QUESTION 2015

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any ten of the following:

i) Consider the grammar $S \rightarrow aSAb / \in$

$A \rightarrow bA / \in$

The grammar generates the strings of the form $a^i b^j$ for some $i, j \geq 0$. What is the conditions of the values of i and j?

a) $i = j$ b) $j \leq 2i$ c) $j \geq 2i$ ✓d) $i \leq j$

ii) Let N be an NFA with n states and let M be the minimized DFA with m states recognizing the same language. Which of the following is NECESSARILY true?

✓a) $m \leq 2^n$ b) $n \leq m$

c) M has one accept state d) $m = 2^n$

iii) Compatible pairs are obtained from

✓a) merger graph b) compatible graph

c) testing table d) testing graph

iv) The string 1101 does not belong to the set represented by

a) 110*(0+1) b) 1(0+1)*101

✓c) (10)*(01)*(00+11)* d) (00+(11)*01)*

v) Regular sets are closed under

a) union b) concatenation c) kleene closure ✓d) all of these

vi) The intersection of CFL & RE is always

✓a) CFL b) RE c) CSL d) CFL or CSL

vii) Which of the following common in both CNF & GNF?

a) (NT) → (Single T) (String of NT) b) (NT) → (String of exactly two NT)

c) (NT) → (String of NT) ✓d) (NT) → (Single T)

viii) Consider the languages:

$L_1 = \{ww^R \mid w \in \{0,1\}^*\}$

$L_2 = \{w\#w^R \mid w \in \{0,1\}^*\}$, where # is a special symbol

$L_3 = \{ww \mid w \in \{0,1\}^*\}$

Which one of the following is true?

a) L_1 is a deterministic CFL
✓b) L_2 is a deterministic CFL
c) L_3 is a CFL, but not a deterministic CFL
d) L_3 is a deterministic CFL

ix) Difference between Turing Machine & Two way FA is in
a) input tape ✓b) read write head c) finite control d) all of these

x) Which of the following statements is false?
a) the halting problem of Turing machine is undecidable
b) determining whether a context-free grammar is ambiguous is undecidable
c) given two arbitrary context free grammars G_1 and G_2, it is undecidable whether $L(G_1) = L(G_2)$
✓d) given two regular grammars G_1 and G_2, it is undecidable whether $L(G_1) = L(G_2)$

Group – B
(Short Answer Type Questions)

2. Let R be an equivalence relation in $\{0\}^*$ with the following equivalence classes:
$[\,]_R = \{0\}^0$
$[0]_R = \{0\}^1$
$[00]_R = \{0\}^2 \cup \{0\}^3 \cup \{0\}^4$ .....
Show that R is right invariant.
See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Short Answer Type Question No. 8.

3. Define NFA. Construct equivalent DFA from the given NFA.

Present State	Next State	
	0	1
→ q0	q0, q1	q2
q1	q2	q1
(q2)	q1	q2

See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Short Answer Type Question No. 35.

4. Design a two input two output sequence detector which generates an output '1' every time the sequence 1001 is detected. And for all other cases output '0' is generated. Overlapping sequences are also counted.
[Denote State Graph, State Table and perform State assignment]
See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Short Answer Type Question No. 34.

5. Construct a Push Down Automata equivalent o the following Context Free Grammar
$G = (Vn, Vt, P, S)$ with $Vn = \{S, E\}$, $Vt = \{0,1\}$ and P is define transition follows:
S-> 0S1/A
A-> 1A0/S/ε

Now check the string 001011 is acceptable by this Push Down Automata or not.
See Topic: PUSHDOWN AUTOMATION, Short Answer Type Question No. 4.

6. a) What is parse tree?
b) Consider the CFG

S- > aaB

A- > bBb / ε

B- > Aa

Find the Parse tree for the string aabbababa.
See Topic: CONTEXT FREE LANGUAGES, Short Answer Type Question No. 12.

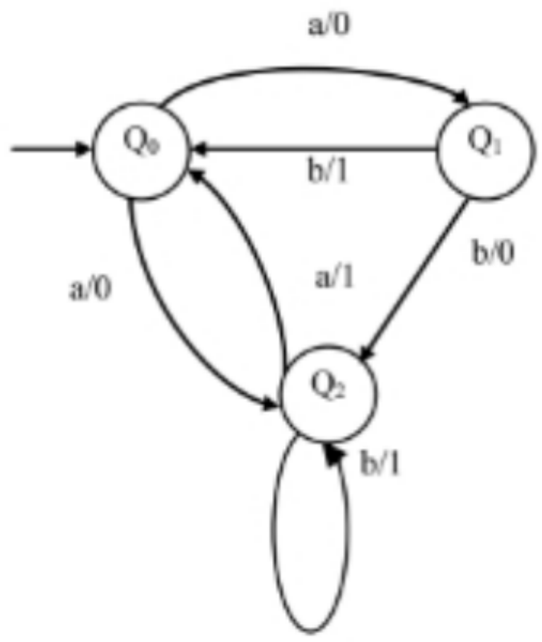
Group – C
(Long Answer Type Questions)

