and (b) are as follows. You can easily get the meaning of other three statuses.

(a). L1, L2 and L3&4 are red (the initial state);
(b). L1 and L3&4 turn to green at the same time, but L2 keeps on red;
(c). L3&4 turns to yellow, L1 keeps on green and L2 keeps on red;
(d). L3&4 turns to red first, then L2 turns to green. L1 keeps on green as well;
(e). L1 and L2 turn yellow, and L3&4 keeps on red. After
(e), it goes back to (a).

2. Tasks:

- Design a Coloured Petri Net with the mathematic definition, i.e., C=(P, T, I, O), the initial marking, and the definition of all closets.
- Implement your Coloured Petri Net by using the CPN IDE. Execution the simulation of your cpn and analysis the state space of your cpn. Please if the states of your Petri Net are same as the specified order from (a) to (e).

P = {Red1, Green1, Yellow1,
Red2, Green2, Yellow2,
Red3, Green3, Yellow3,
Red4, Green4, Yellow4}
T = {T1, T2, T3, T4, T5, T6}

Color set = {"red", "green", "yellow"}
Initial markings (figure a): Red1, Red2, Red3, Red4.
(figure a: Red1, Red2, Red3, Red4)

I(T1) = {Red1, Red3, Red4}
O(T1) = {Green1, Green3, Green4}
(figure b: Green1, Red2, Green3, Green4)

I(T2) = {Green3, Green4}
O(T2) = {Yellow3, Yellow4}
(figure c: Green1, Red2, Yellow3, Yellow4)

I(T3) = {Yellow3, Yellow4}
O(T3) = {Red3, Red4}
I(T4) = {Green1, Red2, Red3, Red4}
O(T4) = {Green1, Green2, Red3, Red4}
(figure d: Green1, Green2, Red3, Red4)

I(T5) = {Green1, Green2} O(T5) = {Yellow1, Yellow2}
(figure e: Yellow1, Yellow2, Red3, Red4)

I(T6) = {Yellow1, Yellow2} O(T6) = {Red1, Red2}
(figure a: Red1, Red2, Red3, Red4)