6SENG002W Concurrent Programming

FSP Process Analysis & Design Form

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1. FSP Process Attributes

Attribute	Value
Name	PRINTER
Description	This is the basic procedure that simulates how a printer behaves in a printing system. Documents may be printed with it. The printer has to be replenished with paper when it runs out. The printer is designed to only allow a single user mutually exclusive access while it is in use, protecting the Printer process from interference and data corruption.
Alphabet	alphabet (PRINTER) = { acquireToPrint, acquireToRefill, cannotFill, fill, release }
Number of States	15
Deadlocks (yes/no)	No
Deadlock Trace(s) (if applicable)	Not Applicable

2. FSP Process Code

FSP Process:

```
const PAPER_TRAY_EMPTY = 0
const FULL_PAPER_TRAY = 3
range PAPER_TRAY = 0..3

set Students = { student1, student2 }
set Users = { Students, technician }

set ActionsCannotPerformByStudent = { acquireToRefill, fill, cannotFill } // Student
cannont preform thease actions
set ActionsCannotPerformByTechnician = { acquireToPrint } // Paper technician
cannont preform thease actions

PRINTER = PRINTER_IN_OPERATION[FULL_PAPER_TRAY],
PRINTER_IN_OPERATION[papersInTray: PAPER_TRAY] =
                        if (papersInTray > PAPER_TRAY_EMPTY)
                        then (acquireToPrint -> release -
>PRINTER_IN_OPERATION[papersInTray - 1]
                                                        | acquireToRefill
-> cannotFill -> release -> PRINTER_IN_OPERATION[papersInTray])
                                                    else
                                                        (acquireToRefill -> fill
-> release -> PRINTER_IN_OPERATION[FULL_PAPER_TRAY]).
```

