

B5.2-R4: AUTOMATA THEORY & COMPILER DESIGN

NOTE:

1. Answer question 1 and any FOUR from questions 2 to 7.
2. Parts of the same question should be answered together and in the same sequence.

Time: 3 Hours

Total Marks: 100

1.
 - a) What is the role of semantic analysis and symbol table management in compilers?
 - b) Draw stepwise construction of the NFA for the regular expression $a(a|b)^*ab$.
 - c) What are the various error recovery strategies used in syntax analysis? Explain each in brief.
 - d) What is an activation record used in runtime storage management? What does a typical activation record consist of? What is the role of processor register used in this management?
 - e) Compare and contrast triples with indirect triples?
 - f) Construct a CFG generating all integers (with sign).
 - g) Define formally a Turing machine model. For what purpose are they use?

(7x4)

2.
 - a) Prove the following by the principle of induction: $1+4+7+\dots+(3n-2)=n(3n-1)/2$.
 - b) Prove that the regular expression $R=\Lambda+ 1^*(011)^*(1^*(011)^*)^*$ also describes the same set of strings.
 - c) Consider the Mealy machine describe by the following transition table. Construct a Moore machine equivalent to the Mealy machine.

Present State	Next State			
	Input a=0		Input a=1	
	State	output	State	output
→q0	q3	0	q1	1
q1	q1	1	q2	0
q2	q2	0	q3	0
Ⓚq3	q3	0	q0	0

(5+6+7)

3.
 - a) State pumping lemma for regular sets. With the help of pumping lemma, show that the set $L= \{a^{i^2} \mid i \geq 1\}$ is not regular.
 - b) Give transition tables for Push Down Automatic (PDA) recognizing the following language:
 $L =$ the language of all non-palindromes over $\{a, b\}$.
 - c) Convert the following grammar G to Chomsky Normal Form.
 $G \rightarrow aAD$
 $A \rightarrow aB|bAB$
 $B \rightarrow b$
 $D \rightarrow d$.

(7+6+5)

4.

- a) Find a grammar that generates $L = \{a^n b^{n+1}, n \geq 0\}$.
 b) Consider a Turing machine given with five states q_1, q_2, \dots, q_5 , where q_1 is the initial state and q_5 is the only final state given in the following table:

Present State	Tape symbol		
	b	0	1
$\rightarrow q_1$	1L q_2	0R q_1	
q_2	b R q_3	0L q_2	1L q_2
q_3		b R q_4	b R q_5
q_4	0R q_5	0 R q_4	1 R q_4
q_5	0L q_2		

- c) Draw the computation sequence of input string 00
 What are the error recovery techniques used in lexical analysis phase? (5+8+5)

5.

- a) Define a left recursive grammar. Write an algorithm to eliminate left recursion.
 b) Remove the left recursion from the following grammar.
 $E \rightarrow E+T|T$
 $T \rightarrow T*F|F$
 $F \rightarrow (E)|id$
 c) Considering the following grammar, briefly explain the steps to construct the parsing table and comment on the type of grammar.
 $S \rightarrow iEtSS'$
 $S' \rightarrow eS| \epsilon$
 $E \rightarrow b$

(6+5+7)

6.

- a) What is a handle? Explain with an example. What are the problems arising in shift reducing parsing?
 b) Write short notes on LEX.
 c) What are inherited and synthesized attributes? Give suitable example.

(7+4+7)

7.

- a) What is code optimization? Explain the following techniques with suitable example:
 i) Constant folding.
 ii) Elimination of common sub expression.
 iii) Copy propagation and dead code elimination.
 b) What is DAG (Direct Acyclic graph)? Find out the syntax tree and DAG for the following expression and point out the differences of these two:
 $a+a*(b-c) + (b-c)*d$

(9+9)