5C

COMSATS University Islamabad, Abbottabad Campus

Department of Computer Science

TERMINAL EXAMINATION – FALL 2023

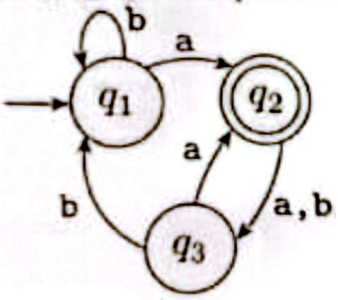
Class: BCS 5C, BCS 5D
Subject: Theory of Automata
Total Time Allowed: 3 hours
Name: Abdullah Sabir

Date: 08/01/2024
Instructor: Dr. S.U. Baig
Max Marks: 100
Registration: # SP21-BCS-037

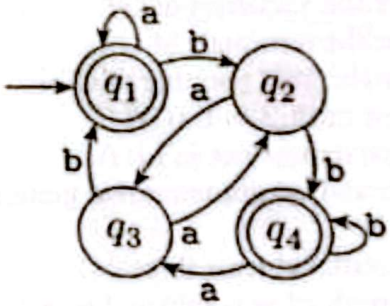
SECTION-A

Q. 1. The following are the state diagrams of two DFAs, M1 and M2. Answer the following questions about each of these machines **(Marks 10)**.

a. What is the start state?
b. What is the set of accept states?
c. What sequence of states does the machines go through on input aabb?
d. Does the machines accept the string aabb?
e. Does the machines accept the string ε?



M_1



M_2

Q. 2. Give the formal description of the machines M1 and M2 **(Marks 6)**.

Q. 3. Construct DFAs for the following languages over {a, b} **(Marks 8)**.

a. {w| w has exactly two a's}
b. {w| w has at least two b's}
c. {w| w has an even number of a's }
d. {w| w has each 'a' followed by at least one 'b'}

Q. 4. Construct NFAs for the following languages over {0, 1} **(Marks 6)**.

a. {w| w ends with 00} with three states
b. {1*(001)*} with three states

Q. 5. Convert the following Regular Expression (R.E) to FSM **(Marks 10)**.

a. $10 + (0 + 11)0^* 1$
b. $1 (0 + 1)^* 0$
c. $(a + b)^*$
d. $0^*1 + 10$
e. $(ab + ba)^*$

CamScanner

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SECTION-B

Q. 6. Generate parse tree for (x + y) + x – z + y – (x + x) using Left Most Derivation (LMD): **(Marks: 10)**

Q. 7. Answer each part for the following Context Free Grammar (CFG) G: **(Marks: 10)**

R → XRX	R → S	S → aTb
S → bTa	T → XTX	T → X
T → ε	X → a	X → b

a. What are the variables of G?
b. What are the terminals of G?
c. Which is the start variable of G?
d. Give three strings in L (G)?
e. Give three strings not in L(G).

Q. 8. Give Context-free grammar that generate the following languages, over {0, 1} **(Marks: 10)**

a. {w| w contains at least three 1s}
b. {w| the length of w is odd and its middle symbol is a 0}
c. { w| the set of strings with more 0's than 1'}

Q. 9. Generate the language L = {$a^p b^p c^p$ for $p = 3$} from the following Context Free Grammar (CFG) **(Marks: 10)**

S → abc	S → aAbc	Ab → bA
Ac → Bbcc	bB → Bb	aB → aa
aB → aaA		

Q. 10. Generate the language L = {$a^p b^p c^p$ for $p = 2$} from the following Context Sensitive Grammar (CSG) **(Marks: 10)**

S → aSBC	S → aBC	CB → HB
HB → HC	HC → BC	aB → ab
bB → bb	bC → bc	cC → cc

Q. 11. Generate an algorithm (design) for the language L = {$0^n 1^n$ for $n \geq 1$} in the Turing Machine (TM) **(Marks: 10)**

a. Design tape with tape symbols
b. Design final state diagram
c. Table (transition) representation of the final state diagram

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