53 (CS 502) THCM

2017

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. 2×10

(a) What do you mean by non-regular language ?

(b) Regular language is represented by —

(i) DFA

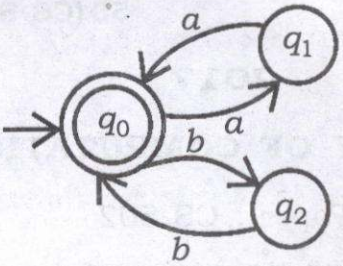
(ii) NFA

(iii) Regular expression

(iv) Regular grammar.

(c) Write a DFA or NFA for the regular expression $r = \in + a^+$.

(d) Write the regular expression of



(e) Arrange according to the computational power :

NFA, DFA, NPDA, DPDA, TM.

(f) Is the language is regular ?

$L = \{a^m b^n : m, n \geq 0 \text{ and } m \neq n\}$

(g) State the pigeonhole principle.

(h) $L = \{awbwa : w \in \{a,b\}^*\}$

Write all the strings in L of length ≤ 5.

(i) Explain the input and output of a DFA.

(j) Define indistinguishable state in DFA.

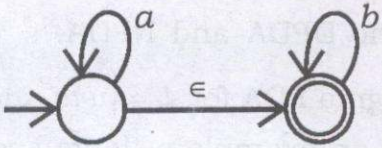
2. (a) Write a DFA or NFA of

$L = \{aw_1w_2a : w_1, w_2 \in \{a,b\}^*\}$.

(b) Write a regular expression of $L = \{awa \text{ or } bwb : w \in \{a,b\}^*\}$.

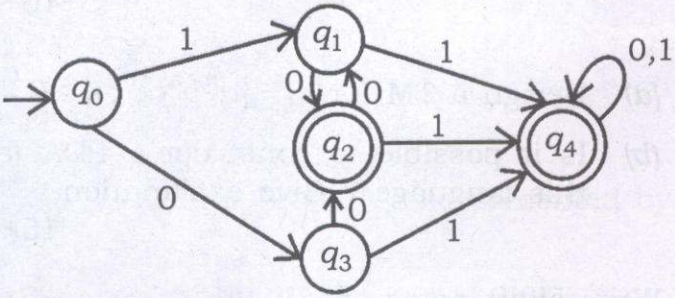
(c) Write a grammar of $L = \{a^n b^m c^n : m,n \geq 0\}$.

(d) Convert the $\in$-NFA to equivalent $\in$-free NFA.



5+5+5+5

3. (a) Minimize the DFA



(b) State and prove the pumping lemma of regular language.

(c) Prove that $L = \{a^n b^n : n \geq 0\}$ is not regular.

5+10+5

4. (a) Define CNF and GNF.

(b) Convert the grammar into CNF

$S \to bA|aB$, $A \to bAA|aS|a$,

$B \to aBB|bS|b$.

(c) Define ambiguous and un-ambiguous grammar with example.

5+10+5

5. (a) Define DPDA and NPDA.

(b) Design a PDA for $L = \{ww^R : w \in \{a,b\}^*\}$.

(c) Give an example of language which is recognized by NPDA but not DPDA with explanation.

5+10+5

6. (a) Design a TM for $L = \{a^n b^n c^m : n \geq 0\}$.

(b) Is it possible to construct a PDA for this language ? Give explanation.

15+5

7. Write short notes on : 5×4

(a) Univarsal TM

(b) Recursive and Recursively enumerable language

(c) Primitive Recursive Function

(d) Church-Turing Thesis.
