# A6SENG002W Concurrent Programming

# FSP Process Analysis & Design Form

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## 1. FSP Process Attributes

| Attribute | Value |
|---|---|
| **Name** | PRINTER |
| **Description** | A printing machine which can be used to print documents. |
| **Alphabet** | {{acquire, empty}, print[1..3], {refill_printer, release}} |
| **Number of States** | 18 |
| **Deadlocks (yes/no)** | No deadlocks/errors |
| **Deadlock Trace(s) (if applicable)** | None |

## 2. FSP Process Code

**FSP Process:**

```
const START_SHEET_COUNT        =    0
const START_DOC_COUNT          =    1
const MIN_SHEET_COUNT          =    1
const MAX_SHEET_COUNT          =    3
range DOC_COUNT                =    MIN_SHEET_COUNT ..
MAX_SHEET_COUNT
range SHEET_STACK              =    START_SHEET_COUNT ..
MAX_SHEET_COUNT


// First printer must be started before printing, then
// printer acquires by user and print docs and releases it, If there are no sheets
available technician will refill it.
// First printer must be started before printing, then
// printer acquires by user and print docs and releases it, If there are no sheets
available technician will refill it.
PRINTER(SHEETS_AVAILABLE = MAX_SHEET_COUNT) =
PRINTER_AVAILABLE[MAX_SHEET_COUNT],
      PRINTER_AVAILABLE[sheets_available: SHEET_STACK] =
                        if  ( sheets_available > START_SHEET_COUNT )
                        then ( acquire -> print[DOC_COUNT] -> release ->
PRINTER_AVAILABLE[sheets_available - 1]  )
                        else ( empty -> refill_printer -> release ->
PRINTER_AVAILABLE[MAX_SHEET_COUNT] ).
```

## 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 |
|---|---|---|
| acquire | Acquiring the printer by a student to print a document or to by a technician to refill the printer | Synchronised |
| Print[1] | Printing a document which has ID = 1 | Synchronised |
| Print[2] | Printing a document which has ID = 2 | Synchronised |
| Print[2] | Printing a document which has ID = 3 | Synchronised |
| empty | Notifying the technician that the printer ran out of documents | Synchronised |
| release | Releasing the printer by a student after printing a document or by a technician after refilling the printer | Synchronised |

