



BCA/TOC-602

2024

(6th Semester)

BACHELOR OF COMPUTER APPLICATIONS

Paper No. : TOC-602

(Theory of Computation)

Full Marks : 70

Pass Marks : 45%

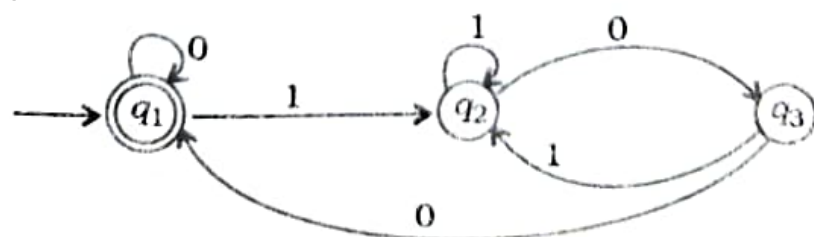
Time : 3 hours

(PART : B—DESCRIPTIVE)

(Marks : 45)

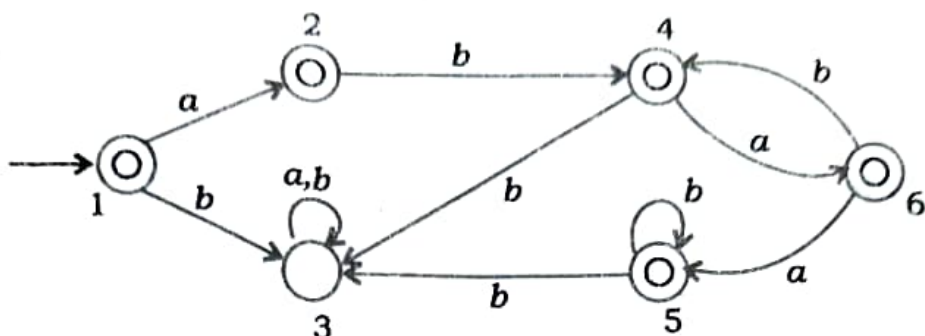
The figures in the margin indicate full marks for the questions

1. (a) Convert the DFA to regular expression. 3



(b) Minimize the given DFA.

6



Or

(c) Construct a DFA to accept strings of 0's and 1's ending with 101.

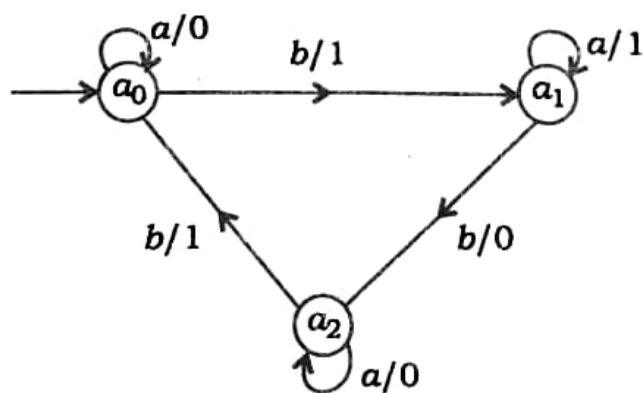
4

(d) Write down the procedure for converting an NFA to its equivalent DFA.

5

2. Convert the following Mealy machine into Moore-machine.

9



Or

Explain the following with an example : $4+5=9$

(a) Pumping lemma for CFG

(b) Myhill-Nerode theorem

3. (a) Define ambiguous grammar. Show that the following grammar is ambiguous. 6

$$S \rightarrow aSbS | bSaS | \epsilon$$

- (b) Define derivation. Mention the different types of derivation. 3

Or

Explain the normal forms of CFG. Reduce language $L = \{a^m b^n c^n d^n / m, n \geq 1\}$ into—

(i) CNF; 5

(ii) GNF. 4

4. (a) Write a turing machine that performs proper subtraction of two integer numbers. 4

- (b) What is meant by Church's hypothesis? Explain the type of Church turing. 5

Or

Define turing machine. Design a TM for language $L = \{a^n b^n c^n / n \geq 1\}$. Show the computation sequence for $w = aa bb cc$. 9

