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44 (5) AUTL 5.4.2

2021

(Held in 2022)

AUTOMATA THEORY AND LANGUAGES

Paper : BCA 5.4.2 (E)

Full Marks : 80

Time : Three hours

The figures in the margin indicate full marks for the questions.

1. Answer the following questions as directed :
1×8=8

(a) To visualize and represent finite automata, _____ graph is used.

(Fill in the blank)

(b) In DFA null (or ϵ) move is allowed.

(State True or False)

(c) A regular grammar is one that is either right-linear or left-linear.

(State True or False)

(d) Regular language is closed under union, intersection.

(State True or False)

Contd.

- (e) Every regular grammar is not context-free. (State True **or** False)
- (f) Intersection of two context-free languages may produce a language that is not context-free. (State True **or** False)
- (g) A _____ pushdown acceptor is a pushdown automaton that never has a choice in its move. (Fill in the blank)
- (h) Deterministic context-free language is never inherently ambiguous. (State True **or** False)

2. Define the following terms : $2 \times 6 = 12$

- (a) ϵ -moves
- (b) Left linear Grammar
- (c) Star closure
- (d) Parsing
- (e) Useless production
- (f) Unit-production

3. Answer **any four** of the following questions : $5 \times 4 = 20$

- (a) Find a *dfa* that accepts all the strings on $\{0, 1\}$, except those containing the substring 001.

- (b) Show that $L = \{a^n : n \geq 4\}$ is regular.
- (c) Show that if L is regular, so is L^R .
- (d) Find a regular expression for the set $\{a^n b^m : n \geq 3, m \text{ is even}\}$
- (e) Show that the following grammar is ambiguous :

$$S \rightarrow AB \mid aaB,$$

$$A \rightarrow a \mid Aa,$$

$$B \rightarrow b.$$

- (f) Convert the grammar with productions

$$S \rightarrow ABa,$$

$$A \rightarrow aab,$$

$$B \rightarrow Ac$$

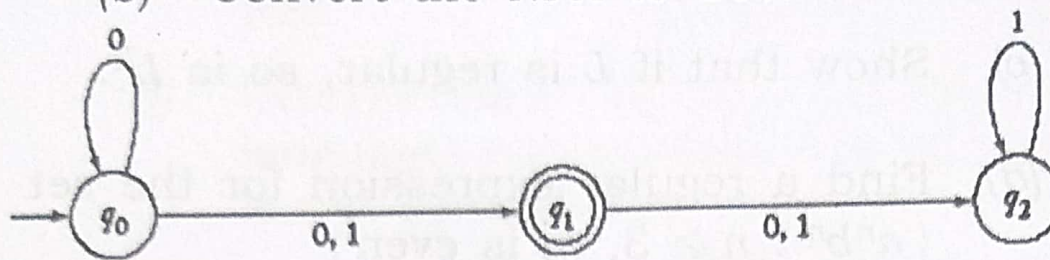
to Chomsky normal form.

4. Answer **any four** of the following questions :
10×4=40

- (a) Find minimal *dfa*'s for the following language :

$$L = \{a^n : n \geq 0, n \neq 3\}$$

(b) Convert the NFA to DFA



(c) Show that $L = \{a^n : n \text{ is a perfect square}\}$ is not regular.

(d) Find context-free grammars for the following language :

$$L = \{a^n b^m : n \geq 0, m \geq 0, n \leq m + 3\}.$$

(e) Remove all unit-productions, all useless productions, and all λ -productions from the grammar

$$S \rightarrow aA \mid aBB,$$

$$A \rightarrow aaA \mid \lambda,$$

$$B \rightarrow bB \mid bbC,$$

$$C \rightarrow B.$$

(f) Show that the language $L = \{a^n b^n c^n : n \geq 0\}$ is not context-free.

(g) Give formal definition of Deterministic pushdown automata and Deterministic context-free languages.