# 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.
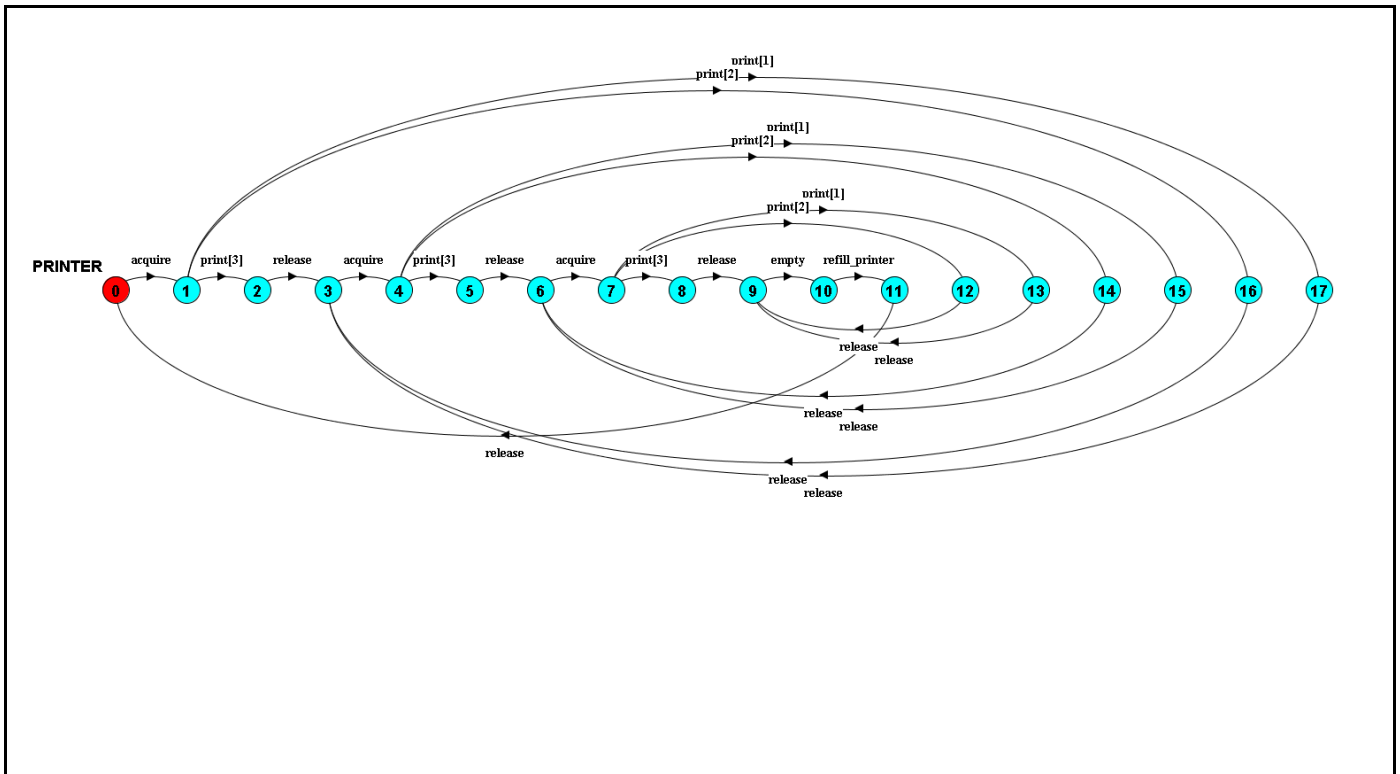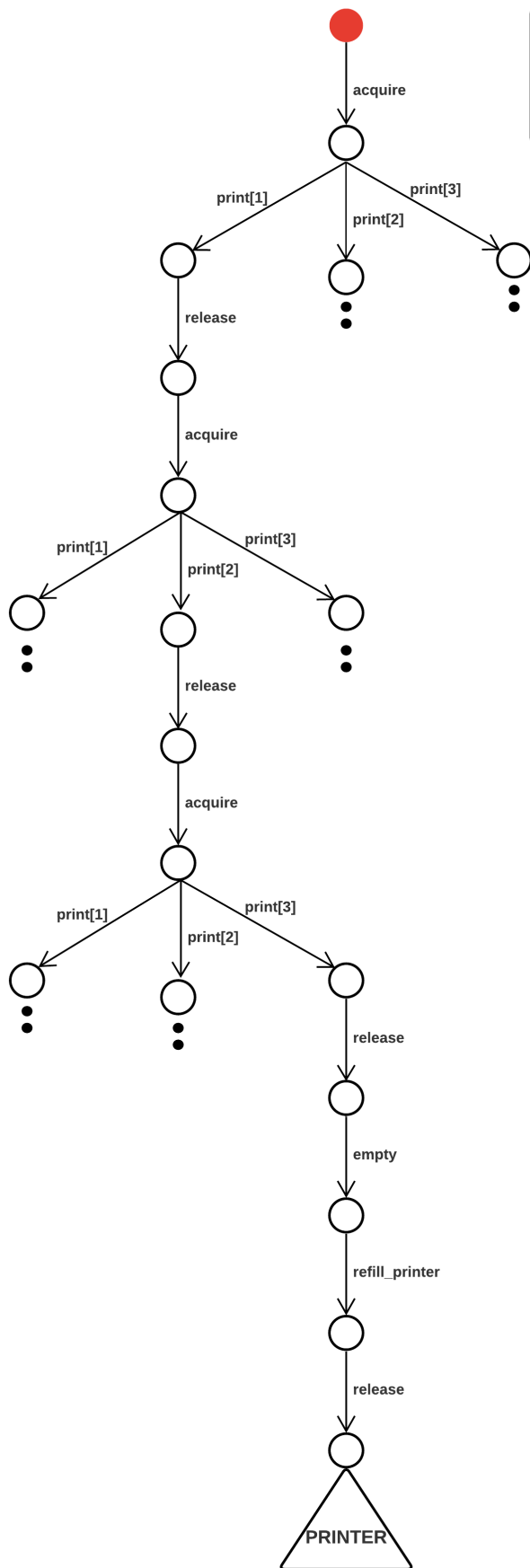
## 5. LTS States

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 |
|---|---|
| 0 | Printer is available to be acquired by either a student or a technician |
| 1 | Printer is acquired by a student |
| 2 | A document with ID = 3 has been printed |
| 3 | Printer is released by a student after printing a document |
| 4 | Printer is acquired by a student |
| 5 | A document with ID = 3 has been printed |
| 6 | Printer is released by a student after printing a document |
| 7 | Printer is acquired by a student |
| 8 | A document with ID = 3 has been printed |
| 9 | Printer is released by a student after printing a document |
| 10 | Printer has run out of paper and acquired by a technician to refill it |
| 11 | Printer has refilled by a technician |
| 12 | A document with ID = 2 has been printed |
| 13 | A document with ID = 1 has been printed |
| 14 | A document with ID = 2 has been printed |
| 15 | A document with ID = 1 has been printed |
| 16 | A document with ID = 2 has been printed |
| 17 | A document with ID = 1 has been printed |

## 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.

**PRINTER**

**acquire**

**print[1]**  **print[2]**  **print[3]**

**release**

**acquire**

**print[1]**  **print[2]**  **print[3]**

**release**

**acquire**

**print[1]**  **print[2]**  **print[3]**

**release**

**empty**

**refill_printer**

**release**

**PRINTER**

I have drawn the diagram only for one trace to avoid the complexity. Double black dots are used to show the repertative pattern.
( Not infinite )