

# 6SENG006W Concurrent Programming

## FSP Process Analysis & Design Form

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### 1. FSP Process Attributes

<b>Attribute</b>	<b>Value</b>
<b>Name</b>	TICKET_PRINT_SYSTEM
<b>Description</b>	This is the model of the ticked print system based on printing tickets for the passengers. The machine is initialised with 3 tickets and if the print if the paper is available, and when the paper runs out the machine must be refilled.
<b>Alphabet</b>	{ {passenger1, passenger2}. { {acquireMachine, acquireRefill, insufficientPapers, paperFilled, printTicket}, printTicket[0], {refillPaper, refillPrinter, refillToner, release} }, {ticketTechnician, tonerTechnician}. {acquireMachine, acquireRefill, insufficientPapers, paperFilled, printTicket, refillPaper, refillPrinter, refillToner, release, wait} }
<b>Number of States</b>	12
<b>Deadlocks (yes/no)</b>	No
<b>Deadlock Trace(s) (if applicable)</b>	N/A

## 2. FSP Process Code

### FSP Process:

```
const TICKET_COUNT_MAX = 3
range TICKET_RANGE = 0..TICKET_COUNT_MAX

const PAPER_COUNT_MAX = 3
range PAPER_RANGE = 0..PAPER_COUNT_MAX

set MACHINE_ACTIONS = {acquireMachine, printTicket, acquireRefill, release,
                        refillPrinter, |refillToner}

TICKET_MACHINE(PAPER_COUNT = PAPER_COUNT_MAX) = TICKET_MACHINE[PAPER_COUNT],
TICKET_MACHINE[y : PAPER_RANGE] =
  if(y>0)
  then (acquireMachine -> (printTicket -> release -> TICKET_MACHINE[y-1]))
      ||| paperFilled -> release -> TICKET_MACHINE[y]))
  else (acquireRefill -> (refillPrinter -> release -> TICKET_MACHINE[PAPER_COUNT_MAX]))
      ||| insufficientPapers -> release -> TICKET_MACHINE[y])).
```

