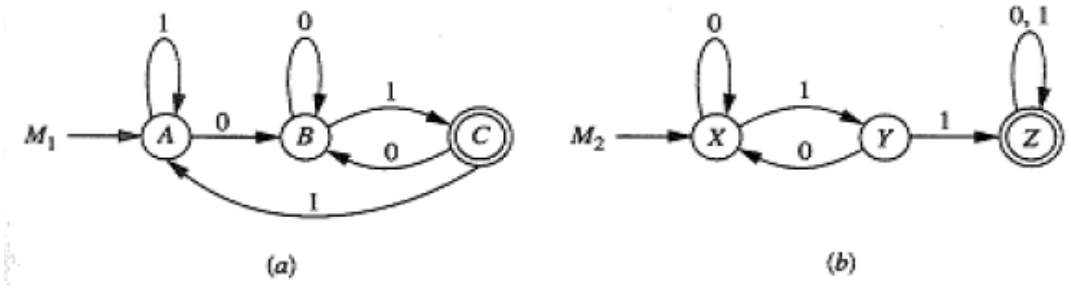
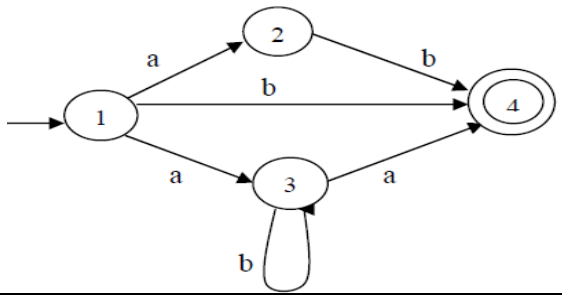
BE Semester- VI (ATKT CE) Question Bank
Theory of Computation
All questions carry equal marks (10 marks)

Q.1	Answer the following 1. In the given relation determine the properties(reflexivity, symmetry, transitivity), which ones the relation has: R = {(1,1),(2,2),(3,3),(1,2)} and R = Ø 2. Show that for any language L, L* = (L*)* = (L+)* = (L*)+ 3. Give the definition of "Transitive Closure of a Relation" using induction.
Q.2	Answer the following 1. Define regular language and regular expressions. 2. Find regular expression for the following: Language of all string that do not end with 01. 3. Describe the language corresponding to following: (1+01)*(0+01)*
Q.3	Write Kleene's Theorem part-I, Any regular language can be accepted by a finite automation.
Q.4	Let M1 and M2 be the FA in fig below for the language L1 and L2, find L1 U L2 and L1 ∩ L2. 
Q.5	Use the pumping lemma to show that following language is not regular: L = {xy|x,y ϵ {0,1}* and y is either x or xr}
Q.6	Answer the following 1.Find context free grammar generating following language {aibjck | i = j or i = k} 2. Show that CFG S a|Sa|bSS|SSb|SbS is ambiguous
Q.7	Write TM accepting Palindrome
Q.8	Write TM accepting {ss | s ϵ {a,b}*}
Q.9	For the language L = { xcx^r / x Ϲ {a,b}* } design a PDA(Push Down Automata) and trace it for string "bacab "
Q.10	Prove that $\sqrt{2}$ (square root of 2) is Irrational by method of Contradiction
Q.11	Define one-to-one, onto and bijection function. Check whether the function **f: R →R+**, **$f(x) = x^2$** is "one to one" or "onto"
Q.12	Write short notes on the following: (i) The Primitive Recursive Functions. (ii) The Sets P, NP, PSpace and NPSpace
Q.13	Write short notes on the following: (i)Top Down Parsing And Bottom Up Parsing. (ii)Universal Turing Machine.

