NRT/KS/19/2233

Bachelor of Computer Application (B.C.A.) Semester—IV Examination

THEORY OF COMPUTATION

Paper—III

Time : Three Hours] [Maximum Marks : 50

Note :— (1) All questions are compulsory and carry equal marks.

(2) Draw neat and labelled diagrams wherever necessary.

EITHER

1. (A) Prove that if L is a set accepted by NFA, then there exists a DFA that accepts L. 5

(B) Explain Moore machine and Mealy machine with suitable example. 5

OR

(C) Give Deterministic Finite Automata over the alphabet {0, 1} accepting the language as, the set of all strings ending with 00. 5

(D) What are the applications of finite automata ? Explain. 5

EITHER

2. (A) Define Context Free Grammar (CFG). Give the CFG generating the set of palindromes over the alphabet {a, b}. 5

(B) Prove that the class of regular sets are closed under Union, Concatenation and Kleene closure. 5

OR

(C) Explain the terms :—

(i) Derivation trees.

(ii) Useless symbol. 5

(D) Show that $L=\{0^n 1^n \mid n \geq 1\}$ is not regular. 5

EITHER

3. (A) State and prove pumping lemma for context free languages. 5

(B) Define Chomsky Normal Form (CNF). Find a grammar in CNF equivalent to $S \rightarrow aAbB$, $A \rightarrow aA|a$, $B \rightarrow bB|b$. 5

OR

(C) What is Greibach Normal Form (GNF) ? Explain with suitable example. 5

(D) Prove that context free languages are not closed under intersection and complement. 5

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EITHER

4. (A) Define deterministic PDA.

Construct a PDA for :

$L=\{0^n\ 1^{2n} \mid n \geq 1\}$. 5

(B) If L is a context free language then prove that three exits a PDA such that L = N(M). 5

OR

(C) Construct PDA for the language,

$L = \{WW^R \mid W \text{ in } (a+b)^*\}$ 5

(D) Give the informal description of Push Down Automata. 5

5. (A) What is DFA ? Explain with suitable example. 2½

(B) What is Ambiguity in context free grammar ? Explain. 2½

(C) Prove that context free languages are closed under Substitution. 2½

(D) What do you mean by Non-deterministic Push Down Automata ? Explain. 2½

Bachelor of Computer Application (B.C.A.) Semester—IV (C.B.S.) Examination

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Paper—III

Time : Three Hours] [Maximum Marks : 50

N.B. :— (1) All questions are compulsory and carry equal marks.

(2) Draw neat and labelled diagrams wherever necessary.

EITHER

1. (a) Define and explain deterministic finite automata with example. 5

(b) If $D = (Q_D, \Sigma, \delta_D, \{q_0\}, F_D)$ is the DFA constructed from NFA $N = (Q_N, \Sigma, \delta_N, q_0, F_N)$ by the subset construction, then prove : $\mathbf{L}(D) = \mathbf{L}(N)$. 5

OR

(c) Give a DFA over the alphabet {0, 1} accepting languages as the set of strings with 011 as a substring. 5

(d) Write regular expression for the language in which the set of strings of 0's and 1's where 0's are divisible by 5 and whose number of 1's are even. 5

EITHER

2. (a) State and prove pumping lemma for regular set. 5

(b) Define CFG for the language such as :

The set of $\{0^n1^n \mid n \geq 1\}$, that is the set of all strings of one or more 0's followed by an equal number of 1's. 5

OR

(c) Show that every regular language is context-free language. 5

(d) Consider the CFG G defined by productions : $S \rightarrow aS \mid Sb \mid a \mid b$. Construct the language $\mathbf{L}(G)$ that does not have "ba" as a substring. 5

EITHER

3. (a) Define Chomsky Normal Form (CNF) and convert following CFG into Chomsky Normal Form :

$S \rightarrow AbA$

$A \rightarrow Aa/\in$. 5

(b) Explain pumping lemma for CFL's. 5

OR

(c) Define Greibach Normal Form (GNF). Convert following grammar G into GNF

$S \rightarrow XA \mid BB, B \rightarrow b \mid SB, X \rightarrow b, A \rightarrow a$. 5