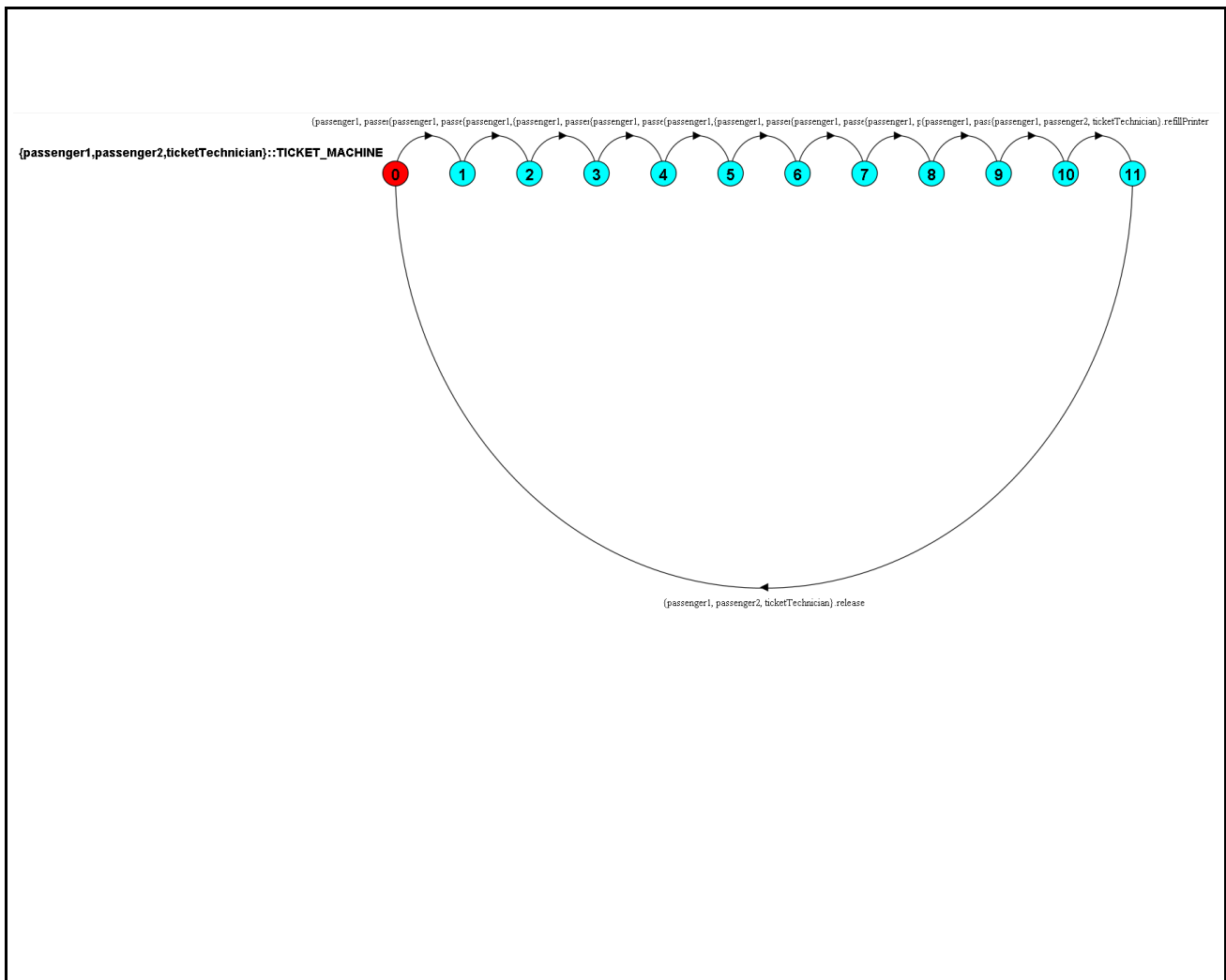
## 3. Actions Description

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
acquireMachine	Acquiring the lock on the ticket printer machine for mutual exclusive access to print a ticket.	Synchronous
acquireRefill	Acquiring the lock on the ticket printer machine for mutual exclusive access to print a ticket.	Synchronous
printTicket	Printing the ticket using the ticket machine.	Synchronous
release	Releasing the ticket machine after the tickets are printed or completing the paper refill process.	Synchronous
refillPrinter	Refilling the ticket machine with paper.	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
Q0	The ticket machine containing 3 tickets initially is ready to be used. Waiting to enter CS state.
Q1	The ticket machine is acquired by a process for printing the first ticket. ME
Q2	The ticket machine had printed the first ticket and ready to be released. Left the CS state.
Q3	After printing the 1 <sup>st</sup> ticket, the machine has been released and at this state the printer has 2 remaining tickets that are ready to be printed. Waiting to enter CS state.
Q4	The machine acquired by process for printing the 2 <sup>nd</sup> ticket. ME
Q5	The ticket machine had printed the second ticket and ready to be released. Left the CS state.
Q6	After printing the 2 <sup>nd</sup> ticket, the machine has been released and at this state the printer has 1 remaining ticket that are ready to be printed. Waiting to enter CS state.
Q7	The machine acquired by process for printing the 3 <sup>rd</sup> ticket. ME
Q8	The ticket machine had printed the third ticket and ready to be released. Left the CS state.
Q9	After printing the 3 <sup>rd</sup> ticket, the machine has been released and at this state the printer has no remaining ticket that are ready to be printed and is ready to be refilled. Waiting to enter CS state.
Q10	The machine has been acquired for refilling.
Q11	The ticket machine is waiting to be released at this state the printer has 3 sheets of paper.
Q12	The ticket machine containing 3 tickets is ready to be used. Waiting to enter CS state.

## 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.

