2020

B.C.A

[HONOURS]

Paper : BCA-304

(Theory of Computing)

Full Marks : 80 Time : 4 Hours

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer **Q. No. 1** and any **four** from the rest.

1. Answer any **eight** questions : 2×8=16

a) What is meant by DFA?

b) State 'pumping lemma' for regular language.

c) Give an example of language which is both regular and context free.

d) What is type-O grammar?

e) Define trap state.

f) What do you mean by accepter and transducer?

g) Find the language from the following production-

$S \rightarrow aSa / bSb / \in$

h) Check the following language is regular or not- L={abaab, babba} over Σ={a,b}.

i) Let $L_1 = \{w :| w | \text{ is odd}\}$ and $L_2 = \{w :| w | \text{ is even}\}$. What can you conclude about $L_1 \cap L_2$?

j) What do you mean by $\in$ Production?

k) What do you mean by "Kleen closure"?

l) Draw the DFA for following language $L = \{w : w \in \Sigma^+\}$ over $\Sigma = \{a, b\}$

m) What do you mean by CNF?

n) Let Σ={a,b} and L={aa, bb}. Use set notation to describe $\overline{L}$.

2. a) Prove that for every NFA there exists an equivalent DFA.

b) Draw the DFA for the following languages over Σ {a,b}

i) All strings with no more than three a's

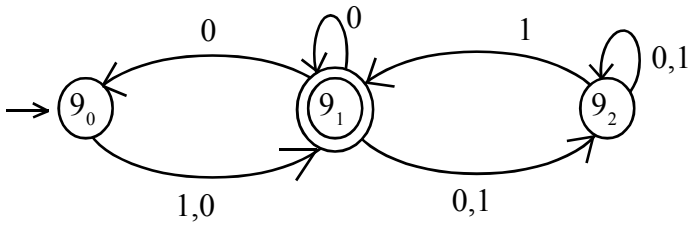
ii) $L = \{w :| w | \bmod 3 = 0\}$

iii) $L = \{w_1 abw_2 : w_1, w_2 \in \{a, b\}^*\}$

c) Construct an NFA with three states that accepts the language {ab, abc}* over Σ={a,b,c}.

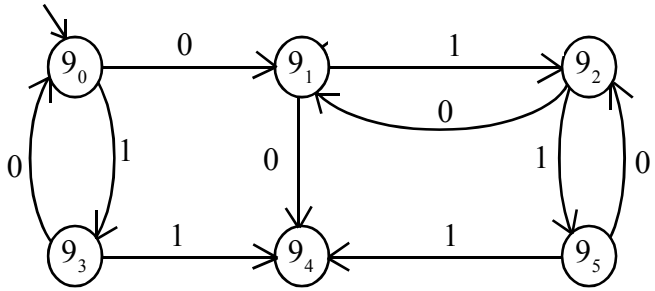
8+(2×3)+2=16

3. a) Convert the following NFA into its equivalent DFA -



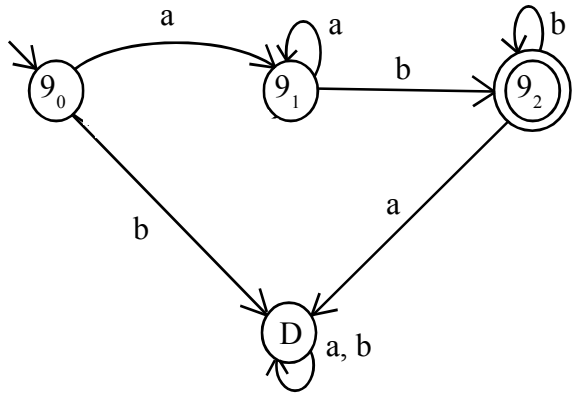
b) Define ∂^* for DFA.

c) Construct the minimum state automaton equivalent to the DFA described in the following figure -



7+2+7=16

4. a) Define Arden's Lemma. Find out the regular expression for the following automaton -



b) What do you mean by regular language?

c) Prove that $L = \{a^{i^2} \mid i \geq 1\}$ is not regular.

7+2+7=16

5. a) Write down the main features of standard Turing Machine.

b) Design a Turing Machine that accepts the language denoted by the regular expression 00*.

c) What is Unit Production of a grammar? Remove all Unit production from following -

$S \rightarrow Aa \mid B$

$A \rightarrow a \mid bc \mid B$

$B \rightarrow A \mid bb$

4+6+(2+4)=16

6. a) What do you mean by Instantaneous description in respect to PDA.

b) Obtain a PDA for the following language -

$$L = \{a^n b^{2n} \mid n \geq 0\} \text{ where } \Sigma = \{a, b\}$$

c) Construct the context free grammar for following languages

i) $L = \{a^n b^{2n} \mid n \geq 0\}$

ii) $L = \{ww^R \mid w \in \{a, b\}^*\}$

iii) $L = \{w \mid w \in \{a, b\}^*, n_a(w) = n_b(w)\}$

iv) $L = \{w_e w^R \mid w \in \{a, b\}^*\}$

where $\Sigma = \{a, b, c\}$ 2+6+(2×4)=16

7. Write short notes with an example (if applied) on following (any **four**) : 4×4=16

a) Derivation Tree.

b) GNF.

c) E-NFA

d) Equivalence of two Finite Automata.

e) PDF

f) MOORE Machine.

g) MEALY Machine.

———————