(d) Prove any context-free language is generated by a context-free grammar in Chomsky Normal Form. 5

EITHER

4. (a) Define PDA and give instantaneous description of PDA. 5

(b) Design PDA for :

$\mathbf{L} = \{0^n 1^n \mid n \geq 0\}$. 5

OR

(c) Prove that PDA and CFGs are equivalent. 5

(d) Design the PDA for palindrome string of alphabets {0, 1}. 5

5. Attempt **ALL** :

(a) What is regular expression ? 2½

(b) Give the derivations of decision tree. 2½

(c) Write closure properties of CFL. 2½

(d) Draw a diagram for Push Down Automata. 2½

5. Attempt **ALL** :

(a) Define two-way finite automata. 2½

(b) What is Regular Set ? 2½

(c) What is ambiguous grammar ? 2½

(d) Define PDA. 2½

TKN/KS/16/5977

Bachelor of Computer Application (B.C.A.)
Semester—IV (C.B.S.) Examination

THEORY OF COMPUTATION

Paper—III

Time—Three Hours] [Maximum Marks—50

Note :— (1) All questions are compulsory and carry equal marks.

(2) Draw neat and labelled diagram wherever necessary.

EITHER

1. (a) Build a DFA for the following language.

L = {w | w is a binary string that contains 01 of a substring} 5

(b) Define NFA and prove equivalence of DFA and NFA. 5

OR

(c) Build a DFA for the following language over the alphabets {0, 1} : of the set of all strings such that each block of five consecutive symbols contains at least two 0's. 5

(d) Construct DFA for the following NFA :

	0	1
→p	{p, q}	{p}
q	{r}	{r}
r	{s}	ϕ
*s	{s}	{s}

5

EITHER

2. (a) State and prove the theorem of pumping lemma for regular set. 5

(b) Prove the context free grammar accepts the word palindrome over the alphabets {0, 1}. 5

OR

(c) Explain the closure properties of regular set. 5

(d) Define CFG and give applications of CFG and CFL. 5

EITHER

3. (a) Explain the process of eliminating useless symbols from CFG. 5

(b) Define CNF. Convert following grammar into CNF :

$S \Rightarrow AS \mid BABC$

$A \Rightarrow A1 \mid 0A1 \mid 01$

$B \Rightarrow 0B \mid 0$

$C \Rightarrow 1C \mid 1$ 5

OR

(c) Define GNF and closer properties of CFL. 5

(d) Explain pumping lemma for CFG. 5

EITHER

4. (a) Design a PDA for $L_{ww}R$. 5

(b) Convert the grammer

$S \rightarrow 0S1 \mid A$

$A \rightarrow 1A0 \mid S \mid \in$

to a PDA that accepts the same language by empty stock. 5

OR

(c) Give the instantaneous description of PDA. 5

(d) Explain the process of converting grammar to PDA. 5

NKT/KS/17/5266

Bachelor of Computer Application (B.C.A.) Semester—IV (C.B.S.) Examination

THEORY OF COMPUTATION

Paper–III

Time : Three Hours] [Maximum Marks : 50

N.B. :— (1) **ALL** questions are compulsory and carry equal marks.

(2) Draw neat and labelled diagrams whenever necessary.

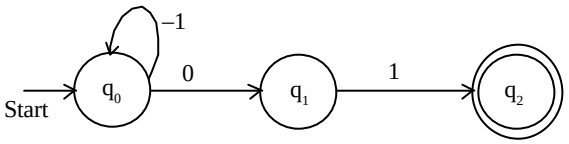
EITHER

1. (a) What is Finite Automata ? Construct a NFA accepting all strings in $\{a, b\}^+$ with either two consecutive a's *or* two consecutive b's. 5

(b) Explain the construction of NFA with E-transition from any given regular expression. 5

OR

(c) Explain the steps in conversion of NFA to DFA. Convert the following NFA to DFA. 5



