CBCS SCHEME - Make-Up Exam

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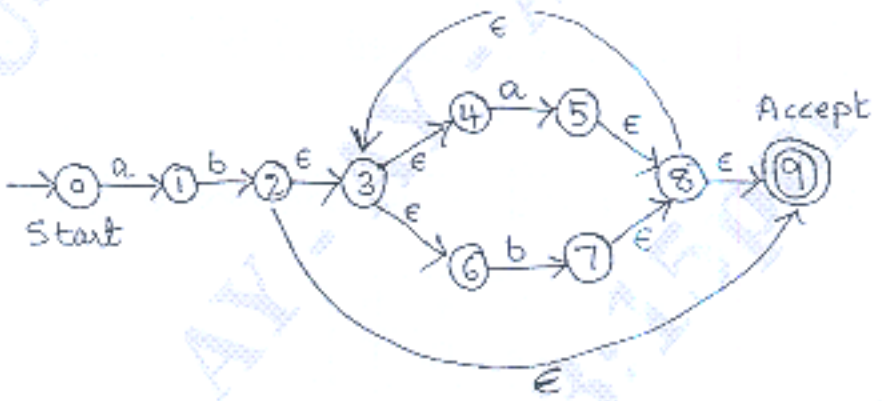
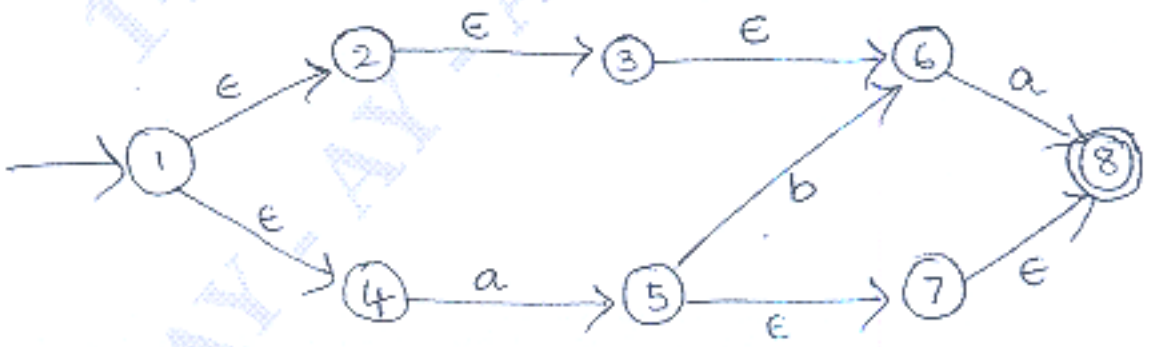
BCS503

Fifth Semester B.E/B.Tech. Degree Examination, June/July 2025
Theory of Computation

Time: 3 hrs. Max. Marks:100

Note: 1. *Answer any FIVE full questions, choosing ONE full question from each module.*
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
1	a.	With a neat diagram, explain a hierarchy of language in automata theory.	5	L2	CO1
	b.	Draw a DFA to accept string of a's and b's ending with ab or ba. Write a transition table for the same.	5	L3	CO1
	c.	Convert the following $\in$ – NFA to it's equivalent DFA.  Fig.Q1(c)	10	L3	CO1
		OR			
2	a.	Draw a DFA to accept the languages : i) $L=\{w : n_a(w)\geq 1, n_b(w)=2\}, \Sigma=\{a,b\}$ ii) $L=\{w : \lvert w\rvert \bmod 5 \neq 0\}$ on $\Sigma=\{a,b\}$ iii) $L=\{a^p b^q c^r / p\geq 0, q>0, r\geq 0\}$ on $\Sigma=\{a,b,c\}$.	12	L3	CO1
	b.	Write differences between DFA, NFA and $\in$ – NFA.	4	L2	CO1
	c.	Compute $\in$ – CLOSURE of each state for the following transition diagram.  Fig.Q2(c)	4	L1	CO1

Module – 2

3	a.	Write regular expression for the following languages : i) $L=\{a^n b^m / n \geq 0, m \geq o, m+n \text{ is even}\}$ ii) $L=\{a^n b^m / n \geq 1, m > 0, nm \geq 3\}$ iii) $L=\{a^n b^m / n \geq 4, m \leq 3\}$.	9	L3	CO1
	b.	Convert the following automata to a regular expression.  Fig.Q3(b)	3	L2	CO2
	c.	Show that $L=\{a^n b^n / n \geq 0\}$ is not regular.	8	L2	CO2
		OR			
4	a.	Show that regular languages are closed under complementation and intersection.	6	L2	CO2
	b.	Minimize the following DFA and draw the transition diagram of minimized DFA. |	8	L3	CO1
	c.	Define Regular Expressions. What are it's applications?	6	L2	CO2

δ	a	b
→A	B	F
B	G	C
* C	A	C
D	C	G
E	H	F
F	C	G
G	G	E
H	G	C

Module – 3

5	a.	Write a grammar for the following languages. i) $L=\{w / n_a(w)=n_b(w)\}$ ii) $L=\{0^i 1^j / i \neq j, i \geq 0, j \geq 0\}$ iii) $L=\{a^{n+2} b^m / n \geq 0, m > n\}$ iv) $L=\{0^m 1^m 2^n / m \geq 1, n \geq 0\}$.	12	L2	CO2
	b.	What is ambiguous grammar? Show that the following grammar is ambiguous. $E \rightarrow E + E / E * E / id$	8	L1	CO2

		OR			
6	a.	Explain the following terms : i) Pushdown automata (PDA) ii) Languages of PDA iii) Instantaneous description of a PDA.	6	L1	CO2
	b.	Obtain a PDA to accept $L=\{a^n b^n / n \geq 0\}$, Draw the transition diagram for the constructed PDA.	8	L3	CO3
	c.	What is the difference between deterministic and non-deterministic pushdown automata? Explain with an example.	6	L1	CO3
		Module – 4			
7	a.	Consider the grammar $S \rightarrow OA / 1B$ $A \rightarrow OAA / 1S / 1$ $B \rightarrow 1BB / OS / O$ Obtain the grammar in CNF.	10	L3	CO3
	b.	Show that $L=\{a^n b^n c^n / n \geq 0\}$ is not context free.	10	L2	CO3
		OR			
8	a.	State and prove pumping lemma for context free languages.	10	L2	CO3
	b.	Prove that CFL are not closed under complementation and intersection.	10	L2	CO3
		Module – 5			
9	a.	Design a Turing Machine to accept the following languages. $L=\{0^n 1^n 2^n / n \geq 1\}$.	10	L3	CO3
	b.	Write a short notes on i) Multi – tape Turing Machine ii) Non- deterministic TM.	10	L1	CO4
		OR			
10		Write a short notes on i) Post correspondence Problem ii) Halting Problem of TM iii) Recursively enumerable language iv) Linear Bounded Automata.	20	L1	CO4

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