53 (CS 502) THCM

2018

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 the following : 2×10

   (a) Arrange with respect to the computational power : DPDA, NFA, NPDA, DFA, TM, LBA.

   (b) Find the power set of $\{a, b, \phi\}$.

   (c) State the pigeonhole principle.

   (d) What do you mean by a string accepted by an NFA ?

   (e) Language accepted by a TM is .....(type-0, type-1, type-2, type-3) language.

(f) Write all the strings of length ≤ 2 generated by the regular expression $r = 0^*1^*$

(g) Write the regular expression of the language $L = \{w \in \{0,1\}^* :$ start and end symbol of w is same.

(h) What is the left linear grammar?

(i) What do you mean by parsing?

(j) Palindrome is recognized by.....(DFA, NFA, PDA).

2. Consider the language $L = \{a^l b^m c^n : l,m,n \geq 0\}$ and answer the following: 7+8+5

(a) Write a DFA as NFA for the language.

(b) Write a grammar for the language.

(c) Write a regular expression of the language.

3. State and prove the pumping lemma for the regular language. Hence prove that the language $L = \{a^n c^n : n \geq 0\}$ is not regular. 20

4. (a) Define PDA. What do you mean by a language is accepted by a PDA with empty stack?

(b) Construct a PDA for the language $L = \{a^n b^m c^n : m,n \geq 0\}$. Is this PDA, DPDA? Justify your answer. 8+12

5. (a) Define the context free grammar. Define the CNF and GNF. Convert the grammar into CNF.

$S \rightarrow ASB$

$A \rightarrow aAS \mid a \mid \in$

$B \rightarrow SbS \mid A \mid bb$

(b) What is ambiguous grammar? Explain with an example. What do you mean by inherently ambiguous? 10+10

6. (a) Give the definition of Turing Machine (TM).

(b) Design a TM for $L = \{a^n b^{2n} : n > 0\}$.

(c) Is it possible to construct a PDA for this language? Give explanation. 5+10+5

7. *(a)* What is the difference between Recursive language and Recursively Enumerable language ?

(b) Write a short note on Multitape TM.

(c) What do you mean by decidable problem ?

(d) Show that addition is Primitive recursive function.

5×4