(d) Explain Finite Automata with output. 5

EITHER

2. (a) Explain the closure properties of regular set with example. 5

(b) Explain Derivation Tree in detail. 5

OR

(c) Find whether the languages :

$\{ww^R$, w is in $(1+0)^*\}$ is regular *or* not. 5

(d) Explain Decision Algorithm for Regular sets. 5

EITHER

3. (a) Explain Chomsky Normal form with suitable example. 5

(b) Explain the process of eliminating useless symbols from CFG. 5

OR

(c) Explain Greibach Normal form with suitable example. 5

(d) Explain closure properties of context free language. 5

EITHER

4. (a) Discuss about PDA acceptance :

(i) From empty stack to final state.

(ii) From final state to empty stack. 5

(b) Define a PDA. Give an example for a Language accepted PDA by empty stack. 5

OR

(c) Construct PDA for language :

$L = \{ww^R/w \text{ in } (a+b)^*\}$. 5

(d) If L is context free language then prove that there exists PDA M such that L = N (M). 5

5. Attempt **ALL** :

(a) Explain two way finite automata. 2½

(b) Define parse tree. 2½

(c) Explain pumping lemma for context free language. 2½

(d) Give formal definition of a PDA. 2½

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Bachelor of Computer Application (B.C.A.) Semester—IV (C.B.S.) Examination

THEORY OF COMPUTATION

Paper—III

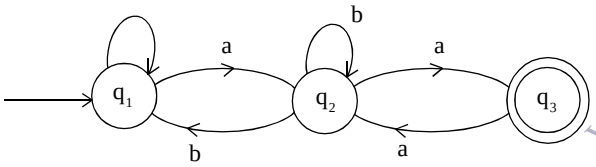
Time : Three Hours] [Maximum Marks : 50

N.B. :— (1) **ALL** questions are compulsory and carry equal marks.

(2) Draw neat and well labelled diagrams wherever necessary.

EITHER

1. (A) Find the regular expression for the following finite automata : 5



(B) Prove that : Let L be a set accepted by NFA. Then there exist DFA that accepts L. 5

OR

(C) Explain two-way finite automata. 5

(D) Construct NFA for the regular expression 01* + 1. 5

EITHER

2. (A) Define :

(i) Transitive closure of R

(ii) Reflexive and transitive closure of R. 5

(B) Define CNF. Find a grammar in CNF equivalent to :

$S \rightarrow aAbB$

$A \rightarrow aA/a$

$B \rightarrow bB/b$ 5

OR

(C) State the Pumping lemma for regular set. What are its applications ? 5

(D) Show that $L = \{0^i 1^i \mid i \geq 1\}$ is not regular. 5

EITHER

3. (A) Show that the following language is not context free,

$L = \{a^n b^n c^n \mid n \leq m \leq 2\ n\}$. 5

(B) (i) Chomsky Normal Form

(ii) Greibach Normal Form. 5

OR

(C) Explain pumping lemma for C & G. 5

(D) Prove any two decision properties of context free languages. 5

EITHER

4. (A) Explain push down Automata. 5

(B) Construct a PDA accepting $L = \{W \subset W^T / W \in \{a, b\}^*\}$ by final state. 5

OR

(C) Prove that context free languages are closed under union. 5

(D) Prove that for every CFL, there exists an equivalent push down automata. 5

5. (A) Explain the role of finite automata in Lexical Analyser. 2½

(B) Explain Derivation trees. 2½

(C) What is ambiguous grammar. 2½

(D) Design a PDA accepting $\{0^n 1^{2n} \mid n \geq 1\}$ by empty stack. 2½

Bachelor of Computer Application (B.C.A.) Semester–IV (C.B.S.) Examination
THEORY OF COMPUTATION
Paper—III

Time : Three Hours] [Maximum Marks : 50

N.B. :— (1) **ALL** questions are compulsory and carry equal marks.
(2) Draw neat and labelled diagram wherever necessary.

