***U.S.N*** | | | | | | | | | | |

# P.E.S. College of Engineering, Mandya - 571 401

***(An Autonomous Institution affiliated to VTU, Belgaum)***

**Fourth Semester, B.E., - Computer Science and Engineering**

**Semester End Examination; June - 2016**

**Theory of Computation**

*Time: 3 hrs* *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

**UNIT - I**

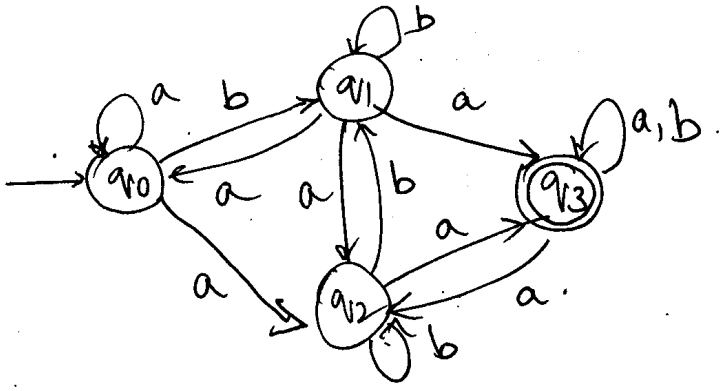
1. a. Distinguish between DFA and NFA. Also construct a DFA to accept the language $\Sigma = \{a, b\}$

i) $L = \{w / n_{a(w)} = \text{atleast 2 and } n_b(w) = \text{exactly one}\}$ 10

ii) Strings having suffix 'abb'.

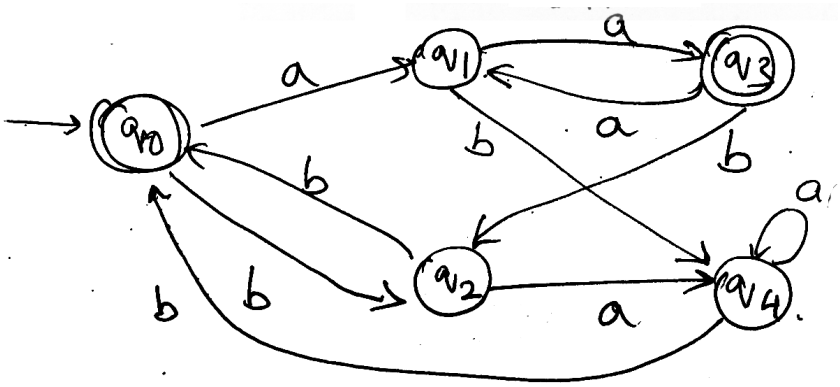
b. Construct $\in$-NFA, where NFA accepts strings having zero or more 'a's followed by zero or more 'b's followed by zero or more 'c's. Also convert it to DFA. 10

2 a. Define DFA and NFA. Convert the following NFA to DFA.




10

b. Minimize the given DFA.




10

Contd…2

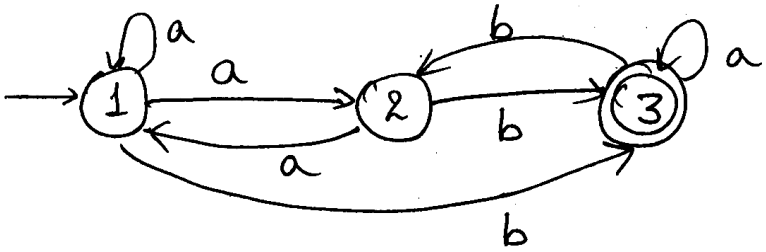
**UNIT - II**

3 a. Write regular expressions for the $\Sigma = \{0,1\}$

i) Strings having atmost three 0's and zero or more 1's 6

ii) $L = \{a^n b^m \mid n+m \geq 3,\ n \geq 0,\ m \geq 0\}$.

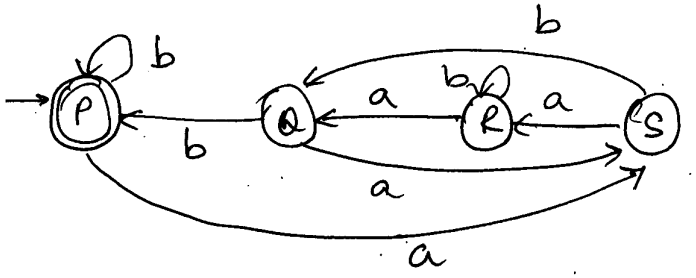
b. Find $R_{13}^{(2)}$ for the given finite automata,




6

c. Prove that the language $L = \{a^p \mid \text{P is prime}\}$ is not regular. 8

4 a. Define regular expression. Find the regular expression for the finite automata.




10

b. Prove that the regular languages are closed under difference and intersection. 10

**UNIT - III**

5 a. Define Context free grammar. Obtain CFG for equal number of a's and b's. 6

b. Write the leftmost derivation, rightmost derivation and parse tree for the string 9

$\sim p \subset (\sim p \subset \sim\sim q)$ $S \to (S) \mid S \subset S \mid \sim S \mid p \mid q$

c. Prove that context free languages are closed under union and concatenation. 5

6. a. Construct CFG for $L = \{a^i b^j c^k \mid i \geq 0,\ j \geq 0,\ k = i + j\}$. 5

b. Check if the given grammar is ambiguous. If so, remove ambiguity

$S \to A / B$
$A \to aAb / \in$ 5
$B \to abB / \in$

c. Convert the given grammar to CNF.

$S \to aABC / abB / AB$
$A \to aAb / \in$ 10
$B \to bbB / \in$
$C \to cC / \in$

Contd…3

**UNIT - IV**

7 a. Define PDA. Construct PDA for the language $L=\{w|n_a(w)>n_b(w)\}$ and also show ID for string abbaabaa. 12

b. Convert the CF grammar to PDA,

$S \rightarrow A \subset B|\sim A|(B)$

$B \rightarrow bB/\in$

$A \rightarrow aAb|aA|\in$ 8

8 a. Define DPDA for the language $L=\{WcW^R|w\in\{a,b\}^*, W^R \text{is the reverse of } w\}$. 10

b. What are the ways in which languages are accepted by PDA? Explain. 6

c. Explain the method for converting a CFG to PDA. 4

**UNIT - V**

9 a. Define Turing machine. Explain multitape Turing machine. Also explain instantaneous description of Turing machine with example. 10

b. Obtain the Turing machine for $\Sigma=\{0,1\}$ accepting strings that are palindrome. 10

10. Write short notes on :

i) Post correspondence problem with example 8

ii) Recursively enumerable languages 6

iii) Undecidable problems. 6

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