6SENG002W Concurrent Programming

FSP Process Composition Analysis & Design Form

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1. FSP Composition Process Attributes

Attribute	Value
Name	PRINTING_SYSTEM
Description	The composite process is shown by the Printing system. It uses the student, technician and printer sub processes and combines to form the composite process. The student, technician and the printer sub processes are mutually exclusive, and each process waits till they are called. The printer process can hold up to 03 sheets of paper in its tray. The printing system terminates all actions after the printing. There is no error or deadlock in this composite process.
Alphabet (Use LTSA's compressed notation, if alphabet is large.)	Alphabet: { student1.{{acquireToPrint, acquireToRefill, cannotFill, fill}, printDocument[1..3], release}, student2.{{acquireToPrint, acquireToRefill, cannotFill, fill}, printDocument[1..2], release}, technician.{acquireToPrint, acquireToRefill, cannotFill, fill, release}, terminate }
Sub-processes (List them.)	student1:STUDENT(3) student2:STUDENT(2) TECHNICIAN PRINTER
Number of States	80
Deadlocks (yes/no)	No deadlocks/errors
Deadlock Trace(s) (If applicable)	No deadlocks/errors

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:

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

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

set StudentProhibitedActions = { acquireToRefill, fill, cannotFill }
set TechnicianProhibitedActions = { acquireToPrint }

||PRINTING_SYSTEM = ( student1: STUDENT(3) || student2: STUDENT(2) ||
technician: TECHNICIAN || Users :: PRINTER ) / { terminate / Users.terminate }.
```

3. Combined Sub-processes

(Add rows as necessary.)

Process	Description
PRINTER	This sub-process carries the functions of the printer. It is used by the technicians and the students to print documents.
Student1 : STUDENT(3)	This sub-process carries the function of a student. This is one student who is waiting to print 03 documents. This sub-process prints only if the paper tray contains enough papers to print the document. If paper level is not available, in the tray, the student waits.
Student2 : STUDENT(2)	This sub-process carries the function of a student. This is another student who is waiting to print 02 documents. This sub-process prints only if the paper tray contains enough papers to print the document. If paper level is not available, in the tray, the student waits.
TECHNICIAN	This sub-process carries the function of a technician. This is technician who is allowed to refill the paper tray of the printer when it's empty. Synchronously checks for the available paper level in the paper tray and refills it by making the student to wait.

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 preform them, because they were added to their alphabet using alphabet extension.
- **Asynchronous** actions are preformed independently by a single sub-process.

Group actions together if appropriate, for example if they include indexes,
e.g. in[0], in[1], …, in[5] as in[1..5].

(Add rows as necessary.)

Synchronous Actions	Synchronised by Sub-Processes (List)
student1.{acquireToPrint, acquireToRefill, cannotFill, fill, release},	student1:STUDENT(3) & PRINTER
student2.{acquireToPrint, acquireToRefill, cannotFill, fill, release}	student2:STUDENT(2) & PRINTER
technician.{acquireToPrint, acquireToRefill, cannotFill, fill, release}	TECHNICIAN & PRINTER
terminate	student1:STUDENT(3) , student2:STUDENT(2) , TECHNICIAN

Sub-Process	Asynchronous Actions (List)
student1 : STUDENT(3)	student1.printDocument[1..3]
student2 : STUDENT(2)	student2.printDocument[1..2]
PRINTER	None
TECHNICIAN	None

5. Parallel Composition Structure Diagram

The structure diagram for the parallel composition.