6SENG006W Concurrent Programming

FSP Process Analysis & Design Form

Name	Achintha Jayatilake
Student ID	2019530
Date	08/01/2024

1. FSP Process Attributes

Attribute	Value
Name	ADVANCED_TICKETING_SYSTEM
Description	The shared printer in this system is designed for concurrent use with the capability to handle various tasks like printing, paper reloading, and toner refilling. It ensures mutual exclusive access to prevent data corruption and interference, allowing only one user to operate it at any given time. The printer also features mechanisms to check and automatically refill paper and toner when they run out. This model provides an efficient and reliable printing process, accommodating the needs of a busy environment while maintaining the integrity of the printer's operations
Alphabet	acquirePrinting, acquireReloading, acquireTonerRefill, free, load, notifyPaperEmpty, notifyTonerEmpty, refillToner}
Number of States	56
Deadlocks (yes/no)	No
Deadlock Trace(s) (if applicable)	Not applicable

2. FSP Process Code

FSP Process:

```
range PAPER_TRAY = 0..2
const EMPTY_PAPER_TRAY = 0
const FULL_PAPER_TRAY = 2

range TONER_LEVEL = 0..3
const EMPTY_TONER_LEVEL = 0
const FULL_TONER_LEVEL = 3

ADVANCED_TICKETING_SYSTEM =
PRINTER_IN_OPERATION[FULL_PAPER_TRAY][FULL_TONER_LEVEL],

PRINTER_IN_OPERATION[papersInTray: PAPER_TRAY] [tonerInPrinter:
TONER_LEVEL] =
 if (papersInTray > EMPTY_PAPER_TRAY) then
   if (tonerInPrinter > EMPTY_TONER_LEVEL) then
     // Prioritize printing over reloading:
     (acquirePrinting -> free -> PRINTER_IN_OPERATION[papersInTray -
1][tonerInPrinter - 1]
          |acquireReloading -> load -> free ->
PRINTER_IN_OPERATION[FULL_PAPER_TRAY][tonerInPrinter]
          |acquireTonerRefill -> refillToner -> free ->
PRINTER_IN_OPERATION[papersInTray][FULL_TONER_LEVEL])
   else
     (notifyTonerEmpty -> acquireTonerRefill -> refillToner -> free ->
PRINTER_IN_OPERATION[papersInTray][FULL_TONER_LEVEL])
 else
   (notifyPaperEmpty -> acquireReloading -> load -> free ->
PRINTER_IN_OPERATION[FULL_PAPER_TRAY][tonerInPrinter]).
```