7. a) A long sequence of pulses enters a synchronous sequential circuit, which is required to produce an output pulse $z = 1$ whenever the sequence 1001 occurs. Overlapping sequences are accepted.
i) Draw a state diagram
ii) Select an assignment and show the excitation and output tables.
b) Minimize the machine using equivalent partitioning

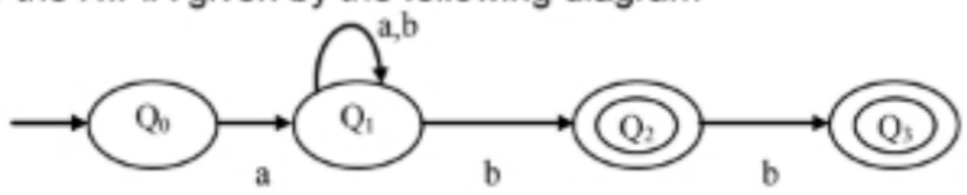
Present state	Next state,	output
	X = 0	X = 1
A	E, 0	D, 1
B	F, 0	D, 0
C	E, 0	B, 1
D	F, 0	B, 0
E	C, 0	F, 1
F	B, 0	C, 0

a) See Topic: INTRODUCTION, Long Answer Type Question No. 2.
b) See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Short Answer Type Question No. 37.

8. a) Define and compare Moore and Mealy machines.
b) Convert the following Mealy machines into Moore machine.



c) Consider the N.F.A given by the following diagram



Find the equivalent D.F.A without e-transition.

a) See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Short Answer Type Question No. 15.

b) See Topic: INTRODUCTION, Long Answer Type Question No. 3.

c) See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Long Answer Type Question No. 20.

9. Consider the following state table

Present state	Next state,	output
	I1	I2
A	E, 0	B, 0
B	F, 0	A, 0
C	E, -	C, 0
D	F, 1	D, 0
E	C, 1	C, 0
F	D, -	B, 0

a) Draw the merger graph.

b) Draw the merger table.

c) Draw the compatibility graph.

d) Find the minimal machine which covers that machine.

See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Long Answer Type Question No. 19.

10. Consider the following state table.

Present state	Next state,	output
	X = 0	X = 1
A	B, 1	H, 1
B	F, 1	D, 1
C	D, 0	E, 1
D	C, 0	F, 1
E	D, 1	C, 1
F	C, 1	C, 1
G	C, 1	D, 1
H	C, 0	A, 1

a) Find the equivalence partition for the machine.

b) Show a standard form of the corresponding reduced machine and draw the state diagram.

c) Find a minimum length sequence that distinguishes state A from state B.

See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Long Answer Type Question No. 3 (a).

POPULAR PUBLICATIONS

11. a) Define Turing machine.
b) Explain different types of Turing machine.
c) What is halting problem in Turing machine?
d) Design a Turing machine accepts the language of all string which contain "aba" as a substring.

a) See Topic: TURING MACHINE & UNDECIDABILITY, Long Answer Type Question No. 3 (a).
b) See Topic: TURING MACHINE & UNDECIDABILITY, Long Answer Type Question No. 3 (b).
c) See Topic: TURING MACHINE & UNDECIDABILITY, Short Answer Type Question No. 1.
d) See Topic: TURING MACHINE & UNDECIDABILITY, Long Answer Type Question No. 3 (c).

QUESTION 2016

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any ten of the following:

i) A context free grammar is not closed under
- a) Product
- b) Union
- ✓c) Complementation
- d) Kleen star

ii) Context sensitive grammar can be recognized by
- a) deterministic push down machine
- b) non-deterministic push down machine
- c) FSM
- ✓d) linearly bounded memory machine

iii) $A=(a+b)^*a$ and $B=b(a+b)^*$ then A intersection B will be
- a) $(a+b)^*ab$
- b) $ab(a+b)^*$
- c) $a(a+b)^*b$
- ✓d) $b(a+b)^*a$

iv) Which of the following is most general phase structured grammar?
- a) Regular
- ✓b) Context sensitive
- c) PDA
- d) none of these

v) The string 1101 does not belong to the set represented by
- a) $110^*(0+1)$
- b) $1(0+1)^*101$
- c) $(10)^*(01)^*(00+11)^*$
- ✓d) $\left[00+(11)^*0\right]^*$

vi) Pumping lemma is generally used for
- a) a given grammar is regular
- ✓b) a given grammar is not regular
- c) whether two regular expressions are equivalent or not
- d) none of these

vii) The basic limitation of FSM is that
- ✓a) it cannot remember arbitrary large amount of information
- b) it some times fail to recognize grammar that are regular
- c) it some times fail to recognizes grammar that are not regular

d) all of these

viii) Recursive languages are
a) closed under insertion
b) recursively enumeration
c) closed under complementation
✓d) all of these

ix) k -level equivalence is possible between two finite automata
a) if all equivalence above k -level exist between them
✓b) if all level equivalence up to $k-1$ level already exist
c) if both contain at least k number of states
d) if both contain exactly k number of states

x) An automata is a/an ..... device.
✓a) acceptor only b) acceptor / rejector c) rejector only d) generating

xi) Which of the following is correct?
a) Language can be derived from the FA
b) Regular expressions can be derived from the FA
c) FA can be derived from the language
✓d) both (a) & (b)

Group – B
(Short Answer Type Questions)

2. Design a two-input two-output sequence detector which generates an output '1' every time the sequence 1010 is detected. And for all other cases output '0' is generated. Overlapping sequences are also counted. Draw only state table and state diagram.
See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Short Answer Type Question No. 39.