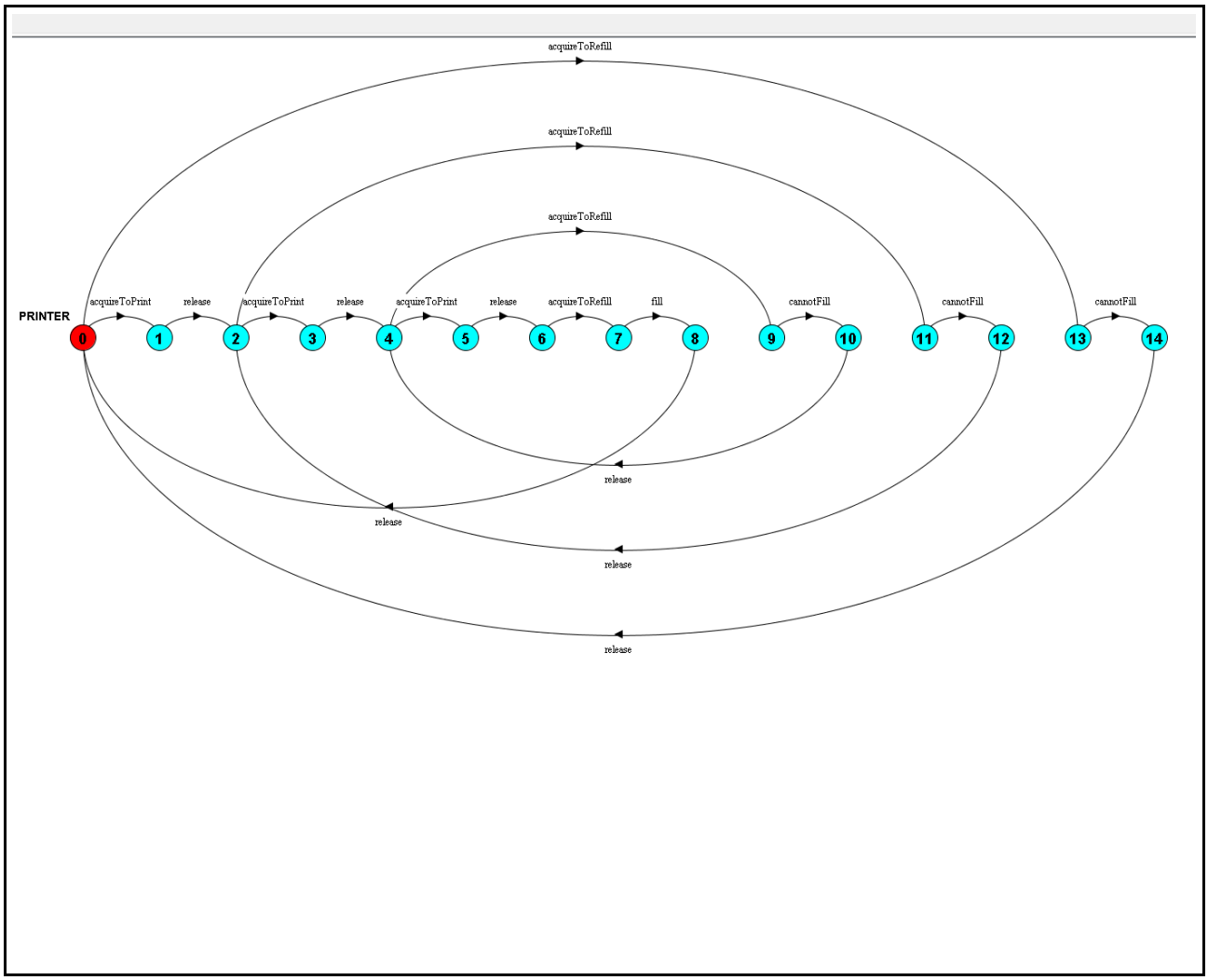
3. Actions Description

A description of what each of the FSP process' actions represents, i.e. is modelling. In addition, indicate if the action is intended to be synchronised (shared) with another process or asynchronous (not shared). (Add rows as necessary.)

Actions	Represents	Synchronous or Asynchronous
acquireToRefill	Acquiring the lock on the printer for mutual exclusive access, to refill the paper tray.	Synchronous
acquireToPrint	Acquiring the lock on the printer for mutual exclusive access, to print.	Synchronous
release	Releasing the lock on the printer	Synchronous
cannotFill	Indicates that cannot fill	Synchronous
fill	Fill the paper tray of the printer with paper when the paper tray is empty	Synchronous

4. FSM/LTS Diagrams of FSP Process

Note that if there are too many states, more than 64, then the LTSA tool will not be able to draw the diagram. In this case draw small diagrams of the most important parts of the complete diagram.



5. LTS States

A description of what each of the FSP process' states represents, i.e. is modelling. If there are a large number of states then you can group similar states together &/or only include the most important ones. For example, identify any states related to mutual exclusion (ME) & the associated critical section (CS), e.g. waiting to enter the CS state, in the CS state(s), left the CS state. (Add rows as necessary.)

State	Represents
0	The Printer is ready to be acquired.
1	A user who now owns the printer has mutually exclusive access to it.
2	The person who previously obtained the printer (State 0) has surrendered their mutually exclusive access to it, exiting the 1 state.
3	A user who now owns the printer has mutually exclusive access to it.
4	Same as State 2. Paper Tray level is at 1 page at this point.
5	A user who now owns the printer has mutually exclusive access to it.
6	The user who had previously acquired the printer (State 4) had released their mutually exclusive access to it and had therefore exited the CS state. The printer, however, is currently out of paper. Therefore, it has to be refilled before being acquired and used to print once again.
7	The paper technician has acquired the lock on the printer to refill the paper tray
8	The paper tray was empty, thus the person who had the printer's lock in the previous state may fill it with more paper.
9	To refill the paper tray, a user bought the printer. At this time, the Paper Tray level is 1.
10	The user is informed by this status that the printer is not currently empty and hence cannot be refilled (current paper tray level is 1 as indicated above)
11	Paper Tray level is 2 at this point
12	Paper Tray level is 2 at this point
13	Paper Tray Level is 3 at this point.
14	Paper Tray Level is 3 at this point

6. Trace Tree for FSP Process

The trace tree for the process. Use the conventions given in the lecture notes and add explanatory notes if necessary.