Student ID: _____

CS 151
Quiz 3

Name : _____ , _____
(Last Name) (First Name)

Student ID : _____

Signature : _____

Instructions:

1. Please verify that your paper contains **8 pages** including this cover.
2. Write down your Student-Id on the top of each page of this quiz.
3. This exam is **closed book**. No notes or other materials are permitted.
4. Total credits of this quiz are **45 points.**
5. To receive credit you must show your work clearly.
6. **No re-grades will be entertained if you use a pencil.**
7. Calculators are **NOT** allowed.

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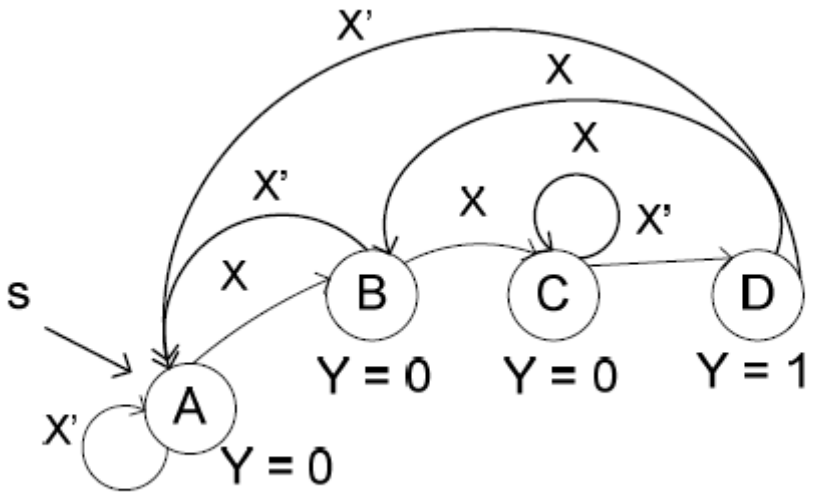
Q1: [Controller Design] [15 points]

Considering the FSM shown below:
X is the input to the FSM and Y is the output associated with each state.



a) Create the architecture for this FSM. **[5 points]**

b) Considering the state encoding shown below, draw the state table. **[10 points]**

A = 00, B = 01, C = 10, D = 11

NOTE: Just write the equation for the output Y.

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Q2: [FSM Design] [10 points]

Design an FSM which detects strings of the form of $1(01)^*$ on the stream of input X. On the detection of the string, an output Y should become 1.

$1(01)^*$ are a class of strings that start from 1, followed by any number of 01 (at least 0).

NOTE: 1, 101, 101…01, etc are some samples of a string of form $1(01)^*$.

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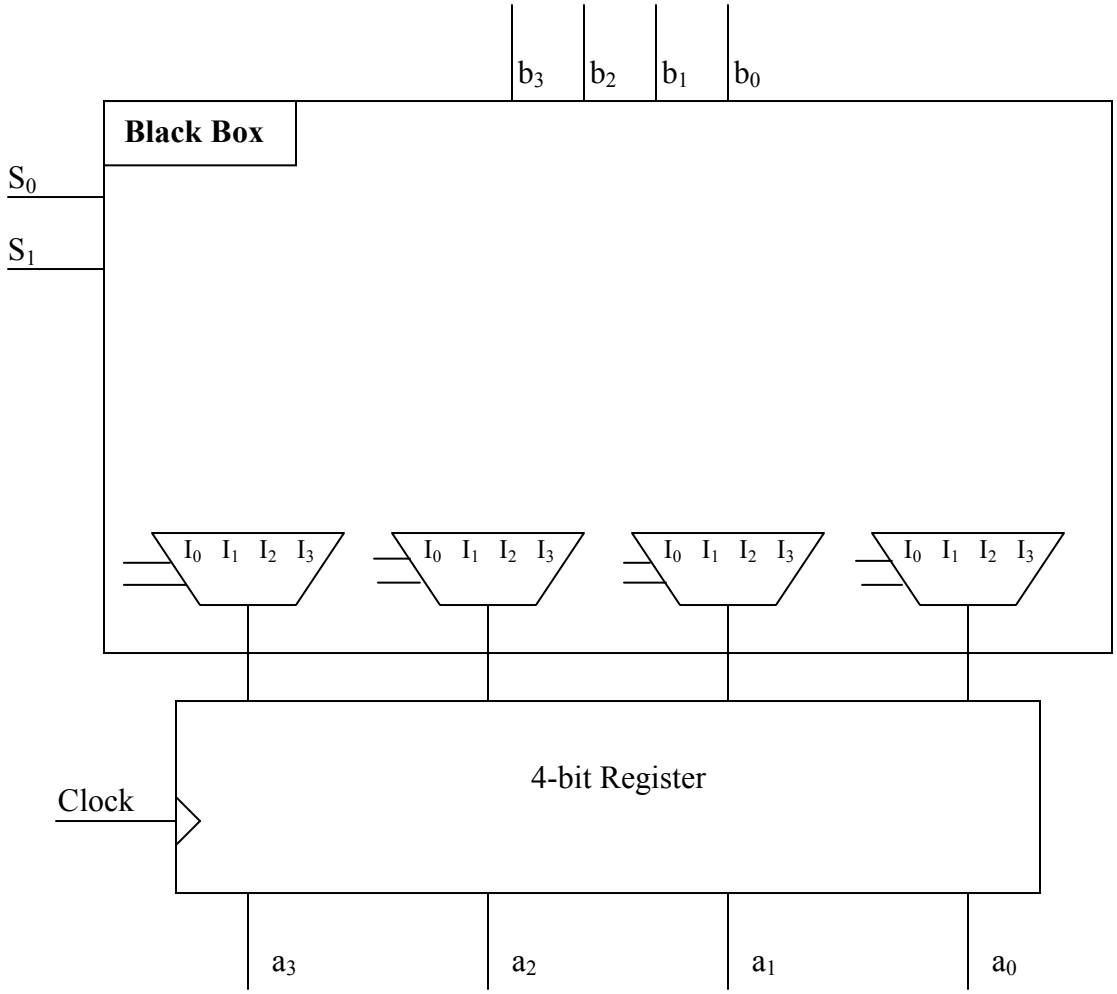
Q3: [Registers] [20 points]

Design inside the Black Box below to implement a 4-bit register with the functionality specified in the following table. (A = $a_3a_2a_1a_0$ is the output of the register.)
B = $b_3b_2b_1b_0$ is the input to the register.

NOTE: Specify the select lines of each multiplexer as well as the inputs. You can use the following components if needed.

- Adder
- Comparator
- Logic gates

S_1S_0	Action	Output
00	**Load**	**$b_3b_2b_1b_0$**
01	**Keep current value**	**A**
10	**If (B>A) -> Load B; else Keep current value**	**If (B>A) -> B; else A;**
11	**If (B>2*A) -> Load B/2; else Load A/2**	**If (B>2*A) -> B/2; else A/2;**



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