3. Convert the following NFA into an equivalent DFA.

PS	NS	
	$a=0$	$a=1$
$\rightarrow q_0$	q_0, q_1	q_0, q_2
q_1	q_3	–
q_2	–	q_3
(q_3)	q_3	q_3

See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Short Answer Type Question No. 38.

4. Define DFA. Derive the DFA for the regular language $0(0+1)^*1$ for the symbols $\sum = \{0, 1\}$.
See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Short Answer Type Question No. 41.

POPULAR PUBLICATIONS

5. Construct a minimum state automaton from the transition table given below:

PS	$x=0$	$x=1$
q_0	q_1	q_2
q_1	q_2	q_3
q_2	q_2	q_4
q_3	q_3	q_3
q_4	q_4	q_4
q_5	q_5	q_4

q_3, q_4, q_5 are final states.

See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Short Answer Type Question No. 42.

6. Find the string which is applied on state 'D' producing output string 10011110 and final state 'D' for the machine given below:

PS	$NS, o/p$	
	$x=0$	$x=1$
A	$A, 1$	$C, 1$
B	$E, 0$	$B, 1$
C	$D, 0$	$A, 0$
D	$C, 0$	$B, 0$
E	$B, 1$	$A, 0$

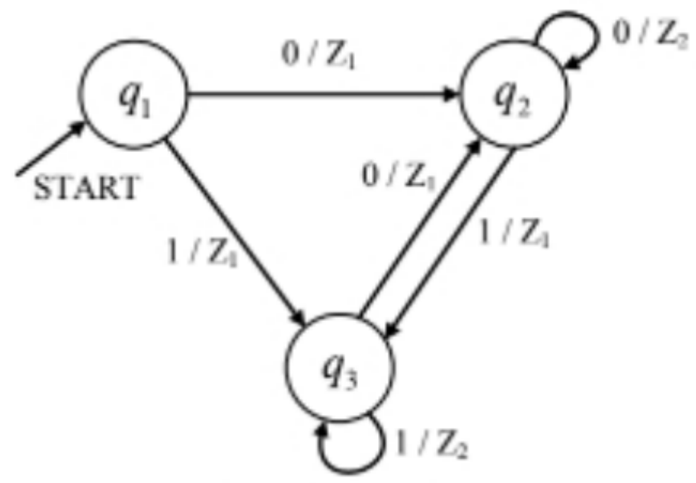
See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Short Answer Type Question No. 40.

Group – C

(Long Answer Type Questions)

7. a) Construct a regular grammar G generating the regular set represented by $P = a^*b(a+b)^*$

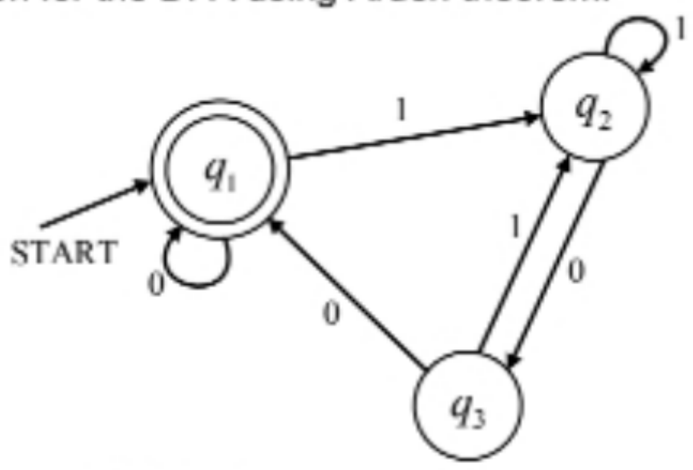
b) Convert the following Mealy machine to Moore machine.



c) What is Klenne's star? Give example. What is positive closure? Give example.

a) See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Short Answer Type Question No. 7.
b) See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Short Answer Type Question No. 28.
c) See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Short Answer Type Question No. 25.

8. a) Construct an equivalent PDA for the following CFG:
S → aAB / bBA
A → bS / a
B → aS / b
Show an ID for the string abbaaabbbab for the PDA generated with stack description.
b) Give the regular expression for the DFA using Arden theorem.



c) Convert the following grammar into GNF:
S → ABb / a
A → aaA / B
B → bAb.
a) See Topic: PUSHDOWN AUTOMATION, Long Answer Type Question No. 4.
b) See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Short Answer Type Question No. 26.
c) See Topic: CONTEXT FREE LANGUAGES, Short Answer Type Question No. 7.

