53 (CS 502) THCP

2016

THEORY OF COMPUTATION

Paper : CS 502

Full Marks : 100

Time : Three hours

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

*Answer **any five** questions.*

1. Answer ***any five*** : 5×4

   (a) State the differences between DFA and NFA.

   (b) State the pigeonhole principle and its utility in pumping lemma.

   (c) Are DPDA and NPDA equivalent ? (explanation needed)

   (d) What is ambiguous grammar ? Give an example.

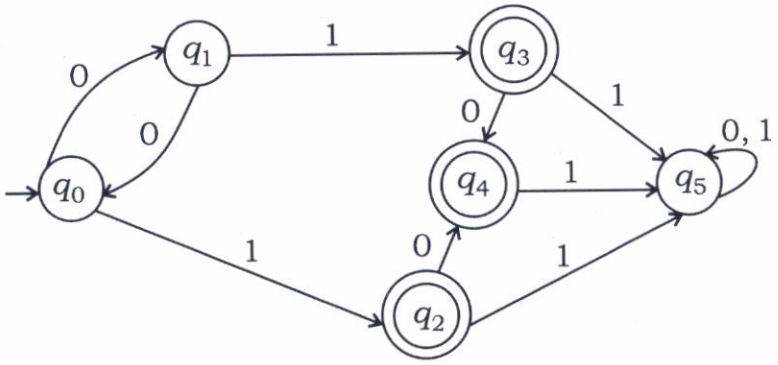
(e) Give the definition of PDA accepted by empty stack.

(f) Write a grammar for the language

$$L = \{a^n b a^n : n \geq 1\}$$

(g) Write a regular expression over {0, 1} with the substring 0101.

2. (a) What are the advantages of minimum DFA? What do you mean by indistinguishable states? Minimize the following DFA.



(b) Prove that, if language L_1 and L_2 are regular then $L_1 - L_2$ and $L_1 \cap L_2$ are also regular. 10+10

3. Draw the DFA (or NFA) for the languages

(a) $L = \{w \in \{a_1 b\}^* : w$ not starts with $ba\}$

(b) $L = \{w \in \{0, 1\}^* :$ binary representation of w is not divisible by 5 (five)$\}$

(c) Construct a NFA for the regular expression

$$r = (0+1)^* 0110 (0+1)^* + 10(0+1)^*.$$

7+7+6

4. Define CNF and GNF. Convert the following CFG into CNF 5+15

$$S \to ASA \mid aB$$
$$A \to B \mid S$$
$$B \to b \mid \in$$

5. (a) State the pumping lemma of regular language. What is its utility ?

(b) Design a PDA for the language

$$L = \left\{a^n b a^n : n \geq 0\right\}$$

(c) Write a CFG for the language

$$L = \left\{w \in \{a, b\}^* : |w_a| = |w_b|\right\}$$

6+7+7

6. *(a)* Define Turing Machine.

(b) Design a Turing Machine for the language $L = \{a^n b^n : n > 0\}$

(c) How Turing Machine can be used as Transducers? 5+10+5

7. Give the brief description of 4×5

(a) Church-Turing Thesis

(b) Multi-tape Turing Machine

(c) Recursive and Recursively enumerable languages

(d) Primitive recursive function.