



CBCS Scheme

USN

--	--	--	--	--	--	--	--	--	--

15CS/IS54

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018

Automata Theory & Compatibility

Time: 3 hrs.

Max. Marks: 80

Note: Answer FIVE full questions, choosing one full question from each module.

Module-1

- 1 a. Define the following terms with examples: (i) Alphabet (ii) Power of an alphabet (04 Marks)
(iii) Concatenation (iv) Languages (03 Marks)
- b. Draw a DFA to accept strings of a's and b's ending with 'bab'. (09 Marks)
- c. Convert the following NDFSM Fig. Q1 (c) to its equivalent DFSM.

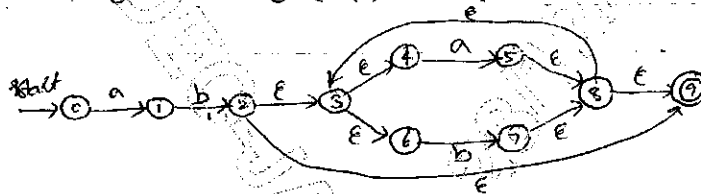


Fig. Q1 (c)

OR

- 2 a. Draw a DFSM to accept the language,
 $L = \{\omega \in \{a, b\}^* : \forall x, y \in \{a, b\}^* ((\omega = x abbaay) \vee (\omega = x babay))\}$ (03 Marks)
- b. Define distinguishable and indistinguishable states. Minimize the following DFSM,

S	0	1
A	B	A
B	A	C
C	D	B
*D	D	A
E	D	F
F	G	E
G	F	G
H	G	D

- (i) Draw the table of distinguishable and indistinguishable state for the automata.
- (ii) Construct minimum state equivalent of automata. (09 Marks)
- c. Write differences between DFA, NFA and ϵ -NFA. (04 Marks)

Module-2

- 3 a. Consider the DFA shown below:

States	0	1
$\rightarrow q_1$	q_2	q_1
q_2	q_3	q_1
* q_3	q_3	q_2

Obtain the regular expressions $R_{ij}^{(0)}$, $R_{ij}^{(1)}$ and simplify the regular expressions as much as possible. (09 Marks)

- b. Give Regular expressions for the following languages on $\Sigma = \{a, b, c\}$

- (i) all strings containing exactly one a
- (ii) all strings containing no more than 3 a's.
- (iii) all strings that contain at least one occurrence of each symbol in Σ . (03 Marks)

- 3 c. Let L be the language accepted by the following finite state machine.

(04 Marks)

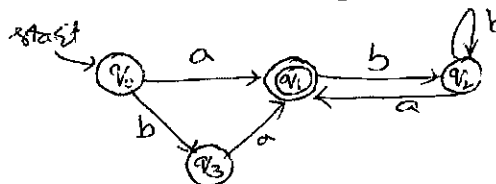


Fig. Q3 (c)

Indicate for each of the following regular expressions, whether it correctly describes L:

- (i) $(a \cup ba)bb^*a$
- (ii) $(\varepsilon \cup b)a(bb^*a)^*$
- (iii) $ba \cup ab^*a$
- (iv) $(a \cup ba)(bb^*a)^*$

OR

- 4 a. Prove that the following language is not regular : $L = \{0^n 1^n \mid n > 0\}$. (05 Marks)
- b. If L_1 and L_2 are regular languages then prove that $L_1 \cup L_2$, $L_1.L_2$ and L_1^* are regular languages. (05 Marks)
- c. Is the following grammar ambiguous? (06 Marks)
- $S \rightarrow iC + S \mid iC + SeS \mid a$
- $C \rightarrow b$

Module-3

- 5 a. Define Grammar, Derivation, Sentential forms and give one example for each. (03 Marks)
- b. What is CNF? Obtain the following grammar in CNF
- $S \rightarrow ASB \mid \varepsilon$
- $A \rightarrow aAS \mid a$
- $B \rightarrow SbS \mid A \mid bb$ (09 Marks)
- c. Let G be the grammar,
- $S \rightarrow aB \mid bA$
- $A \rightarrow a \mid aS \mid bAA$
- $B \rightarrow b \mid bS \mid aBB$
- For the string aaabbabbbba find a
- (i) Left most derivation.
 - (ii) Right most derivation.
 - (iii) Parse tree. (04 Marks)

OR

- 6 a. Explain the following terms:
- (i) Pushdown automata (PDA).
 - (ii) Languages of a PDA.
 - (iii) Instantaneous description of a PDA. (03 Marks)
- b. Construct a PDA to accept the language $L = \{\omega\omega^R \mid \omega \in \{a, b\}^*\}$. Draw the graphical representation of this PDA. Show the moves made by this PDA for the string aabbaa. (10 Marks)
- c. Convert the following CFG to PDA
- $S \rightarrow aABB \mid aAA$
- $A \rightarrow aBB \mid a$
- $B \rightarrow bBB \mid A$
- $C \rightarrow a$ (03 Marks)



15CS/IS54

Module-4

- 7 a. If L_1 and L_2 are context free languages then prove that $L_1 \cup L_2$, $L_1 \cdot L_2$ and L_1^* are context free languages. (04 Marks)
- b. Give a decision procedure to answer each of the following questions:
- (i) Given a regular expression α and a PDA M , the language accepted by M a subset of the language generated by α ?
 - (ii) Given a context-free Grammar G and two strings S_1 and S_2 , does G generate $S_1 S_2$?
 - (iii) Given a context free Grammar G , does G generate any even length strings.
 - (iv) Given a Regular Grammar G , is $L(G)$ context-free? (12 Marks)

OR

- 8 a. Explain with neat diagram, the working of a Turing Machine model. (05 Marks)
- b. Design a Turing machine to accept the language $L = \{a^n b^n c^n \mid n \geq 1\}$. Draw the transition diagram. Show the moves made by this turing machine for the string aabbcc. (11 Marks)

Module-5

- 9 Write short notes on:
- a. Multi-tape turing machine.
 - b. Non-deterministic turing machine.
 - c. Linear Bounded automata. (16 Marks)

OR

- 10 Write short notes on:
- a. Undecidable languages.
 - b. Halting problem of turing machine.
 - c. The post correspondence problem. (16 Marks)
