

## Exercise 1:

1.  $LTS = \langle S, L, \rightarrow \rangle$        $\langle X, Y, S, \delta_{ext}, \delta_{int}, \lambda, \tau \rangle$

$S = S$   
 $L = X \cup Y$   
 $\rightarrow = \delta_{ext}, \delta_{int}$

$\lambda, \tau$  doesn't match any of these,  
 cause  $\rightarrow$  is a set of state transition  
 but  $\lambda = S \rightarrow Y$  they are not state transition  
 $\tau \alpha = S \rightarrow R_o^+$

## Exercise 2: (a)

$r_n \rightarrow [b] \rightarrow r_{n-1}$   
 $r_{n-1} = D(r_n)$   
 $r_{n-2} = D(r_{n-1})$   
 $r_{n-3} = D(r_{n-2})$   
 $r_{n-4} = D(r_{n-3})$   
 $r_n = D(r_n) - D(r_{n-3}) - \alpha^3$

$$\begin{bmatrix} r_n(k+1) \\ r_{n-1}(k+1) \\ r_{n-2}(k+1) \\ r_{n-3}(k+1) \\ r_{n-4}(k+1) \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & -1 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} r_n(k) \\ r_{n-1}(k) \\ r_{n-2}(k) \\ r_{n-3}(k) \\ r_{n-4}(k) \end{bmatrix} + \begin{bmatrix} \alpha^3 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$\rightarrow$  so we don't need  $r_{n-4}$ , set  $n=4$

## Exercise 2: (b)

k	r1	r2	r3	r4
0	1	2	-2	1
1	2	-2	1	$-\alpha^3$
2	-2	1	$-\alpha^3$	$-2\alpha^3 - 2$
3	1	$-\alpha^3$	$-2\alpha^3 - 2$	$-3\alpha^3$
4	$-\alpha^3$	$-2\alpha^3 - 2$	$-3\alpha^3$	$-4\alpha^3 - 1$
5	$-2\alpha^3 - 2$	$-3\alpha^3$	$-4\alpha^3 - 1$	$-4\alpha^3 - 1$

## Exercise 3(a):

### Primary States:

phase: passive, active, respond

sigma: any positive real number including positive infinity

### Secondary States:

count: any positive integer less than or equal to seven

**Parameters:**

stepTime: time unit for every single step

**Initialization:**

Phase = passive

Sigma = infinity

Count = 0

stepTime = 1

**External Transition Function:**

If (input == 1) set Phase = active

Else if (input == 0) set Phase = respond

**Internal Transition Function:**

If (Phase == active) count = count+1

**Output Function:**

If (Phase == respond) print out the output

**Exercise 3(b)**

Time	Input	State	Output
0	1	(active,1.0,0)	∅
1--	∅	(active,1.0,1)	∅
1-	∅	(passive,∞,1)	∅
1	0	(respond,1.0,1)	∅
2--	∅	(respond,1.0,1)	∅
2-	∅	(passive, ∞,1)	1
2	1	(active,1.0,1)	∅
3--	∅	(active,1.0,2)	∅
3-	∅	(passive, ∞,2)	∅
3	1	(active,1.0,2)	∅
4--	∅	(active,1.0,3)	∅
4-	∅	(passive, ∞,3)	∅
4	0	(respond,1.0,3)	∅
5--	∅	(respond,1.0,3)	∅
5-	∅	(passive, ∞,3)	3

**Exercise 5**

Zcounter = <SZ,IZ,OZ,NZ,RZ>

SZ : {active,passive,respond}

IZ : {1,-1,2,0}

OZ : {0,1,2,3,4,5,6,7}

NZ : internal state transition deltint()

RZ : output function [message](#) out( )