

Roll No.: \_\_\_\_\_

Section: \_\_\_\_\_

(FOR ONLY A,B,C,D)

## CS 301: Theory of Automata

Sessional 1, Fall 2016

**Total Marks: 65**

**Total Time: 60 Minutes**

**NOTE: This paper is only for sections A,B,C,D**

**NOTE: Answer in the space provided. You can ask for rough sheets but they won't be graded**

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### QUESTION 1

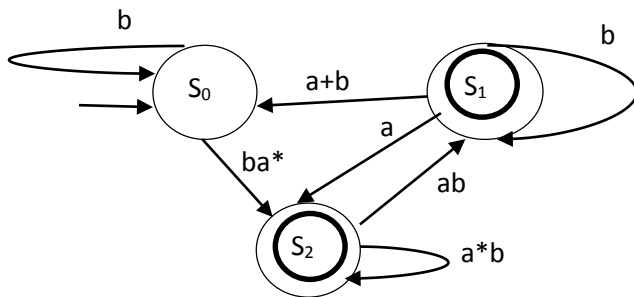
(Marks 5)

Name the components required to construct a DFA (name them only, no description/math is required)

### QUESTION 2

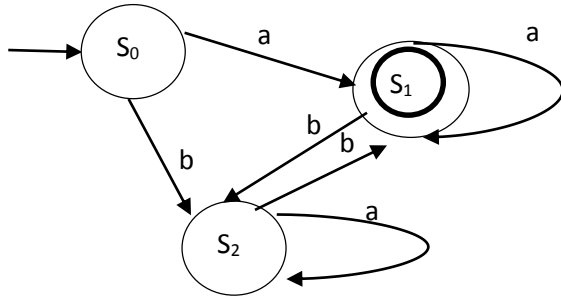
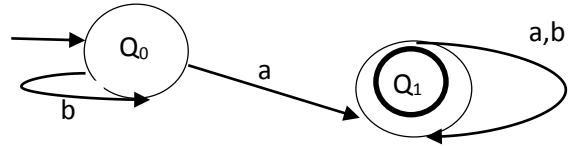
(Marks 20)

We have the following intermediate step when applying state elimination to extract the regular expression from a DFA. **Write the final regular expression** and show ALL working.



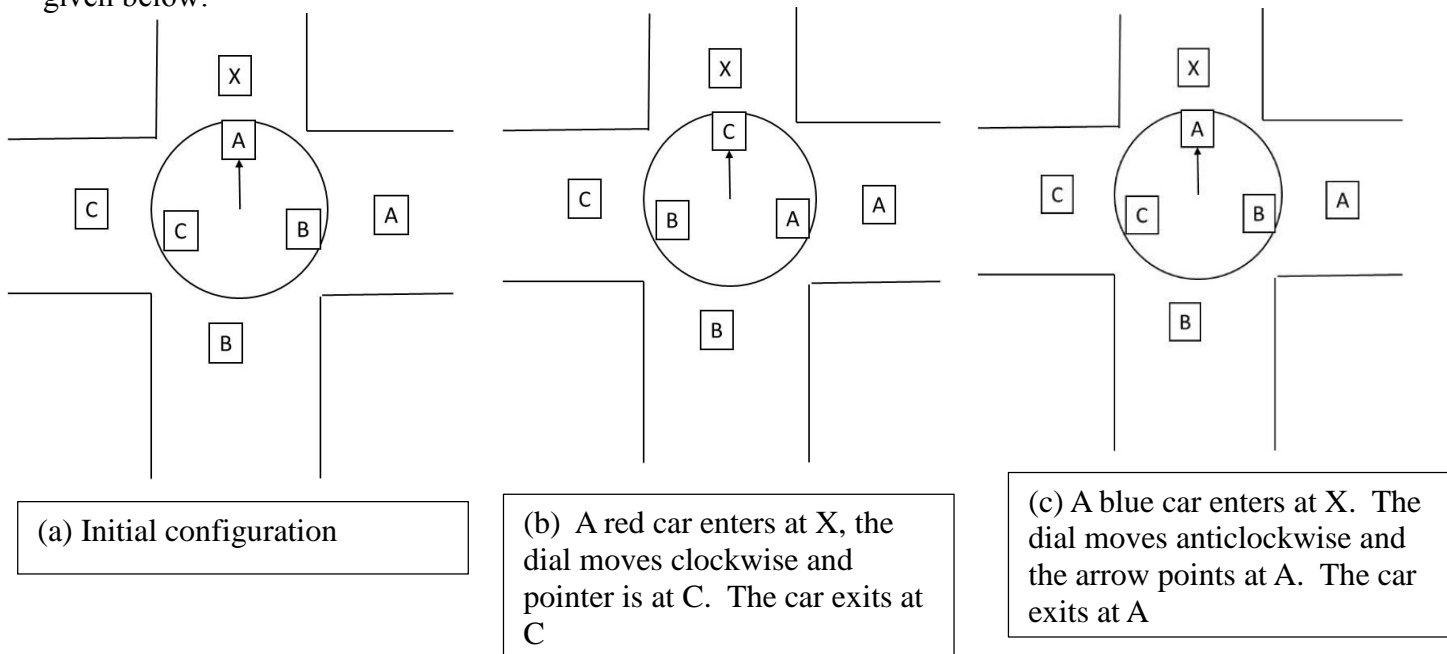
**QUESTION 3****(Marks 20)**

Given the following two DFAs that recognize the languages  $L_1$  and  $L_2$ . Construct a DFA to recognize  $(L_1 \cup L_2)'$  (where  $X'$  denotes the complement of  $X$ )

(a) DFA that recognizes  $L_1$ (b) DFA that recognizes  $L_2$

**QUESTION 4****(Marks 20)**

We have a road intersection, where either blue or red cars enter at X. There is a dial at the center with a sensor attached to it that detects the color of a car. If a red car is detected the dial moves clockwise and the car goes in the direction pointed to by the arrow on the dial. If a blue car is detected the dial move anticlockwise and the car goes in the direction pointed to by the vertical arrow. All cars enter at X and exit at either A,B or C depending upon what the arrow points to. If at the end of a car sequence the last car exits at C, we say that we have won the game. If at the end of a car sequence, the last car exits at A or B, we say that the game is lost. An example is given below:



The initial configuration of the dial is shown in figure (a), where the arrow points at A. The figures (a,b,c) shows an example of the car sequence **Red,Blue**. As the last car exits at A, we have lost. Note the sequence **Red** would win and the sequence **Red,Blue,Red** would win. Also, the sequences **Blue,Blue** and the sequence **Red,Red,Blue** would win. We can have any finite number of cars in the sequence. Model the entire game using a DFA, making a minimum number of states. (you can use the back side for the answer)