

Oct 23, 2015
CSE 241

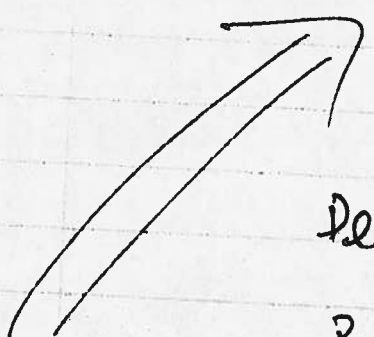
Finite State Machines FSM

↓ tool

Design of a sequential circuit

Problem that has "state"

~~Memory~~
MEMORY



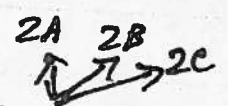
- program
- Java
- python
- any lang.

US Football

FSM Five-tuple

{ initial state, final state, set of states, set of transitions, symbols / triggers that bring about the transition }

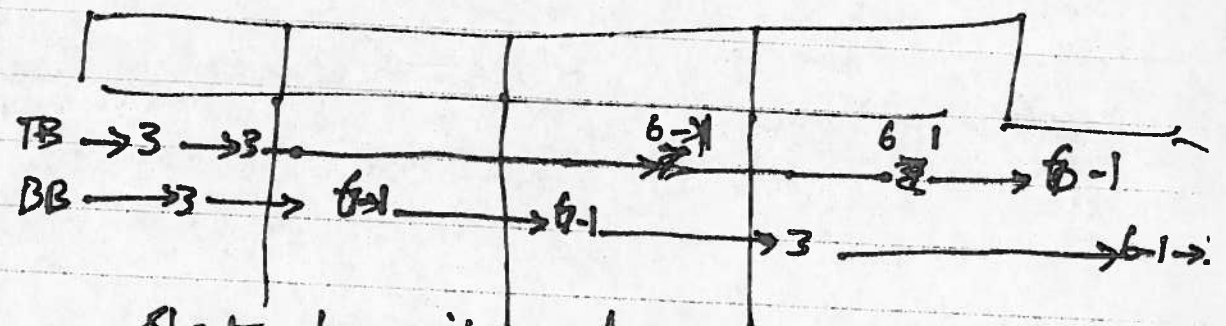
- Two beams
- set of input symbol { 1, 2, 3, 6 }
initial (S_0) → (S_{score}) ... → (S_x)
- state diagram transitions



②
Oct 23, 201

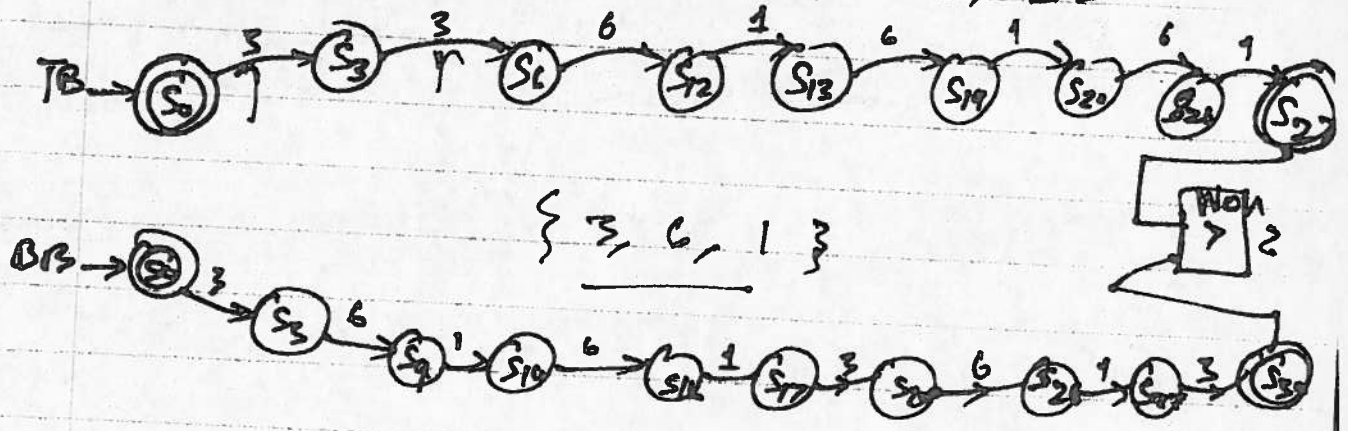
Two teams: Buffalo Bills (BB)
Tambay Buccaneers (TB)