9. a) Let G be the grammar S → aB | ba, B → b | bS | aBB.
For the string aaabbabbba find:
i) left most derivation
ii) rightmost derivation
iii) parse tree
b) Prove that CFLs are not closed under intersection and complement operation.
c) Design an NFA which accepts set of all binary strings containing 1100 or 1010.
a) See Topic: CONTEXT FREE LANGUAGES, Short Answer Type Question No. 13.
b) See Topic: PUSHDOWN AUTOMATION, Long Answer Type Question No. 2.
c) See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Short Answer Type Question No. 14.

10. a) What do you mean by distinguishable and indistinguishable states?

b) Draw the Merger graph, Merger table, compatibility graph and then minimize the following:

Present State	Next State, o/p			
	Input = 0	Input = 1	Input = 2	Input = 3
A	–	C, 1	E, 1	B, 1
B	E, 0	–	–	–
C	F, 0	F, 1	–	–
D	–	–	B, 1	–
E	–	F, 0	A, 0	D, 1
F	C, 0	–	B, 0	C, 1

a) See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Long Answer Type Question No. 13 (a).

b) See Topic: INTRODUCTION, Long Answer Type Question No. 1.

11. a) Design a TM that accepts $\{0^n 1^n \mid n >= 1\}$.

b) What do you mean by halting problem of a Turing machine?

c) Explain Ogden's Lemma for CFL.

d) Construct CFG for the following:

i) Palindrome for binary numbers

ii) $L = \{a^n b^n c^m d^m \mid m, n > 0\}$

a) See Topic: TURING MACHINE & UNDECIDABILITY, Long Answer Type Question No. 1 (a).

b) See Topic: TURING MACHINE & UNDECIDABILITY, Short Answer Type Question No. 1.

c) See Topic: PUSHDOWN AUTOMATION, Long Answer Type Question No. 2.

d) See Topic: CONTEXT FREE LANGUAGES, Long Answer Type Question No. 4 (a).

QUESTION 2017

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following:

i) Regular grammar is

✓a) context free grammars
b) context sensitive grammar
c) non-context grammar
d) none of these

ii) In Moore machine, output is associated with

✓a) present state only
b) next state only
c) present state and input
d) none of these

iii) Compatible pairs are obtained from

✓a) Merger Graph b) Compatible Graph

c) Testing Table d) Testing Graph

iv) The string 1101 does not belong to the set represented by

a) 110 * (0 + 1) b) 1 (0 + 1) * 101

✓c) (10) * (01) * (00 + 11)* d) (00 + (11) * 01)*

v) Regular expression is accepted by

a) Finite automata b) Mealy machine

c) Pushdown automata ✓d) all of these

vi) If *P* and *Q* are regular expression (*P* is not null), then $R = Q + RP$ has the unique solution

a) $R = Q * P$ b) $R = PQ^*$ c) $R = Q * P^*$ ✓d) $R = QP^*$

vii) Which of the following is common in both CNF & GNF?

a) (*NT*) → (Single *T*) (String of *NT*) b) (*NT*) → (String of exactly two *NT*)

c) (*NT*) → (String of *NT*) ✓d) (*NT*) → (Single *T*)

viii) Consider the languages:

$L_1 = \{ww^R \mid w \in \{0,1\}^*\}$

$L_2 = \{w\#w^R \mid w \in \{0,1\}^*\}$, where # is a special symbol

$L_3 = \{ww \mid w \in \{0,1\}^*\}$

Which one of the following is true?

a) L_1 is a deterministic CFL ✓b) L_2 is a deterministic CFL

c) L_3 is a CFL, but not a deterministic CFL d) L_3 is a deterministic CFL

ix) Difference between Turing Machine & Two way FA is in

a) Input tape b) Read wire head c) Finite control ✓d) all of these

x) Which of the following statements is *false*?

a) The halting problem of Turing machine is undecidable

b) Determining whether a context-free grammar is ambiguous is undecidable

c) Given two arbitrary context free grammars G_1 and G_2. It is undecidable whether $L(G_1) = L(G_2)$

✓d) Given two regular grammars G_1 and G_2. It is undecidable whether $L(G_1) = L(G_2)$

Group – B

(Short Answer Type Questions)

2. What do you mean by unit production? Remove unit productions from the grammar $S \to AB$, $A \to a$, $B \to C$, $C \to D$, $D \to b$.

POPULAR PUBLICATIONS

See Topic: CONTEXT FREE LANGUAGES, Short Answer Type Question No. 14.

3. Construct grammar of the following:

a) For the language $a^n b^n$, where $n >= 0$.

b) All even integers up to 998.

a) See Topic: CONTEXT FREE LANGUAGES, Short Answer Type Question No. 15.

b) See Topic: CONTEXT FREE LANGUAGES, Short Answer Type Question No. 10 (b).

