



Final Assessment Test – May 2024

Course: BCSE304L - Theory of Computation
 Class NBR(s): 0758/ 0762/0764/0767/0769/0770/
 0773/0783/0788/0794/0842/0859/1011/1013/1024/ 1027/1028/1031/1034/1038/1040 Slot: B1+TB1

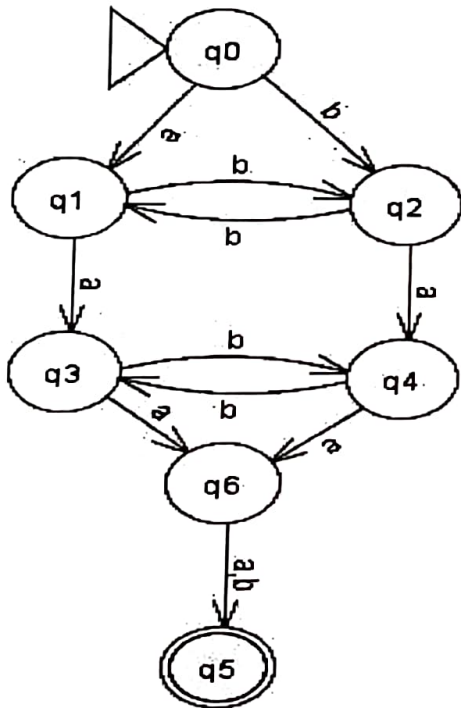
Time: Three Hours

Max. Marks: 100

- KEEPING MOBILE PHONE/ELECTRONIC DEVICES EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE
- DON'T WRITE ANYTHING ON THE QUESTION PAPER

Answer any **TEN** Questions
 (10 X 10 = 100 Marks)

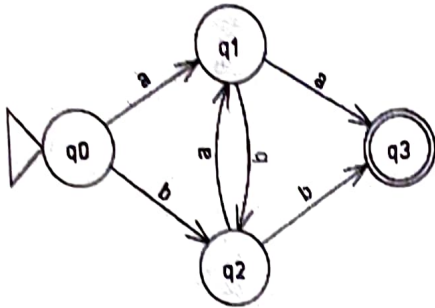
1. a. If $x+y$ is an even number, then prove that x and y are of same parity [4]
 (even-even or odd-odd) using contra-positive.
 b. $L_1=a^n b^m$ and $L_2=b^m$, where $n, m = 2$ find $(L_1 \cap L_2)^2$ and $(L_1 \cup L_2)^2$ [6]
2. Minimize the following DFA using table filling method



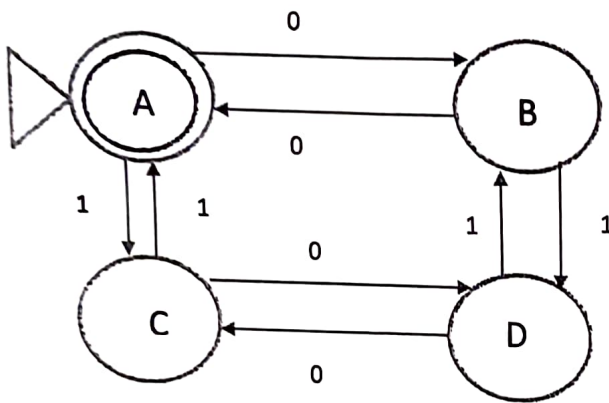
3. Convert the following NFA with epsilon moves to an equivalent NFA without epsilon moves where the starting state is q_0 and final state is q_2 .

States/input	ϵ	a	b	c
q_0	Φ	$\{q_0\}$	$\{q_1\}$	$\{q_2\}$
q_1	$\{q_0\}$	$\{q_1\}$	$\{q_2\}$	Φ
q_2	$\{q_1\}$	$\{q_2\}$	Φ	$\{q_0\}$

4. Derive the regular expression from the below DFA using Ardens and State elimination method.



5. a) Convert the given finite state automata accepting the language $L = \{w \mid n_0(w) \bmod 2 = 0 \text{ and } n_1(w) \bmod 2 = 0\}$ where $n_0(w)$ denotes the number of 0's in w and $n_1(w)$ denotes the number 1's in w to an equivalent regular grammar. Where the start state is A. [5]



- b) By using pumping lemma, prove that the following language is not regular [5]
 $L = \{a^n b^l a^k \mid n=l \text{ or } l \neq k\}$
6. a) Prove the context free Grammar, G is having ambiguity for the string $w = aaaabbbb$, (S is the start symbol). [5]
 $S \rightarrow ASB \mid BSA \mid AB \mid BA$
 $A \rightarrow Aa \mid a$
 $B \rightarrow Bb \mid b$
- b) Convert the given context free grammar G , into an equivalent context free grammar G' in Chomsky Normal Form (CNF), where the start symbol is A . [5]
 $A \rightarrow BAZ$
 $B \rightarrow aBA \mid a \mid \epsilon$
 $Z \rightarrow AbA \mid B \mid bb$

7. Check the membership for the string $w = babab$ by using CYK algorithm for the given grammar, where S is the start symbol.
- $S \rightarrow AC \mid CB$
- $A \rightarrow CA \mid a$
- $B \rightarrow AB \mid b$
- $C \rightarrow CB \mid b$
8. Construct a PDA for the given language $L = \{a^n b^{n+m} c^m \mid n, m \geq 1\}$ and show the moves made by the PDA for the following strings (a) $aabbbbcc$ (b) abc .
9. Construct a Turing machine for the language $L = \{a^n b^n c^n \mid n \geq 1\}$ and show the ID of the Turing machine of the string from abc to $a^2 b^2 c^2$.
10. Discuss any four types of TMs focusing on the transition function with a sample transition rule. Draw necessary diagrams at the required places.
11. Discuss
- (i) Any two closure properties where recursive languages are closed
 - (ii) Any two closure properties where recursively enumerable languages are not closed.
12. Define Chomsky hierarchy of grammars with suitable examples and their corresponding machines.

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