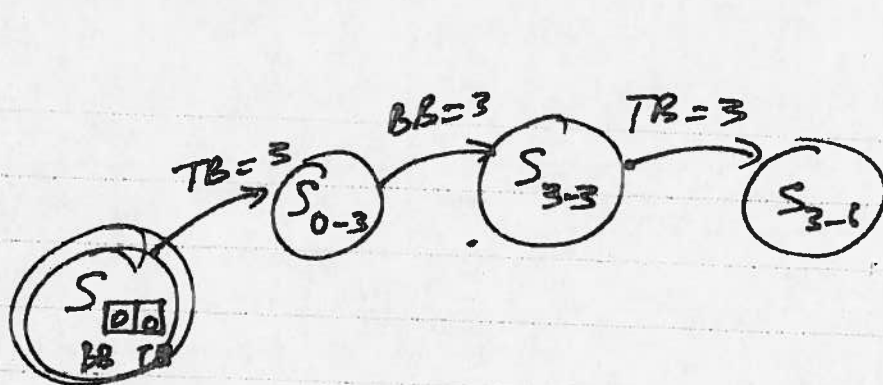
Scoring History:



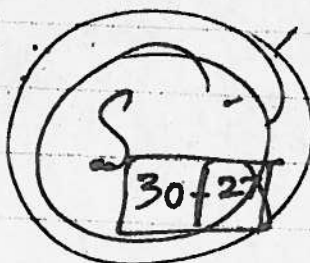
State transition diagram:

Design 1: Two instances: TB / BB





Oct 23, 2017 ⁽³⁾



Oct 25, 2017 ^①

1. How to submit Lab on Ublearns.
2. Academic Integrity
 - Individual labs
 - List of 'No's

language recognition

2. Sequential circuit design

Design a sequential circuit for recognizing pattern 1001 in an input string (x) of 0's and 1's. Use D-FF and provide the complete design. Show all the steps.

↑ small pattern

x 1 0 1 0 0 0 0 0 0 1 0 0 1
~~x x x x x x x x x~~ ↑ ↑ ↑ ↑
 1

Analysis ↑
 Design ↓

word problem

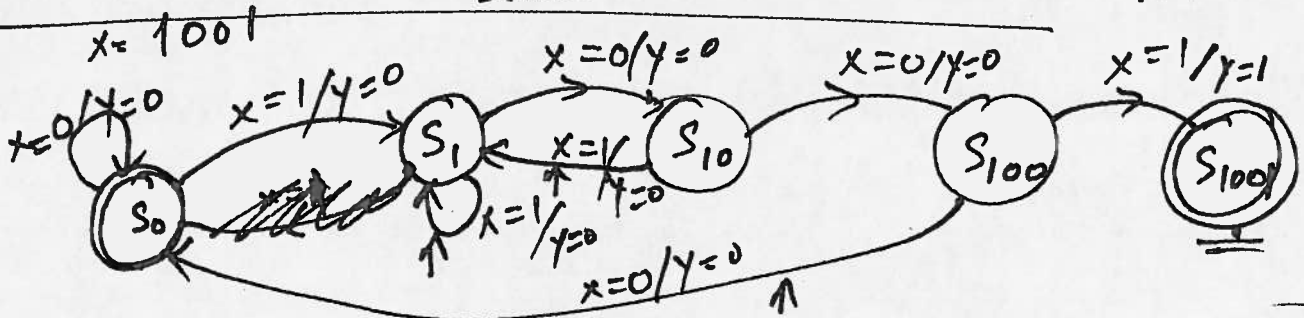
Finite state machine

Decide what type of FF? ^{many}

characteristic table

FF input equations

Draw the circuit



- Case 1: 11001
- Case 2: 101001
- Case 3: 10001001

0000100100000001001

non-overlapping pattern

"State reduction"