4. Define *NFA*. Construct equivalent *DFA* from the given *NFA*.

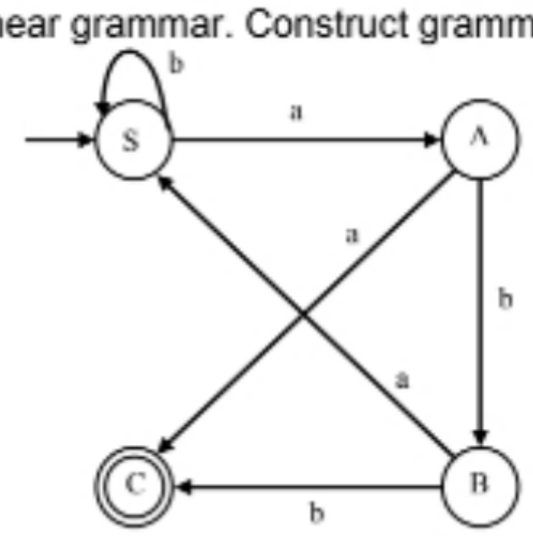
Present State	Next State	
	0	1
$\rightarrow q_0$	q_0, q_1	q_2
q_1	q_2	q_1
(q_2)	q_1	q_2

See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Short Answer Type Question No. 35.

5. Design a two-input two-output sequence detector which generates an output 1 every time the sequence 1101 is detected. And for all other cases output 0 is generated. Overlapping sequences are also counted.

See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Short Answer Type Question No. 43.

6. Define Left Linear and Right linear grammar. Construct grammar for the following *FA*:



See Topic: CONTEXT FREE LANGUAGES, Short Answer Type Question No. 16.

Group – C
(Long Answer Type Questions)

7. State and prove Arden's theorem in regular expression. Minimize the following incompletely specified machine:

PS	*NS, Z*		
	I_1	I_2	I_3
A	*A*, 1	*D*, _	*C*, _
B	*A*, _	*D*, _	*E*, _
C	*E*, 0	*A*, 1	_, _
D	*E*, _	*A*, 1	_, _
E	*E*, 0	_, _	*C*, _

1st Part: See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Long Answer Type Question No. 22.
2nd Part: See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Long Answer Type Question No. 18.

8. Convert the following Mealy machine to equivalent Moore machine:

Present state	I/P = 0		I/P = 1	
	Next Sate	O/P	Next Sate	O/P
→ q_0	q_1	1	q_2	1
q_1	q_3	0	q_0	1
q_2	q_4	0	q_3	1
q_3	q_1	0	q_4	0
q_4	q_2	1	q_4	0

Using Pumping lemma prove that $L=\{a^n b^n \mid n \geq 1\}$ is not regular.

Construct Finite Automata equivalent to the Regular Expression
$L = ab(a+b)(ab)^* b$.

1st Part: See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Long Answer Type Question No. 17.
2nd Part: See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Long Answer Type Question No. 21.
3rd Part: See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Long Answer Type Question No. 23.

9. Find a reduced grammar equivalent to the grammar:
$S \to aAa$
$A \to bBB$
$B \to ab$
$C \to aB$
Convert the following grammar into GNF.
$S \to AA/a$
$A \to SS/b$
Prove that Context Free Languages are not closed under intersection.
1st Part: See Topic: CONTEXT FREE LANGUAGES, Long Answer Type Question No. 3 (b).
2nd Part: See Topic: CONTEXT FREE LANGUAGES, Short Answer Type Question No. 11.
3rd Part: See Topic: CONTEXT FREE LANGUAGES, Long Answer Type Question No. 5.

10. Define PDA by giving a block diagram. Explain how a string be accepted by a PDA? Design a non-Deterministic Pushdown Automata for accepting the string $L=\{WCW^R \mid W\varepsilon(a,b)^*\}$ and W^R is the reverse of *W* by Empty stack.
Construct an equivalent PDA for the following CONTEXT FREE GRAMMARS.

POPULAR PUBLICATIONS

$S \rightarrow aA$

$A \rightarrow aABC \,/\, bB \,/\, a$

$C \rightarrow c$

Show an ID for the string *aabbbc* for the PDA generated.

1st Part: See Topic: PUSHDOWN AUTOMATION, Long Answer Type Question No. 5 (1st part).
2nd Part: See Topic: PUSHDOWN AUTOMATION, Long Answer Type Question No. 6.
3rd Part: See Topic: PUSHDOWN AUTOMATION, Long Answer Type Question No. 5 (3rd part).
4th Part: See Topic: PUSHDOWN AUTOMATION, Long Answer Type Question No. 5 (4th part).

11. Design a Turing Machine which accepts the language $L = \{a^n b^n, n \geq 1\}$. Write a short note on Multi-Tape and Multi Head Turing Machine.

See Topic: TURING MACHINE & UNDECIDABILITY, Long Answer Type Question No. 4.