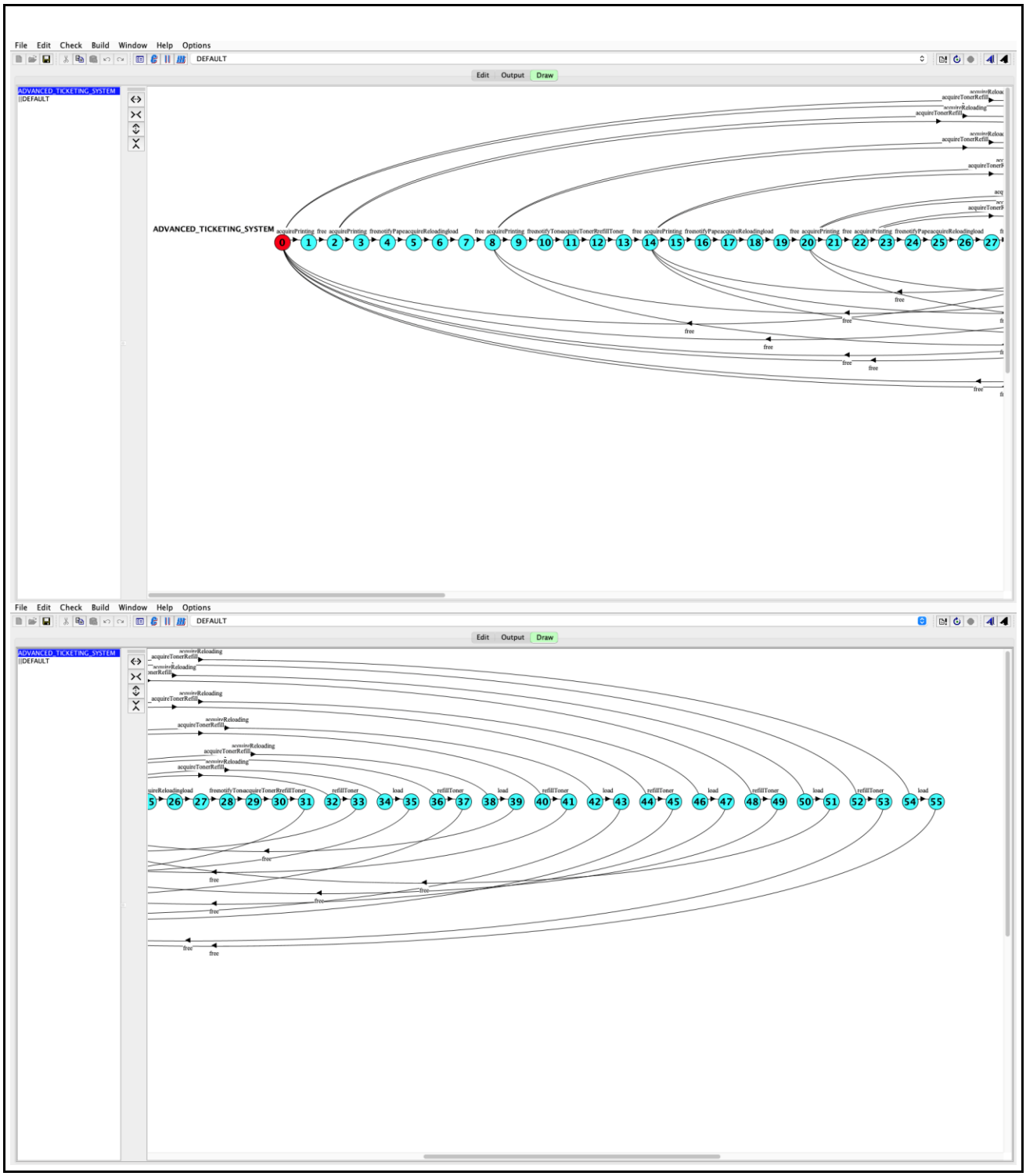
3. Actions Description

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
acquirePrinting	A user starts a printing operation	Asynchronous
free	Releases the printer after use	Asynchronous
acquireReloading	A user or technician initiates paper reloading	Asynchronous
unableToLoad	Indicates paper reloading is not possible currently	Asynchronous
load	Actual loading of paper into the printer	Asynchronous
acquireTonerRefill	Initiating the process to refill toner	Asynchronous
refillToner	Actual refilling of the toner	Asynchronous
notifyTonerEmpty	Notification that the toner is empty	Asynchronous
notifyPaperEmpty	Notification that the paper tray is empty	Asynchronous

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, Q7, Q8, Q13, Q14, Q19, Q20, Q27, Q28, Q31, Q33, Q35, Q37, Q39, Q41, Q43, Q45, Q47, Q49, Q51, Q53, Q55	System ready for printing, toner refill, or reloading; awaiting free state after an action
Q1, Q3, Q9, Q15, Q21, Q23	Printing process ongoing, awaiting free state
Q2, Q22	Ready for printing, toner refill, or reloading; handling resources
Q4, Q16, Q24	Notification of paper empty
Q5, Q17, Q25	Acquiring reloading due to paper empty
Q6, Q18, Q26, Q34, Q38, Q42, Q46, Q50, Q54	Loading paper
Q10, Q29	Notification of toner empty
Q11, Q30	Acquiring toner refill due to toner empty
Q12, Q32, Q36, Q40, Q44, Q48, Q52	Refilling toner

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.