Midterm

<div align="right">

Monday, 7 March 2022
10:30–11:20 AM

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There are 5 problems each worth 6 points for a total of 30 points. No notes, no collaboration. Please respect and uphold the integrity of the examination process. Sign the cover page to show agreement with these instructions.

Name: _____

Problem	Credit
1	
2	
3	
4	
5	
Total	

1. Give an DFA that accepts the language,

$$\{\, s \in \{\, 0, 1 \,\}^* \mid s \text{ does not contain the substring } 101 \,\}$$

You must draw the diagram of the DFA, making sure to indicate the start and accept states and all necessary arrows.

2. (a) Use the pumping lemma to show that the language

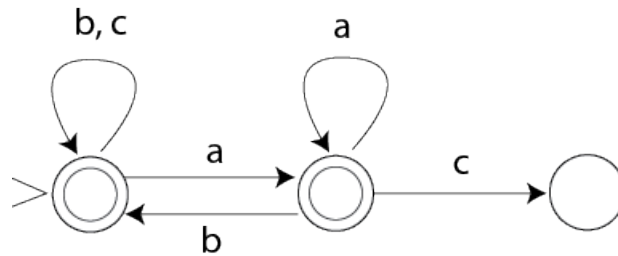$$\{\, s \in \{\, 0, 1 \,\}^* \mid s = (01)^i (10)^i \text{ for } i \geq 0 \,\}$$

is not regular.

(b) Show that the language

$$\{\, s \in \{\, 0, 1 \,\}^* \mid s = (01)^i (01)^i \text{ for } i \geq 0 \,\}$$

is regular.

3. Write a Regular Expression that expresses the same language as the following NFA. Although it is not necessary to take all the states demanded by the textbook's approach (there are shortcuts), you must show the relevant work.

4. Write a Context Free Grammar that expresses the same language as a Regular Expression,

$$0^*1^*0^*0$$

5. (a) Check (✓) the box if the operation is closed for the language class,

	Regular	Context Free
Union		
Concatenation		
Star		
Intersection		
Complement		

(b) Are all Regular languages also Context Free languages?

Yes	No

(c) Given a Context Free language and a Regular language, their intersection can be (check all that apply),

Regular	Context Free	neither