

# 6SENG002W Concurrent Programming

## FSP Process Composition Analysis & Design Form

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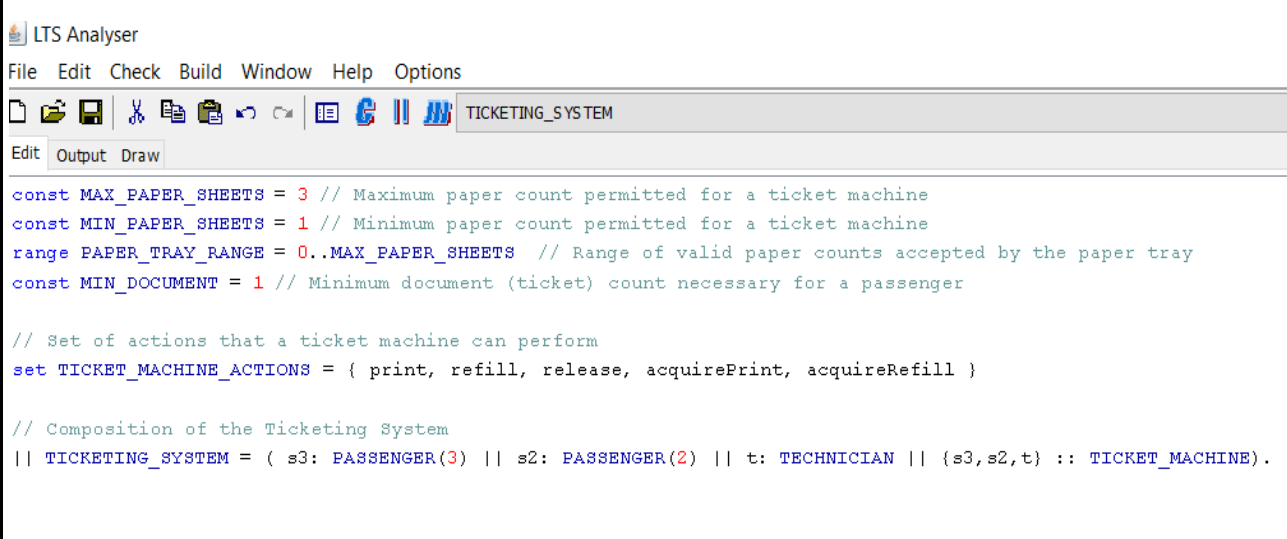
### 1. FSP Composition Process Attributes

Attribute	Value
<b>Name</b>	TICKETING_SYSTEM
<b>Description</b>	This depicts a composite process model for a ticketing system, encompassing two passenger processes and a technician process.
<b>Alphabet</b> (Use LTSA's compressed notation, if alphabet is large.)	{ {p2, p3}. {acquirePrint, acquireRefill, print, refill, release}, t. {acquirePrint, acquireRefill, print, refill, release, wait} }
<b>Sub-processes</b> (List them.)	TICKET_MACHINE, p1: PASSENGER, p2: PASSENGER, TECHNICIAN
<b>Number of States</b>	55
<b>Deadlocks</b> (yes/no)	No
<b>Deadlock Trace(s)</b> (If applicable)	Not applicable

## 2. FSP "main" Program Code

The code for the parallel composition of all of the sub-processes and the definitions of any constants, ranges & process labelling sets used. (Do not include the code for the other sub-processes.)

**FSP Program:**



The screenshot shows the LTS Analyser application window. The title bar reads 'LTS Analyser'. The menu bar includes 'File', 'Edit', 'Check', 'Build', 'Window', 'Help', and 'Options'. The toolbar contains icons for file operations and analysis. The main text area displays the following FSP code:

```
const MAX_PAPER_SHEETS = 3 // Maximum paper count permitted for a ticket machine
const MIN_PAPER_SHEETS = 1 // Minimum paper count permitted for a ticket machine
range PAPER_TRAY_RANGE = 0..MAX_PAPER_SHEETS // Range of valid paper counts accepted by the paper tray
const MIN_DOCUMENT = 1 // Minimum document (ticket) count necessary for a passenger

// Set of actions that a ticket machine can perform
set TICKET_MACHINE_ACTIONS = { print, refill, release, acquirePrint, acquireRefill }

// Composition of the Ticketing System
|| TICKETING_SYSTEM = ( s3: PASSENGER(3) || s2: PASSENGER(2) || t: TECHNICIAN || {s3,s2,t} :: TICKET_MACHINE).
```

## 3. Combined Sub-processes

(Add rows as necessary.)

Process	Description
P2: PASSENGER	This sub-process models the behaviour of a passenger who uses the ticket machine to print ticket documents. This instance of a passenger process is wished to print 3 ticket documents.
P3: PASSENGER	This sub-process models the behaviour of a passenger who uses the ticket machine to print ticket documents. This instance of a passenger process is wished to print 3 ticket documents.
TECHNICIAN	This sub-process models the behaviour of a technician who refills the printer with paper when it needs to be refilled.
TICKET_MACHINE	This sub process models the behaviour of the ticket machine.

#### 4. Analysis of Combined Process Actions

- **Synchronous** actions are performed by at least two sub-process in the combination.
- **Blocked Synchronous** actions cannot be performed, since at least one of the sub-processes cannot perform them, because they were added to their alphabet using alphabet extension.
- **Asynchronous** actions are performed independently by a single sub-process.

Group actions together if appropriate, for example if they include indexes, e.g.  $\text{in}[0], \text{in}[1], \dots, \text{in}[5]$  as  $\text{in}[1..5]$ .

Synchronous Actions	Synchronised by Sub-Processes (List)
p2.acquirePrint, p2.print	P2:PASSENGER(2), TICKET_MACHINE
p3.acquirePrint, p3.print	P3:PASSENGER(3), TICKET_MACHINE
p2.release, t.release	t:TECHNICIAN, P3:PASSENGER(3), TICKET_MACHINE
p3.release, t.release	t:TECHNICIAN, P2:PASSENGER(2), TICKET_MACHINE
t.acquireRefil, t.refill	t:TECHNICIAN,TICKET_MACHINE

Blocked Synchronous Actions	Synchronizing Sub process (List)	Blocking sub-process
p2.acquireRefill, p2.refill	P2: PASSENGER (2), TICKET_MACHINE	P2: PASSENGER (2)
p3.acquireRefil, p3.refill	P3: PASSENGER (3), TICKET_MACHINE	P3: PASSENGER (3)
t.acquirePrint, t.print	t.TECHNICIAN, TICKET_MACHINE	t.TECHNICIAN

Sub-Process	Asynchronous Actions (List)
P2: PASSENGER (2)	Not applicable
P3: PASSENGER (3)	Not applicable
TICKET_MACHINE	Not applicable
t.TECHNICIAN	t.wait

## 5. Parallel Composition Structure Diagram

The structure diagram for the parallel composition.

