

6SENG006W Concurrent Programming

FSP Process Composition Analysis & Design Form

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1. FSP Composition Process Attributes

Attribute	Value
Name	Printing_System
Description	Process representing a printing system with two students, one student printing 3 documents and the other printing 2 documents, a technician refilling the printer with 3 documents, and a printer that can hold up to 3 documents
Sub-processes (List them.)	PRINTER, STUDENT, TECHNICIAN
Number of States	55 (0..54)
Deadlocks (yes/no)	no
Deadlock Trace(s) (If applicable)	N/A

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 individual sub-processes.)

FSP Program:

```
// Set of actions that can be performed on the printer
set PRINTER_ACTIONS = {print, printAquire, refill, refillAquire, release}
// The maximum number of sheets printer can hold
const MAXIMUM_SHEETS = 3

// Printing system consisting of 2 students, one student that is to print 3 documents and
// one student that is to print 2 documents, a technician that is to refill the printer with 3 documents,
// and a printer that can hold up to 3 documents
||PRINTING_SYSTEM = (
    // Student 3 prints 3 documents
    stu3: STUDENT(3)
    // Student 2 prints 2 documents
    || stu2: STUDENT(2)
    // Technician refills the printer when it runs out of paper and waits otherwise
    || tech: TECHNICIAN
    // the 2 students (stu3 and stu2), the technician (tech), and the printer are all running in parallel
    || {stu3, stu2, tech} ::
    PRINTER
)
```

3. Combined Sub-processes

(Add rows as necessary.)

Process	Description
PRINTER	Initializes the printer with a given number of sheets and continues. If the printer has at least one sheet of paper left, allows a user to take mutually exclusive control of the printer, prints a document, releases control of the printer, and transitions to the same process with one less sheet of paper. If the printer has run out of paper, allows the technician to take mutually exclusive control of the printer, refills the printer with the maximum number of sheets (3), releases control of the printer, and transitions to the same process with the maximum number of sheets (3).
STUDENT	A process that represents a student. It takes a number of documents to be printed as an input and performs the actions printAcquire , print , and release . It takes mutually exclusive control of the printer, prints each of the documents, and releases control of the printer. It ends after printing the last document.
TECHNICIAN	A process that represents a technician. It performs the actions refillAcquire , refill , and release . It takes mutually exclusive control of the printer, refills it with the maximum number of sheets(3), and releases control of the printer. It then waits for the next action and repeats the process.

4. Analysis of Combined Process Actions

- **Alphabets** of the combined processes, including the final process labelling.
- **Synchronous** actions are performed by at least two sub-process in the combination.
- **Blocked Synchronous** actions cannot be performed, because at least one of the sub-processes can never 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, e.g. if they include indexes in[0], in[1], ..., in[5] as in[1..5]. Add rows as necessary.

Processes	Alphabet (Use LTSA's compressed notation , if alphabet is large.)
PRINTER	{print, printAquire, refill, refillAquire, release}
STUDENT	{print, printAquire, release}
TECHNICIAN	{refill, refillAquire, release, wait}

Synchronous Actions	Synchronised by Sub-Processes (List)
printAquire	PRINTER, STUDENT, TECHNICIAN
refillAquire	TECHNICIAN, PRINTER
release	PRINTER, STUDENT, TECHNICIAN
print	PRINTER, STUDENT
refill	TECHNICIAN, PRINTER
wait	TECHNICIAN

Blocked Synchronous Actions	Blocking Processes	Blocked Processes
refillAquire	PRINTER	TECHNICIAN
printAquire	PRINTER	STUDENT
release	PRINTER	STUDENT, TECHNICIAN
print	PRINTER	STUDENT
refill	TECHNICIAN	PRINTER
refillAquire	PRINTER	TECHNICIAN

Sub-Processes	Asynchronous Actions (List)
PRINTER	PAPER_AMOUNT, pap
STUDENT	DOCUMENT_AMOUNT, doc
TECHNICIAN	None - <i>does not perform any actions that do not depend on other actions being performed at the same time.</i>

5. Parallel Composition Structure Diagram

The structure diagram for the parallel composition.

