

## All The best For Exams - Rejinpaul Team

Anna University Exams Nov / Dec 2017 – Regulation 2013  
Rejinpaul.com Unique Important Questions – 5th Semester BE/BTECH  
CS6503 Theory of Computation

### Unit 1

1. Let L be a set accepted by a NFA, then there exists a DFA that accepts L. Justify your answer?
2. Define NFA with  $\epsilon$ -transition and prove that if L is accepted by an NFA with  $\epsilon$ -transition, then L is also accepted by a NFA without  $\epsilon$ -transitions
3. Construct a DFA equivalent to the NFA

$M = (\{p, q, r\}, \{0, 1\}, \delta, p, \{q, s\})$  Where  $\delta$  is defined in the following table

	0	1
P	{q, s}	{q}
q	{r}	{q, r}
r	{s}	{p}
s	--	{p}

4. Consider the following  $\epsilon$ -NFA. Compute the  $\epsilon$ -closure of each state and find its equivalent NFA.

	$\epsilon$	a	b	c
p	{q, }	p	$\Phi$	$\Phi$
q	{r}	$\Phi$	{q}	$\Phi$
*r	$\Phi$	$\phi$	$\phi$	r

5. Find whether the languages  $\{ww, w \text{ is in } (1+0)^*\}$  and  $\{1^k \mid k=n^2, n \geq 1\}$  are regular or not.
6. Prove That  $L = \{a^n b^n \mid n \geq 1\}$  and  $L = \{0^p \mid p \text{ is prime no}\}$  is not regular
7. Convert the following NFA into its equivalent DFA

States/input	0	1
$\rightarrow P$	{P, Q}	P
Q	R	R
R	S	-
* S	S	S

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### Unit II

1. Show that  $E \rightarrow E+E/E^*E/(E)/id$  is ambiguous.
2. Let  $G=(V,T,P,S)$  be a Context free Grammar then prove that if  $S \Rightarrow \alpha$  then there is a derivation tree in  $G$  with yield  $\alpha$ .
3. Find a grammar in Chomsky Normal form equivalent to

$$S \rightarrow aAD; \quad A \rightarrow aB/bAB; \quad B \rightarrow b; \quad D \rightarrow d$$

4. Convert the grammar  $S \rightarrow AB, A \rightarrow BS/b, B \rightarrow SA/a$  into Greibach Normal
5. Convert to GNF the grammar  $G, G = (\{A_1, A_2, A_3\}, \{a, b\}, P, A_1)$  Where  $P$  consists of the following  $A_1 \rightarrow A_2A_3, A_2 \rightarrow A_3A_1/b, A_3 \rightarrow A_1A_2/a$ .
6. Convert the following grammar into CNF

$$S \rightarrow aAa / bBb / \epsilon, \quad A \rightarrow C / a, \quad B \rightarrow C / b,$$

$$C \rightarrow CDE / \epsilon, \quad D \rightarrow A / B / ab$$

7. What is

meant by GNF? Write the procedure of converting a grammar into GNF

8. Derive the string "aabbabba" for LMD, RMD and parse tree using a CFG given by where

a.  $S \rightarrow aB/bA$

b.  $A \rightarrow a / aS / bAA$

$B \rightarrow b / bS / aBB$

### Unit III

1. Construct a PDA accepting  $\{a^m b^n a^m / m, n \geq 1\}$  by empty stack
2. Discuss about pumping lemma for CFL with suitable example.
3. Construct the grammar or CFG for the following PDA.

$$M = (\{q_0, q_1\}, \{0, 1\}, \{X, Z_0\}, \delta, q_0, Z_0, \Phi) \text{ and}$$

where  $\delta$  is given by

$$\delta(q_0, 0, Z_0) = \{(q_0, XZ_0)\}, \delta(q_0, 0, X) = \{(q_0, XX)\}, \delta(q_0, 1, X) = \{(q_1, \epsilon)\},$$

$$\delta(q_1, 1, X) = \{(q_1, \epsilon)\}, \delta(q_1, \epsilon, X) = \{(q_1, \epsilon)\}, \delta(q_1, \epsilon, Z_0) = \{(q_1, \epsilon)\}$$

4. Construct PDA for the following grammar  $S \rightarrow ASB/ab/Sb; A \rightarrow aA/A; B \rightarrow bB/A$
5. Convert the grammar  $S \rightarrow 0S1/A; A \rightarrow 1A0/S / \epsilon$  into PDA that accepts the same language by empty stack. Check whether 0101 belongs to  $N(M)$ .

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6. Give formal pushdown automata that accepts  $\{ww^R/w \text{ in } (0+1)^*\}$  or  $\{wcw^R/w \text{ in } (0+1)^*\}$  by empty stack. And trace the string '011110' or '011c110'

### Unit IV

1. Design a TM for the language over  $(0,1)$  such that number of 1's are divisible by 3
2. Discuss about Multi head turing Machine and multi tape turing machine and Chomsky hierarchy of languages
3. Write about programming techniques in TM. Design a TM to compute  $f(x) = x-1$  or  $f(x) = x-2$
4. Design a turing machine to compute  $f(x,y) = x + y$ .
5. Design TM  $L = \{a^n b^n / n \geq 1\}$  and  $L = \{a^n b^n c^n / n \geq 1\}$
6. Design the Turing machine for Language  $L = \{ww^r / w \in (a,b)^*\}$
7. Prove that halting problem is undecidable

### Unit V

1. Explain properties of recursive and recursively enumerable languages
2. Explain about the post correspondence problem with an example
3. Explain about the P-class problem and NP-class problem (all types) with examples
4. Explain about primitive recursive function with an example.
5. Explain about encoding of turing machine with an example

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