Oct 25, 2019

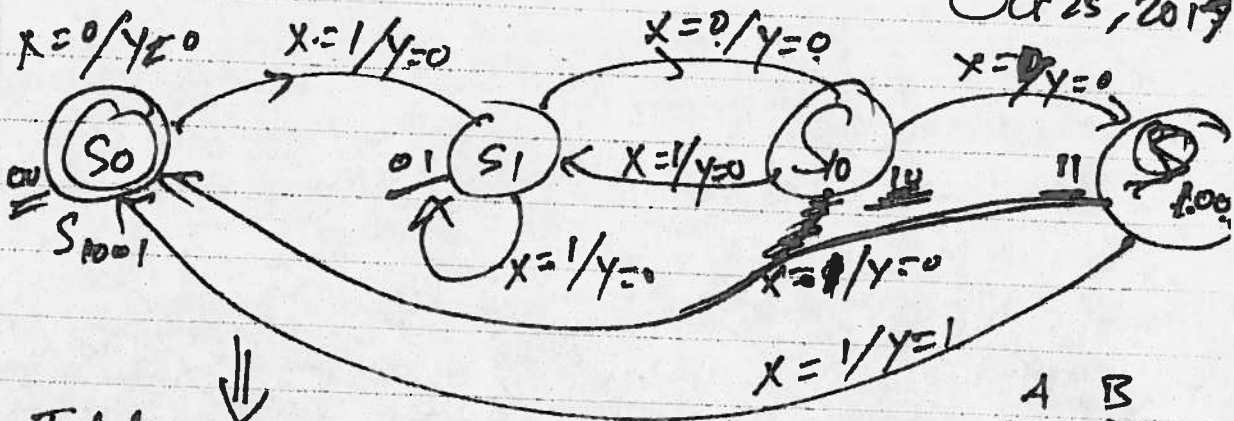


Table:

Current state		input	next state		Output	FF input/output	
A(t)	B(t)	x	A(t+1)	B(t+1)	FE inputs	DA	DB
0	0	0	0	0	0	0	0
0	0	1	0	1	0	0	1
0	1	0	1	0	0	1	0
0	1	1	0	1	0	0	1
1	0	0	1	1	0	1	1
1	0	1	0	1	0	0	1
1	1	0	0	0	0	0	0
1	1	1	0	0	1	0	0

FF input equations:

DA = ?

DB = ?

	Ax	00	01	11	10
0	0	0	0	0	1
1	1	0	0	0	0

	Bx	00	01	11	10
0	0	0	1	0	0
1	1	1	1	0	0

$$DA = A \oplus B \cdot x + A \cdot B \cdot x$$

$$= B(A \oplus 1) + A \cdot x$$

$$DB = A \oplus B + B \cdot x + A \cdot x$$

(2)
Oct-27, 201

... continuation of 1001 recognizer.

FF input equations: $DA = ?$ $DB = ?$

		Bx			
		00	01	11	10
A	0	0	0	0	1
	1	1	0	0	0

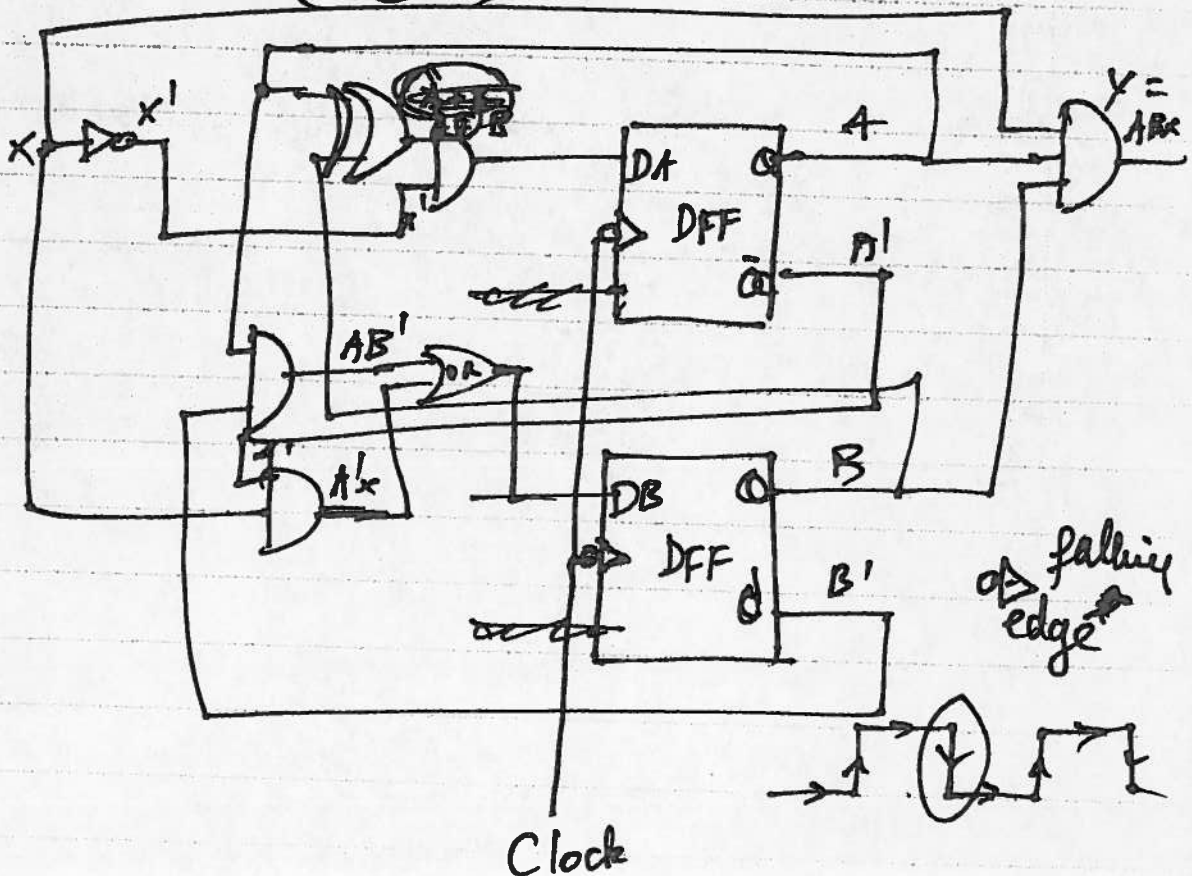
		bx			
		00	01	11	10
A	0	0	1	1	0
	1	1	1	0	0

$$DA = AB'x' + A'Bx'$$

$$= x'(AB' + A'B)$$

$$= x'(A \oplus B)$$

$$DB = AB' + A'x$$



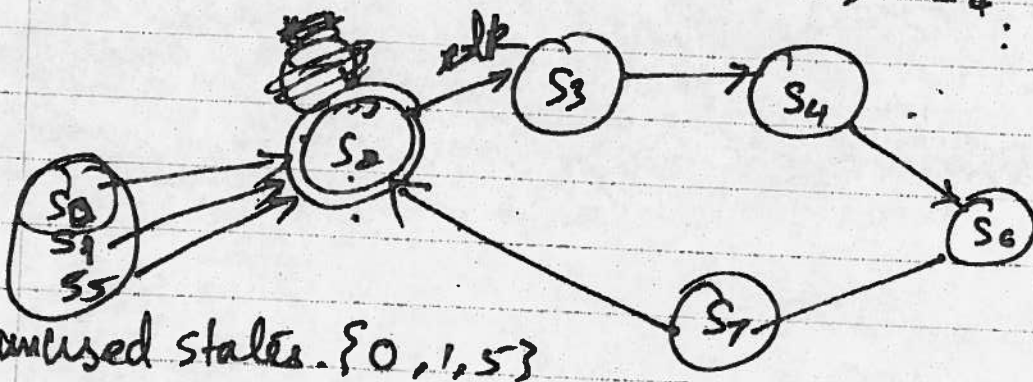
Problem: Design a counter 3 27
 that counts with a sequence