<table>
<tr><td>Q.14</td><td>Using Principle of Mathematical Induction, Prove that
For every n >= 1,
$\sum_{i=1}^{n} i^2 = n(n+1)(2n+1)/6$</td></tr>
<tr><td>Q.15</td><td>Convert following NFA- Λ to NFA and FA
<table><tr><th>Q</th><th>δ(q, Λ)</th><th>δ(q, 0)</th><th>δ(q, 1)</th></tr><tr><td>A</td><td>{B,D}</td><td>{A}</td><td>Ø</td></tr><tr><td>B</td><td>Ø</td><td>{C}</td><td>{E}</td></tr><tr><td>C</td><td>Ø</td><td>Ø</td><td>{B}</td></tr><tr><td>D</td><td>Ø</td><td>{E}</td><td>{D}</td></tr><tr><td>E</td><td>Ø</td><td>Ø</td><td>Ø</td></tr></table></td></tr>
<tr><td>Q.16</td><td>Write definition of finite automata and draw FA for the strings:
(i)The string in {0,1}* ending in 10 or 11.
(ii)The string corresponding to Regular expression $\{11\}^* \{00\}^*$</td></tr>
<tr><td>Q.17</td><td>Convert following CFG to equivalent Chomsky Normal Form(CNF).
S →AACD | ACD | AAC | CD | AC | C
A →aAb | ab
C →aC | a
D →aDa | bDb | aa | bb</td></tr>
<tr><td>Q.18</td><td>Design a CFG for the following language.
L = { $0^i 1^j 0^k$ / j > i + k }</td></tr>
<tr><td>Q.19</td><td>Define Function and Relation. Explain each type of relation with an example.</td></tr>
<tr><td>Q.20</td><td>Write Regular Expressions for the following languages of all strings in {0,1}*
(i) Strings that contains odd number of 0’s (zeroes).
(ii) Strings that begin or end with 00 or 11.</td></tr>
<tr><td>Q.21</td><td>Convert the following NFA into FA.
 
</td></tr>
<tr><td>Q.22</td><td>Given the CFG G, find a CFG G’ in Chomsky Normal form generating
L(G) – { Λ}
S →AaA | CA | BaB
A →aaBa | CDA | aa | DC
B →bB | bAB | bb | aS
C →Ca | bC | D
D →bD | Λ</td></tr>
<tr><td>Q.23</td><td>Define PDA and design PDA for L = { x ∈ { a, b}* | na(x) > nb(x) }</td></tr>
<tr><td>Q.24</td><td>Explain Derivation Tree, Expression Tree and Ambiguity with Example</td></tr>
<tr><td>Q.25</td><td>Define CFG and Design a CFG for the following language.
L = { 0i 1j 0k / j > i + k }</td></tr>
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Q.26	Explain Universal TM and Church Turing Thesis
Q.27	Differentiate the NP Hard and NP Complete Problems
Q.28	Draw an DFA that recognize the language of all strings of 0's and 1's of length at least 1 that, if they were interpreted as binary representation of integers, would represent evenly divisible by 3. Your DFA should accept the string 0 but no other strings with leading 0's.
Q.29	Find CFG for the following languages. 1. L = { ai bj ak | j > i + k } 2. L = { ai bj ck | i = j or j = k }
Q.30	Draw a transition diagram for a Turing machine accepting the following language. { an bn cn | n ≥ 0 }
Q.31	Define Nondeterministic Finite Automata (NFA) and write down recursive definition of δ* for NFA- Λ.
Q.32	Give the recursive definition of PAL of Palindrome over any alphabet Σ
Q.33	Write definition of Finite Automata and draw FA for the strings: (i) The string with next to last symbol as 0. (ii) The string with number of 0s odd and number of 1s odd
Q.34	Using Principle of Mathematical Induction, prove that for every n >= 1, $\sum_{i=0}^{n} i = n\,(n+1) / 2$
Q.35	Using Principle of Mathematical Induction, prove that for every n >= 1, 7 + 13 + 19 + . . . + (6n + 1) = n(3n +4)
Q.36	Compare FA, NFA and NFA- Λ with illustration
Q.37	Define Turing Machine. Describe its capabilities. Also write short notes on Universal Turing Machine.
Q.38	Explain in Brief: (i) Halting Problem. (ii)Chomsky Normal Form(CNF).
Q.39	Define Pumping Lemma for Regular Languages. Prove that the language L = {an: n is a prime number} is not regular.
Q.40	Give transition table for deterministic PDA recognizing the following language. { ai bj ck | i, j, k ≥ 0 and j = i or j = k }