5. Write short notes on the following : 3+3+3=9

- (a) Top-down parsing
- (b) LR (K) grammars
- (c) Context-sensitive language

Or

Explain the following : 3+3+3=9

- (a) Type 0
- (b) Type 1
- (c) Type 2

2024

(6th Semester)

BACHELOR OF COMPUTER APPLICATIONS

Paper No. : TOC-602

(Theory of Computation)

(PART : A—OBJECTIVE)

(Marks : 25)

The figures in the margin indicate full marks for the questions

- I. Choose the most appropriate answer from the given options by putting a Tick (✓) mark in the brackets provided : 1×10=10

1. Which one of the given regular expressions is not equivalent to this regular expression?

$$(m + n + o)^*$$

(a) $(m^*n^* + o^*)^*$ ()

(b) $((mn)^* + o^*)^*$ ()

(c) $(m^*n^*o^*)^*$ ()

(d) $(m^* + n^* + o^*)^*$ ()

2. The language that a Pushdown Automaton accepts in which the stack stays limited to about 10 items, is described best as
 - (a) recursive ()
 - (b) deterministic context-free ()
 - (c) regular ()
 - (d) context-free ()
3. Which of these problems given below is undecidable?
 - (a) The ambiguity problem for the CFGs ()
 - (b) The membership problem for the CFGs ()
 - (c) The equivalence problem for FSAs ()
 - (d) The finiteness problem for FSAs ()
4. The $L = \{0^i 21^i \mid i \geq 0\}$ language over the $\{0, 1, 2\}$ alphabet is
 - (a) a CFL but not a deterministic CFL ()
 - (b) a regular language ()
 - (c) recursive as well as deterministic CFL ()
 - (d) not recursive ()
5. An automation is made up of
 - (a) states ()
 - (b) transitions ()
 - (c) Both of the above ()
 - (d) None of the above ()

6. _____ is a finite collection of symbols from the alphabet.
- (a) Switch () (b) String ()
- (c) States () (d) Symbols ()
7. How do you define a transition function of NFA?
- (a) $\delta: Q \times \Sigma \rightarrow 3Q$ ()
- (b) $\delta: Q \times \Sigma \rightarrow 2Q$ ()
- (c) $\delta: Q \times \Sigma \rightarrow 4Q$ ()
- (d) $\delta: Q \times \Sigma \rightarrow FQ$ ()
8. Moore machine is described by how many tuples?
- (a) 5 () (b) 4 ()
- (c) 3 () (d) 6 ()
9. According to Chomsky's hierarchy, which of the following represents context-free grammar?
- (a) Type 3 () (b) Type 2 ()
- (c) Type 1 () (d) Type 0 ()
10. Which of the following automata is the most powerful?
- (a) Finite automaton ()
- (b) Pushdown automaton ()
- (c) Turing machine ()
- (d) None of the above ()

II. State whether the following statements are *True (T)* or *False (F)* by putting a Tick (✓) mark against the appropriate answer in the brackets provided : $1 \times 5 = 5$

1. Every DFA is NFA, but NFA is not DFA.

True () *False* ()

2. If L is a regular language, then its Kleen closure L^* will not be a regular language.

True () *False* ()

3. A Mealy machine is a machine in which the output symbol depends upon the present input symbol and next stage of the machine.

True () *False* ()

4. Any language which can be acceptable by FA can also be acceptable by PDA.

True () *False* ()

5. Every type 2 language is also type 1 and a type 0.

True () *False* ()

(5)

III. Answer the following questions :

2×5=10

1. Define regular grammar with suitable example.

2. Draw turing machine to compute double the value of an integer.

3. Design non-deterministic automata (without ϵ moves) for the regular language that consists of all strings with at least 2 consecutive 0's. Assume $\Sigma = \{0, 1\}$

4. Formally define the pushdown automata based on the types of acceptance.

5. Define GNF (Greibach Normal Form).