EITHER

1. (a) Design a finite automata accepting string ''110101'' over the alphabets {0, 1}. 5
(b) Let R be a regular expression. Prove that there exists an NFA with $\in$ transition that accepts L(r). 5

OR

(c) Let L be accepted by a non-deterministic finite automata. Prove that there exists a deterministic finite automation that accepts L. 5
(d) Write a regular expression for the language having set of all strings with equal number of 0s and 1s. 5

EITHER

2. (a) Prove that regular sets are closed under intersection. 5
(b) Explain principle of pumping lemma for regular set. 5

OR

(c) Justify the set of all strings that do not have three consecutive 0's is regular set or not. 5
(d) Prove that the class of regular set is closed under complementation. 5

EITHER

3. (a) Consider a grammar :—
$G = (v, T, P, S)$ where
$v = \{S\}$ and $P = \{S \rightarrow aSb, S \rightarrow ab\}$.
Give the language generated by this. 5
(b) Explain pumping lemma for context free grammar. 5

OR

(c) Explain closure properties of CFL. 5
(d) Write a note on Greibach normal form. 5

EITHER

4. (a) Prove that every context free language is accepted by same push down automation. 5
(b) What are the properties of context free language ? 5

OR

(c) Give the informal description of Push Down Automata. 5
(d) Prove $L = \{a^n b^n c^n : n \geq 0\}$ it not context free. 5

5. Attempt all :—
(a) Define two-way automata. 2½
(b) What is Regular set ? 2½
(c) What is context free grammar ? 2½
(d) Define Push-Down Automata. 2½

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THEORY OF COMPUTATION

Paper—III

Time : Three Hours] [Maximum Marks : 50

N.B. :— (1) **All** questions are compulsory and carry equal marks.

(2) Draw neat and labelled diagrams wherever necessary.

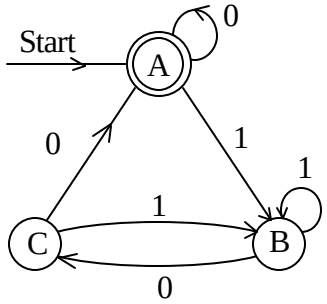
EITHER

1. (A) Give DFA accepting a language over the alphabet {0, 1} for set of all strings ending in 00. 5

(B) Let L be a set accepted by a non-deterministic finite automata. Then prove that there exists a deterministic finite automation that accepts L. 5

OR

(C) Construct regular expression corresponding to the state diagram : 5



(D) Explain Finite Automata with output. 5

EITHER

2. (A) Show that L = $\{O^{i^2}/i$ is an integer, $i \geq 1\}$ is not regular. 5

(B) Prove that regular sets are closed under intersection. 5

OR

(C) Give a CFG generating the set of all strings over alphabet {a, b, ·, +, ∗, (,), ∈, ϕ} that are well formed regular expression over alphabet {a, b}. 5

(D) What is leftmost derivation, rightmost derivation and ambiguous grammar ? Illustrate using example. 5

EITHER

3. (A) What is unit production and ∈-production ? State the Chomsky Normal Form. 5

(B) Find Greibach Normal Form grammar equivalent to the following CFG :

$S \rightarrow AA/0$

$A \rightarrow SS/1$ 5

OR

(C) State pumping Lemma for CFG. Show that $L = \{a^i b^i c^i / i \geq 1\}$ is not context free language. 5

(D) Prove that context-free languages are closed under union and concatenation. 5

EITHER

4. (A) Define – Deterministic PDA with example. 5

(B) Construct PDA that accepts {WCW^R/W in (0 + 1)*} by empty stack. 5

OR

(C) Construct PDA equivalent to the following grammar :

$S \rightarrow aAA$

$A \rightarrow aS/bS/a$ 5

(D) Explain the conversion of PDA to grammar. 5

5. Attempt **ALL** :

(A) Prove that identity :

(i) $r + s = s + r$

(ii) $(r^*)^* = r^*$ 2½

(B) What are regular sets ? 2½

(C) Give grammar for set of palindromes over alphabet {a,b}. 2½

(D) For a PDA, define a language accepted by final state. 2½