QUESTION 2018

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following:

i) A finite automata recognizes
- a) Any Language
- b) Context Sensitive Language
- c) Context Free Language
- ✓d) Regular Language

ii) Maximum number of states of a DFA converted from a NFA with n states is
- a) n
- b) n^2
- ✓c) 2^n
- d) None of these

iii) Regular Expression is accepted by
- a) Finite Automata
- b) Push Down Automata
- c) Turing Machine
- ✓d) All of these

iv) Pumping Lemma for Regular Expression is used to prove that
- a) Certain sets are Regular
- ✓b) Certain sets are not Regular
- c) Certain Regular Grammar produce Regular Expression
- d) Certain Regular Grammar does not produce Regular Expression

v) CFL is _____ language.
- a) Type 0
- b) Type 1
- ✓c) Type 2
- d) Type 3

vi) Useless symbols in CFG are
- a) Non-generating symbol and non-reachable symbols

✓b) Null alphabets and null string
c) Non-terminal symbols
d) All of the above

vii) PDA is the machine format of
a) Type 0 Language
b) Type 1 Language
✓c) Type 2 Language
d) Type 3 Language

viii) The difference between finite automata and PDA _____.
a) Reading Head
b) Input Tape
c) Finite Control
✓d) Stack

ix) Which is not a part of the mechanical diagram of 'Turing Machine'?
a) Input Tape
b) Read-write head
c) Finite control
✓d) Stack

x) Which of the string is accepted by Turing Machine?
a) $L = a^n c^m b^n$, where $m, n > 0$
b) $L = a^n b^n c^i$, $n, i > 0$
c) $L = a^n b^n c^n$, where $n > 0$
✓d) All of these

xi) Number of vertices of a Merger graph is
✓a) The number of state of the machine
b) Number of compatible pairs
c) Number of states combinations
d) None of the above

xii) Number of vertices of a compatible graph is
a) the number of states of the machine
✓b) number of compatible pairs
c) number of states combinations
d) None of the above

Group – B
(Short Answer Type Questions)

2. Construct the language for the grammar $G = (\{S\}, (a, b), S, P)$, with P given by

$S \to aSb$
$S \to \lambda$

See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Short Answer Type Question No. 45.

3. Define Deterministic Finite Automata. What do you mean by NFA with -moves.
See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Short Answer Type Question No. 44.

4. State and prove Erden's Theorem.
See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Long Answer Type Question No. 22.

5. Remove the UNIT productions from the following grammar:

$S \to Aa \mid B$

$$B \rightarrow A \mid bb$$
$$A \rightarrow a \mid bc \mid B$$

See Topic: CONTEXT FREE LANGUAGES, Short Answer Type Question No. 17.

6. Construct a PDA to accept the language $L = \{a^n b^n c^m ;\ n, m \geq 1\}$ by empty stack and by final state.

See Topic: PUSHDOWN AUTOMATION, Short Answer Type Question No. 5.

7. What is Homomorphism? Find the homomorphic image of $L = \{aa, aba\}$ where h is defined as $h(a) = ab$ and $h(b) = bbc$.

See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Short Answer Type Question No. 46.

Group – C
(Long Answer Type Questions)

8. a) Define Pushdown Automata.

See Topic: PUSHDOWN AUTOMATION, Long Answer Type Question No. 1.

b) Construct an NDPA that accepts the language generated by the productions $S->aSa \mid bSb \mid c$. Show an Instantaneous description of this string $abcba$ for this problem.

See Topic: PUSHDOWN AUTOMATION, Short Answer Type Question No. 2.

9. a) $E->E+E \mid E*E \mid a$. Prove that the CFG with this production rule is ambiguous. Remove the ambiguity from this grammar.

See Topic: CONTEXT FREE LANGUAGES, Long Answer Type Question No. 6 (a).

b) $S->AB;\ A->a;\ B->C/b, C->D;\ D->E, E->a$

Remove the unit production.

See Topic: CONTEXT FREE LANGUAGES, Long Answer Type Question No. 6 (b).

c) Design a PDA which accepts the language.

$L = \{Ws(a,b)^* \mid W \text{ has equal no. of } a \,\&\, b\}$

See Topic: PUSHDOWN AUTOMATION, Short Answer Type Question No. 1.

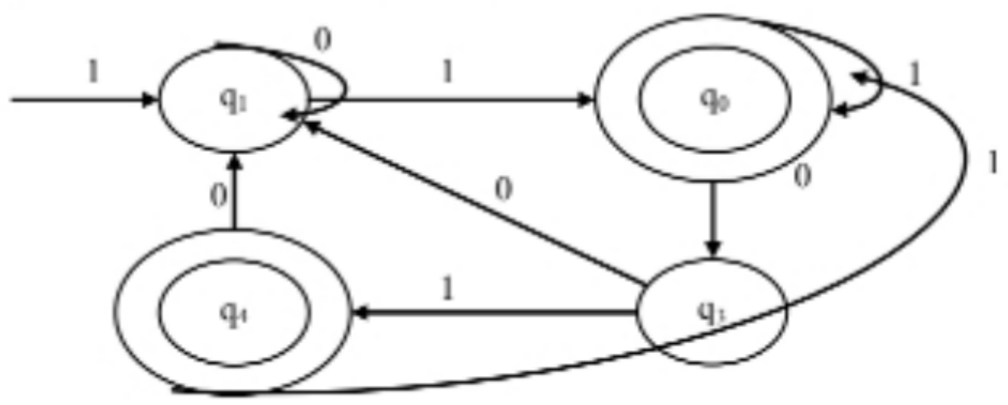
10. a) Construct a minimum state automata equivalent to a given automata M which transition table is given below:

State	input	
	a	b
$\rightarrow q_0$	q_0	q_3
q_1	q_2	q_5

q_2	q_3	q_4
q_3	q_0	q_5
q_4	q_0	q_6
q_5	q_1	q_4
q_6	q_1	q_3

See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Long Answer Type Question No. 26.

b) Find the regular expression corresponding to the following figure:



See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Long Answer Type Question No. 24.

c) Draw sequence detector diagram, table, k-map and circuit for the sequence 0101 which generates a 1 as output after every 0101 sequence. Consider overlapping of sequences.
See Topic: INTRODUCTION, Long Answer Type Question No. 4.

11. Construct the merger table, merger graph, compatibility graph and minimal machine for the following Machine:

PS	NS, z	
	I_1	I_2
A	E, 0	B, 0
B	F, 0	A, 0
C	E, –	C, 0
D	F, 1	D, 0
E	C, 1	C, 0
F	D, –	B, 0

See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Long Answer Type Question No. 27.

12. Construct testing table, testing graph for the following machine and test whether it has finite memory or Not, if yes then find the order.

PS	NS, z	
	$x=0$	$x=1$
A	B, 0	D, 0

B	C, 0	C, 0
C	D, 0	A, 0
D	D, 0	A, 1

See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Long Answer Type Question No. 28.

13. a) State the difference between DFA and NFA.
See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Short Answer Type Question No. 21.

b) Design an NFA which accepts set of all binary strings containing 1100 or 1010 as substrings.
See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Long Answer Type Question No. 25.

c) What is regular language?
See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Long Answer Type Question No. 9 (a).

d) Find regular expressions over $\sum = \{a, b\}$ for the languages as follows:

i) $L1 = \{a^m b^m \mid m > 0\}$

ii) $I.2 = \{a^{2n}\ b^{2m+1} \mid n >= 0\ \ m >= 0\}$

iii) $L3 = \{b^m a b^n \mid n > 0,\ m > 0\}$

See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Long Answer Type Question No.9 (b)8.

e) Define turing machine. Explain Church's hypothesis. What is Universal turing machine?
See Topic: TURING MACHINE & UNDECIDABILITY, Long Answer Type Question No. 5.

QUESTION 2019

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following:

i) A solution to the equation $R = Q + RP$ is

✓a) $R = QP*$ b) $Q = RP*$ c) $P = RQ*$ d) $R = PQ*$

ii) The value of $L = \{\Phi *\}$ is

a) $\sum$ b) $\{\in\}$ ✓c) $\{\ \}$ d) none of these

iii) Which of the following is regular?

a) Strings of 0's whose length is a perfect square
b) Strings of all palindromes made up of 0's and 1's
c) Strings of 0's whose length is prime number
✓d) Strings of odd number of zeros.

iv) The logic of pumping is a good example of

✓a) the pigeon-hole principle
b) the divide and conquer technique
c) recursion
d) iteration

v) If S is the number of states in NDFA then equivalent DFA can have maximum of

a) S states
b) $S-1$ states
✓c) 2^S states
d) 2^S-1 states

vi) The class of context free language is not closed under

a) Concatenation
b) Union
✓c) Intersection
d) Repeated concatenation

vii) Which is true of the following?

a) Merger graph is a directed graph
✓b) Compatible graph is a directed graph
c) Both are directed
d) None of these

viii) The production grammar $\{S \to aSbb,\ S \to abb\}$ is

a) Type-3 grammar
✓b) Type-2 grammar
c) Type-1 grammar
d) Type-0 grammar

ix) The reduce grammar of $S \to AB \mid a,\ A \to a$ is

a) $S \to a,\ A \to a$
b) $S \to a \mid A,\ A \to a$
✓c) $S \to a$
d) $S \to aa$

x) A grammar that produces more than one parse tree for some sentences is said to be

a) contiguous
✓b) ambiguous
c) unambiguous
d) regular

xi) The intersection of CFL and Regular language is

a) need not to be Regular Language
✓b) is always Context Free Language
c) is always Regular Language
d) none of these

xii) Which of the following strings can be obtained by the language $L = \{aib2i \mid i \geq\}$

✓a) $aaabbbbbb$
b) $aabbb$
c) $abbabbba$
d) $aaaabbbabb$

Group – B

(Short Answer Type Questions)

2. Define NFA. Construct equivalent DFA from the given NFA:

Present State	Next State	
	$a=0$	$a=1$
$\rightarrow Q_0$	Q_0, Q_1	Q_2
Q_1	Q_2	Q_1
Q_2	Q_1	Q_2

where Q_2 is the final state.

See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Short Answer Type Question No. 35.

3. Design a two input sequence detector which generates an output '1' every time the sequence 1101 is detected and for all other cases output '0' is generated. Overlapping sequences are also counted. [Denoted State Graph, State Table and perform State assignment].

See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Short Answer Type Question No. 43.

4. Convert the following context free grammar into an equivalent grammar in CNF:

$$S \rightarrow aAbB$$

$$A \rightarrow abAB / aAA / a$$

$$B \rightarrow bBaA / aBB / b$$

See Topic: CONTEXT FREE LANGUAGES, Short Answer Type Question No. 1.

5. $E \rightarrow E+E \mid E*E \mid a$. Prove that the CFG with this production rule is ambiguous. Remove the ambiguity from this grammar.

See Topic: CONTEXT FREE LANGUAGES, Long Answer Type Question No. 2 (a).

6. Consider the set $L=\{a^i b^j c^k \mid$ where i, j, k are integers and $i, j, k \geq 1\}$. Is L regular? Justify your answer.

See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Short Answer Type Question No. 9.

Group – C

(Long Answer Type Questions)

7. a) State and discuss Myhill-Nerode theorem.

See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Short Answer Type Question No. 3.

b) Write the CFG for the language $L=\{0^i 1^j 2^k \mid i=j \text{ or } j=k\}$

See Topic: CONTEXT FREE LANGUAGES, Short Answer Type Question No. 18.

c) Prove that CFLs are not closed under intersection and complement operation.

See Topic: PUSHDOWN AUTOMATION, Long Answer Type Question No. 2.

8. a) Convert the following Context-free grammar into an equivalent grammar in CNF:

$$S \to 1A \mid 0B,\ A \to 1AA \mid 0S \mid 0,\ B \to 0BB \mid 1S \mid 1.$$

See Topic: CONTEXT FREE LANGUAGES, Long Answer Type Question No. 7 (a).

b) Let G be the grammar

$$S \to aB \mid bA,\ A \to a \mid aS \mid bAA,\ B \to b \mid bS \mid aBB\ .$$

For the string $aaabbabbab$, find

i) leftmost derivation and rightmost derivation
ii) derivation tree
iii) is this grammar ambiguous?

See Topic: CONTEXT FREE LANGUAGES, Long Answer Type Question No. 7 (b).

c) Construct a DFA for the following regular expression:

$$R = (11+0)^*(00+1)^*.$$

See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Short Answer Type Question No. 47.

9. Draw the merger graph, merger table, compatibility graph and then find the minimal closed covering with justification of the following machine:

PS	NS, o/p		NS, o/p	
	i/p = 0	i/p = 1	i/p = 2	i/p = 3
A	–	C, 1	E, 1	B, 1
B	E, 0	–	–	–
C	F, 0	F, 1	–	–, 1
D	–	–	B, 1	–
E	–	F, 0	A, 0	D, –
F	C, –	–	B, 0	C, 1

See Topic: INTRODUCTION, Long Answer Type Question No. 5.

10. a) Define pushdown automata.

See Topic: PUSHDOWN AUTOMATION, Long Answer Type Question No. 1.

b) Construct a PDA accepting the set of all strings over $\{a, b\}$ with equal number of a's and b's.

See Topic: PUSHDOWN AUTOMATION, Short Answer Type Question No. 1.

c) What are the non-empty transitions in an NPDA?

See Topic: PUSHDOWN AUTOMATION, Short Answer Type Question No. 3.

d) Explain Ogden's lemma for CFL.

See Topic: PUSHDOWN AUTOMATION, Long Answer Type Question No. 2.

POPULAR PUBLICATIONS

11. a) Construct the minimum state automation equivalent to given automata M defined below:

Present State	Next State	
	$a=0$	$a=1$
$\rightarrow Q_0$	Q_5	Q_1
Q_1	Q_2	Q_6
Q_2	Q_2	Q_0
Q_4	Q_5	Q_7
Q_5	Q_6	Q_2
Q_6	Q_4	Q_6
Q_7	Q_2	Q_6

where Q_2 in the final state.

See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Long Answer Type Question No. 29.

b) Convert the following Mealy machine into Moore machine.

Present State	I/P = 0		I/P = 1	
	Next State	Output	Next State	Output
$\rightarrow Q_0$	Q_1	1	Q_2	1
Q_1	Q_3	0	Q_0	1
Q_2	Q_4	0	Q_3	1
Q_3	Q_1	0	Q_4	0
Q_4	Q_2	1	Q_4	0

See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Long Answer Type Question No. 17.

c) Construct a Finite Automata Equivalent to the Regular expression:

$$L = ab(aa+ab)(a+b)^*b$$

See Topic: REGULAR LANGUAGES & FINITE AUTOMATA, Short Answer Type Question No. 48.

12. a) Define Turing machine.

See Topic: TURING MACHINE & UNDECIDABILITY, Long Answer Type Question No. 3 (a).

b) Explain different types of Turing machine.

See Topic: TURING MACHINE & UNDECIDABILITY, Long Answer Type Question No. 3 (b).

c) What is halting problem in Turing machine?

See Topic: TURING MACHINE & UNDECIDABILITY, Short Answer Type Question No. 1.

d) Design a Turing machine that accepts the language of all string which contains "aba" as a substring.

See Topic: TURING MACHINE & UNDECIDABILITY, Long Answer Type Question No. 3 (c).