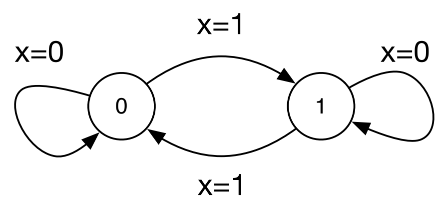
ELEC 2607 ('14) **Assignment 4** 15 Marks

1. An asynchronous FSM has inputs x, y, and z and outputs wa and wb. Inputs x and y are connected to buttons which are controlled by 'person a' and person 'b' respectively. When the buttons are not pushed both inputs read a '0'. When 'person a' or 'person b' pushes their respective buttons the corresponding input registers a '1'. 'Person a' and 'person b' try to race against each other by trying to be the first one to push their respective buttons. Design the asynchronous FSM such that it can figure out who pushed the button first. If 'Person a' pushed the button first output wa should read '1' else it should read '0'. Likewise, if 'Person b' pushed the button first output wb should read '1' else it should read '0'. Input z resets the FSM to its initial state where it waits for both persons to push a button. Assume x and y do not change at exactly the same time. Show your design by drawing a state-graph. Make sure you use the minimum number of states required for this design. 3 Marks

2. Draw the schematic of an asynchronous FSM that implements the following state graph. 2 Marks



3. Identify, with justification, from the following state tables those that have 2 Marks

   (a) Cycles

   (b) Non-critical races

Table 1

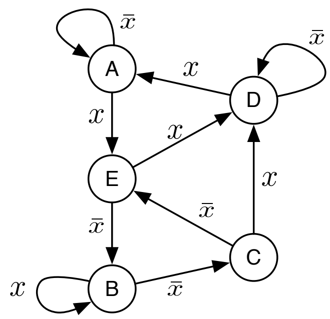
	a^+b^+	
ab	s = 0	s = 1
00	00	10
01	00	01
11	00	10
10	00	11

Table 2

	a^+b^+	
ab	s = 0	s = 1
00	00	11
01	00	01
11	00	01
10	00	11

4. Identify and fix all hazards present in $f = (ab + \bar{a}c)(c + \bar{b}) + ab$. Recheck if the expression you have obtained is indeed hazard-free. 3 Marks

5. Assign values to the states of the following state graph such that there are no races. Make sure you achieve this by introducing a minimum number of extra states if at all they are needed. 3 Marks



6. Find the reduced state table for the following FSM. 2 Marks

	Next State		
State	x = 0	x = 1	Output
A	B	F	0
B	A	B	0
C	G	E	0
D	H	F	1
E	F	C	0
F	E	D	1
G	C	G	1
H	D	H	0