{0, 1, 5}

with T-FF.

{ 2, 3, 4, 6, 7 }

{ 010, 011, 100, 110, 111 }
 s_2 s_3 s_4 s_6 s_7



	A(t)	B(t)	C(t)	A(t+1)	B(t+1)	C(t+1)	T _A	T _B	T _C
S ₀	0	0	0	0	1	0	0	1	0
S ₁	0	0	1	0	1	0	0	1	1
S ₂	0	1	0	0	1	1	0	0	1
S ₃	0	1	1	1	0	0	1	1	1
S ₄	1	0	0	1	1	0	0	1	0
S ₅	1	0	1	0	1	0	1	1	1
S ₆	1	1	0	1	1	1	0	0	1
S ₇	1	1	1	0	1	0	1	0	1

FF Equations:

$T_A = ?$ $T_B = ?$ $T_C = ?$

	BC	00	01	11	10
A	0	0	1	1	0
1	0	1	1	0	0

$T_A(A, B, C)$

	BC	00	01	11	10
A	0	1	1	1	0
1	1	1	0	0	0

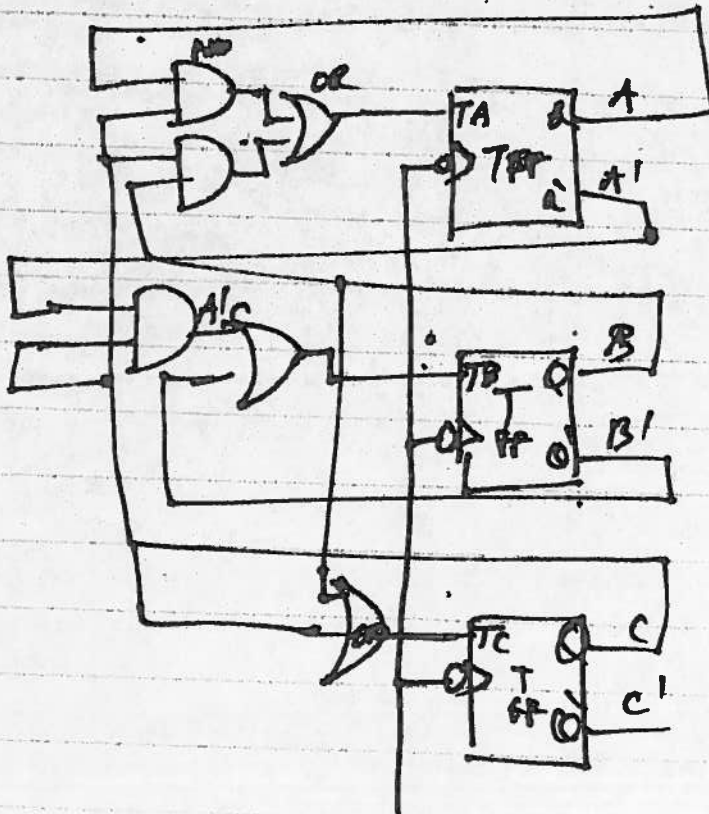
$T_B(A, B, C)$

	BC	00	01	11	10
A	0	0	1	1	1
1	0	1	1	1	1

$T_C(A, B, C)$

$T_A = AC + BC$ $T_B = B' + A'C$

$T_C = C + B$



3 bits = 3 FF
Toggle