Roll Number: _____

Thapar Institute of Engineering & Technology Patiala
Computer Science & Engineering Department

BE CSBS Mid Term Test   UCT301: Formal Languages and Automata Theory
Sept 28, 2022
Time: 02 Hours; MM: 30   Name of Faculty: Dr. Ajay Kumar

Instruction to Students: Attempt all questions. All questions carry equal weightage. **Assume any missing data. Give appropriate reasoning/logic in each question whenever required.**

1. a) Prove that regular languages are closed intersection.   (3)

   (b) Minimize the given finite automaton (Consider q_0 as starting and q_6 as final state).

                                                              (3)

State	Input a	Input b
q_0	q_0	q_3
q_1	q_2	q_5
q_2	q_3	q_4
q_3	q_0	q_5
q_4	q_0	q_6
q_5	q_1	q_4
q_6	q_1	q_2

2. Consider the regular expression (ab)*b

   (a) Apply Thompson construction to convert the regular expression into non-deterministic finite automaton.   (2)

   (b) Convert the obtained NFA from (a) into DFA using subset construction.   (2)

   (c) Minimize the DFA obtained in step (b)   (2)

3. a) Write down the context-free grammar for the language $L_1=\{a^i b^j c^k \mid j=i+k\}$.   (2)

   b) Design the flowchart for the pushdown automata for the language L_1. Write down the transition function for the same.   (4)

4. a) Using Pumping Lemma prove that $L_2=\{a^n \mid i>0 \text{ and } n=i^2\}$ is not a regular language.

   (b) Write down left and right linear grammar for the regular expression $(a+b)^*aa$

                                                              (3+3)

5. a) Design DFA for the language over {a,b} for the regular language L_3.

   $L_3=$ { w | w has an even number of a's and one or two b's}   (3)

   b) Write down regular expression for the language over {0,1} for L_4 and L_5.   (3)

   $L_4=$\{ w | All 0 blocks of w are of even length and w is any string over {0,1}}

   $L_5=$\{w | w consists of substring 101}