Student Id:
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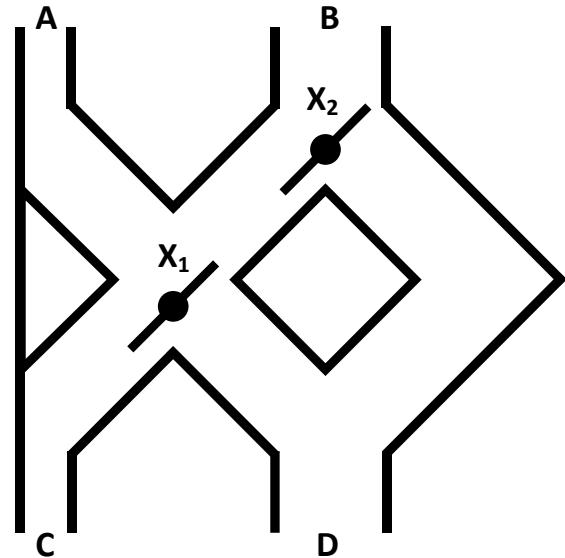
BLG311E – FORMAL LANGUAGES AND AUTOMATA

2016 FALL

QUIZ 1

The figure on the right shows the <u>initial state</u> of a marble rolling toy. A marble can be dropped from **A** or **B**. Levers **X₁** and **X₂** cause the marble to fall either to the left(L) or to the right(R) (the setting in the figure is LL, meaning **X₁**=Left, **X₂**=Left). Whenever a marble encounters a lever, it causes the lever to reverse <u>after</u> the marble passes, so the next marble will take the opposite branch. The marble leaves the toy either from **C** or **D** depending on the lever settings. The player wins the game if the marble leaves the toy from **C**.

Model this machine as a finite state automaton and draw its state transition diagram. Consider the states where the player wins the game as the final (accepted) states.

Determining possible states that the machine can be in by starting from the initial state, checking transitions for different inputs (A and B) and creating new states for different possible configurations $(X_1, X_2, \text{Output})$:

State				Input	
Label	**X_1**	**X_2**	**Output**	**A**	**B**
S_0	L	L	-	S_1	S_2

Both inputs result in different configurations (new states) than S_0.

State				Input	
Label	**X_1**	**X_2**	**Output**	**A**	**B**
S_0	L	L	- (D)	S_1	S_2
*S_1	R	L	C	S_0	
*S_2	R	R	C		

$S_1 \xrightarrow{A} S_0$: Output of S_0 can be considered as D (not an accepted final state)

State				Input	
Label	**X_1**	**X_2**	**Output**	**A**	**B**
S_0	L	L	- (D)	S_1	S_2
*S_1	R	L	C	S_0	S_3
*S_2	R	R	C		

B results in a different configuration (a new state) than S_0, S_1 and S_2 in S_1.

State				Input	
Label	**X_1**	**X_2**	**Output**	**A**	**B**
S_0	L	L	- (D)	S_1	S_2
*S_1	R	L	C	S_0	S_3
*S_2	R	R	C	S_3	
S_3	L	R	D		

$S_2 \xrightarrow{A} S_3$

State				Input	
Label	**X_1**	**X_2**	**Output**	**A**	**B**
S_0	L	L	- (D)	S_1	S_2
*S_1	R	L	C	S_0	S_3
*S_2	R	R	C	S_3	S_4
S_3	L	R	D		

B results in a different configuration (a new state) than S_0, S_1, S_2 and S_3 in S_2.

$S_3 \xrightarrow{A} S_2$

$S_3 \xrightarrow{B} S_0$

State				Input	
Label	**X_1**	**X_2**	**Output**	**A**	**B**
S_0	L	L	- (D)	S_1	S_2
*S_1	R	L	C	S_0	S_3
*S_2	R	R	C	S_3	S_4
S_3	L	R	D	S_2	S_0
S_4	R	L	D	S_0	S_3

$S_4 \xrightarrow{A} S_0$

$S_4 \xrightarrow{B} S_3$

State Transition Diagram: