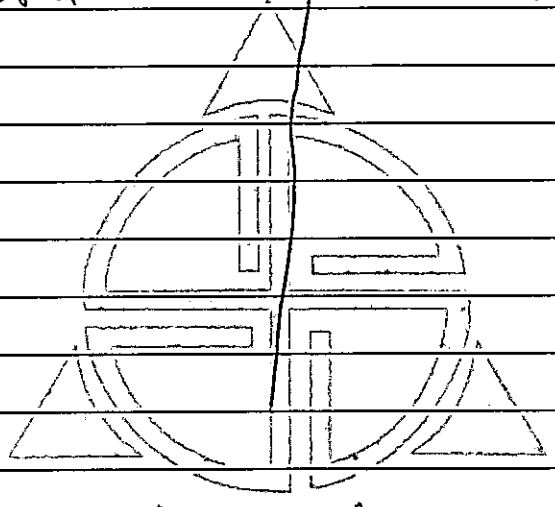
1a,	NFA	DFA
1	~~in~~ its full form is Now Deterministic Automata	full form of DFA is Deterministic automata
2	in this automata we get output for all	in this automata we ~~get~~ did not get output for all
③	All NFA is DFA	All DFA is not ~~DFA~~ NFA
④		



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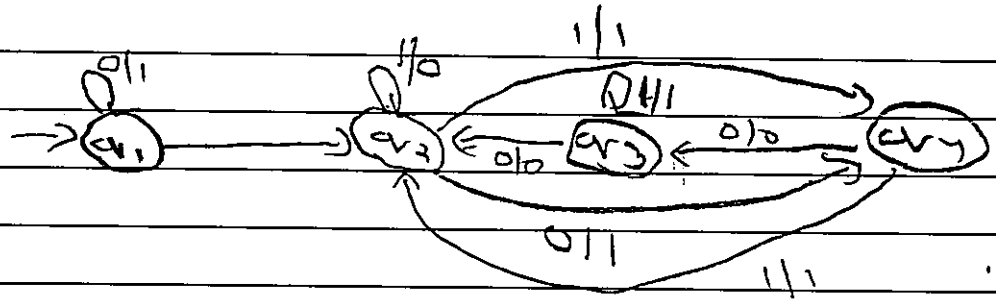
1b, mealy machine

State	state	output	state	output
q_1	q_1	1	q_2	0
q_2	q_4	1	q_4	1
q_3	q_2	0	q_3	1
q_4	q_3	0	q_2	1



mealy machine

State	0	1	Output
q_1			0
q_2			1
q_3			0
q_4			1

	state	0	1
1.C	q_1	q_1	
	q_2	q_2	
	q_3	q_7	
	q_4	q_8	
	q_5	q_5	
	q_6		
	q_7		
	q_8		

state	0	1
→ q_0	q_1	q_4
q_1	q_2	q_3
(*) q_2	q_7	q_8
(*) q_3	q_8	q_7
q_4	q_5	q_6
(*) q_5	q_7	q_8
(*) q_6	q_7	q_8
q_7	q_7	q_7
q_8	q_8	q_8

Equivalence D : $\{q_0, q_1, q_4, q_7, q_8\}\{q_2\}\{q_3\}\{q_5\}\{q_6\}$

$q_0 q_1 = q_{0,0} = q_1 \quad q_{0,1} = q_4$

$q_{1,0} = q_2 \quad q_{1,1} = q_3$

$q_0 \neq q_1$

$q_0 q_4 = q_{0,0} = q_1 \quad q_{0,1} = q_4 \quad q_0 \neq q_4$

$q_{4,0} = q_5 \quad q_{4,1} = q_6$

$q_0 q_7 = q_{0,0} = q_1 \quad q_{0,1} = q_4 \quad q_0 \neq q_7$

$q_{7,0} = q_7 \quad q_{7,1} = q_7$

$q_0 q_8 = q_{0,0} = q_1 \quad q_{0,1} = q_4 \quad q_0 \neq q_8$

$q_{8,0} = q_8 \quad q_{8,1} = q_8$

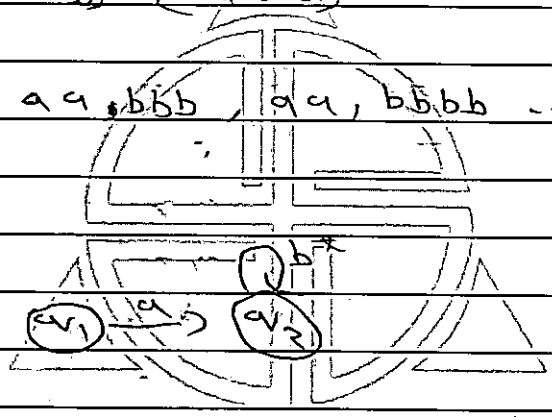
Equivalence : $\{q_0 q_7 q_8\} \{q_5, q_6\}$
$\{q_1\} \{q_2\} \{q_3\} \{q_4\}$

$q_0 q_7 = q_{0,0} = q_1, q_{0,1} = q_4$
$q_7,0 = q_7, q_7,1 = q_7$
$q_0 q_7$ are not equivalent.

$q_0 q_8 = q_{0,0} = q_1, q_{0,1} = q_4$
$q_8,0 = q_0, q_8,1 = q_8$
$q_0 \neq q_8$
$\{q_7 q_8\} \{q_0\} \{q_1\} \{q_2\} \{q_3\} \{q_4\}$
$\{q_5, q_6\}$

::1d $L = \{ aa, bbb, aaa, bbbb, \ldots aa b^* \}$

So First



So the language is $aa b^*$

State	a	b
q_0	q_1	0
q_1	q_2	0
q_2	0	q_2

2.c $L = \{a^n b^n$ where $n \geq 1\}$

in pumping lemma it should satisfy 3 conditions to prove ~~[illegible]~~

1 $|x| > 0$
2 $|xz| \leq P$
3 $x^i y z^i$

let $P = 2$

$L = \cancel{aaabbb} \ldots aabb$, ϵ, ab, $aabb \ldots a^n b^n$

case 1 – $x^i y z^i$ .. $x^i y z^i$

$x = a$
$z = ab$
$b = b$

i $x > 0$
$1 > 0$
True

ii $|xz| \leq P$
~~$2 \leq P$~~
$2 \leq 2$
True

now
$x^i y z^i = a^i a b b^i$
Put $i = 0$
ϵ ab ϵ It belongs to language
now check for $i = 3$

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$= a^i ab b^i$

aaa ab bbb It also belongs to Language

so it is a regular grammer in case 1

It cannot Proove for not regular.

case-2

$L = \{aaa\ bbb\}$

$P = 2$

now

$\underbrace{aaa}_{x^i}\ \underbrace{b}_{y}\ \underbrace{bb}_{z^i}$ $\cancel{aaabbb}$

$x = aa$

$y = ab$

$z = bb$

i

$|x| > 0$

$z > 0$

True

ii

$|xz| \geq P$

$4 \geq 3$

True

iii

$x^i y z^i = (aa)^i ab (bb)^i$

let $i = 3$

$= aaaaaa\ abbbbbbb$

It is also belongs to L

so it is Regular grammer

It cant be Proved.

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~~Construct a finite automata~~

~~$(0+1)^* (0\,0+1\,1)(0+1)^*$~~

~~(a0)~~

3.c $E \to E+T \mid T$

$T \to T^*F \mid F$

$F \to (E) \mid a$

Put all ~~Pro~~ nonterminal with new ~~Prod~~ Nonterminal

$A_1 \to E$

$A_2 \to T$

$A_3 \to F$

now write production according to the new nonterminal symbols.

$A_1 \to A_1 + A_2 \mid A_2$

$A_2 \to A_2 * A_3 \mid A_3$

$A_3 \to (A_1) \mid a$

now ~~Put A3 in A3~~

~~$A_3 \to (A_1 + A_2 \mid A_2) \mid a$~~

~~now Put A2~~

now put A_3 in A_2

$A_2 \to A_2^* A_1 \mid a \mid A_1 \mid a$

now put A_2 in A_1

$A_1 \to A_1 + A_2^* A_1 | a \,|\, A_1 | a \,|\, A_2^* A_1 | a \,|\, A_1 | a$

~~3D~~ ~~$S \to 0B \,|\, 1A$~~

~~$A \to 0 \,|\, 0S \,|\, 1AA$~~

~~$B \to 1 \,|\, 1S \,|\, 0BB$~~

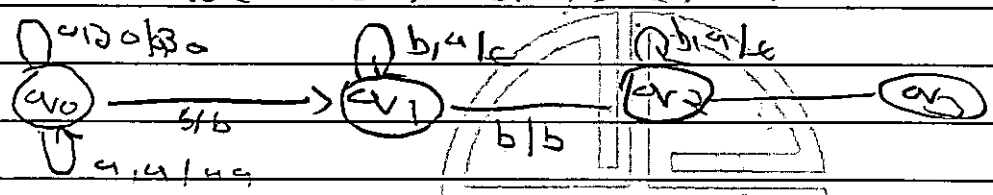
4b $L = \{a^n b^{2n}\}$ when $n \geq 1$

X $L = \{\epsilon, abb, aabbbb \ldots\ldots a^n b^{2n}$

let $n = 2$

So the $L = \{aabbbb\}$

Now we construct PDA for L



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5a Partial function is a function which is defined for some of the element ~~in~~ I it is not defined for all elements

e.g $x \to \sqrt{a}$

initial function is defined by 3 functints in numbers and 2 functions in Alphabets (3)

o initial function defined for Numbers (N)

Zero function → in this function and element belongs to is goes zero. It means the value of element belong to zero function will be zero

e.g $Z(1) = 0$

successor function → in this function every element in this function will get add eg by +1 ~~so~~ e.g [illegible]

Projection function → in this function It projects the element in ~~[illegible]~~ a set of elements e.g :- $U_i^2 \{a, b, c\} = a$

o initial function in alphabets are:

Null function: In this element every alphabet element present in null function will provide null eg: Null (x) = Null

Concatenate Function :- In this function we concatenate element in a set

eg: conc(x) y = xy

5b $f(x,y) = x+y$

$f(x,0) = x+0$

$= 0$

$g(x)$

$z(x)$

$f(x,y+1) = x+y+1$

$= (x.y)+1$

$h(x,y+1) = f(x,y) + x$

$= U_3^3(x,y,f(x,y)) +$

$U_1^3(x,y,f(x,y))$

$h(x,y,+z) = U_3^3(x,y,z) + U_1^3(x,y,z)$

Hence proved it is primitive recursive function as it is expressed through its condition

$P(x,y) = x^y$

$P(x,0) = x^0$

$= 1$

$= s(0)$

$= s(z(0))$

$P(x,y+1) = x \cdot P(x,y)$

$= m(x, P(x,y))$

$H(x,z+1) = m(x, H(x,z))$

$H(x,y,z) = m(x, H(x,z))$

$= m(x, s(z(0)))$

$= m(x, s(z(y)))$

$= m(x, s(z(z(x,y,z))))$

$= m(x, s(z(z(x,y,z))))$

$= m(x, s(z(z(x,y,z))

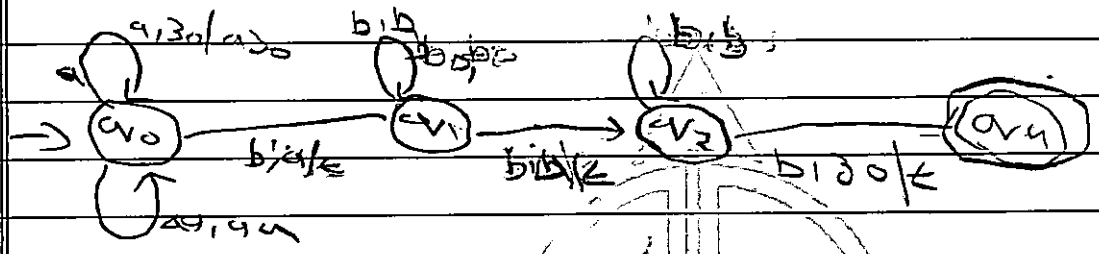
4 b $L = \{a^n b^{2n}\}$ where $n \geq 1$

~~L = {~~

$L = \{\epsilon, abb, aabbbb \ldots a^n b^{2n}\}$

So first take $n = 2$

$L = \{aabbbb\}$



$\delta(a, 30) \rightarrow a30$

$\delta(a, a) \rightarrow (aa)$

$\delta(b, a) \rightarrow (a/\epsilon)$

$\delta(b, b) \rightarrow (bb)$

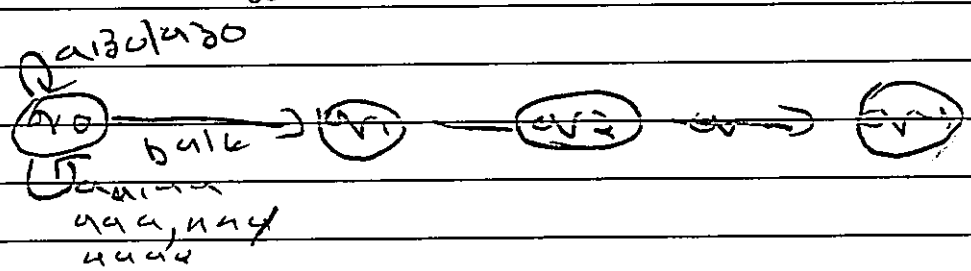
$\delta(b, a) \rightarrow (a/\epsilon)$

$\delta(b, b) \rightarrow (bb)$

$\delta(b, 30) \rightarrow (\epsilon)$

testing aaa bbbbbb

It start with q0 with 30



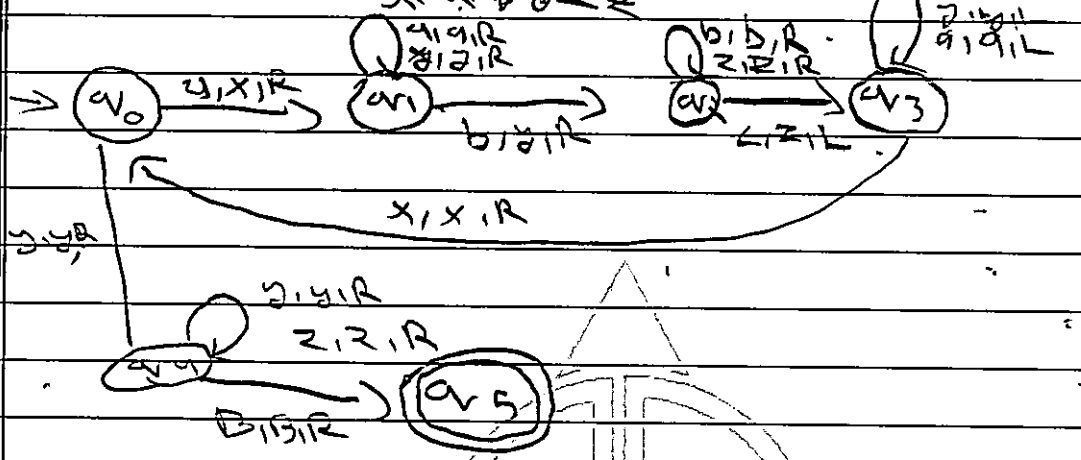
~~a a a~~ ~~b b b b b b~~

4. $L = \{a^n b^n c^n\}$ $n \geq 0$ Turing machine

$L = \{0, abc, aabbcc, \ldots\}$

$n = 2$

$L = \{aabbcc\}$



δ { $q, X, R \rightarrow q_1$

$a, a, R \rightarrow q_1$

$Y, Y, R \rightarrow q_1$

$b, Y, R \rightarrow q_2$

$b, b, R \rightarrow q_2$

$Z, Z, R \rightarrow q_2$

$b, b, L \rightarrow q_3$

$Z, Z, L \rightarrow q_3$

$b, b, L \rightarrow q_3$

$a, a, L \rightarrow q_3$

$X, X, R \rightarrow q_0$

$Y, Y, R \rightarrow q_4$

$Y, Y, R \rightarrow q_4$

$Z, Z, R \rightarrow q_4$

$B, B, R \rightarrow (q_5)$

3 d

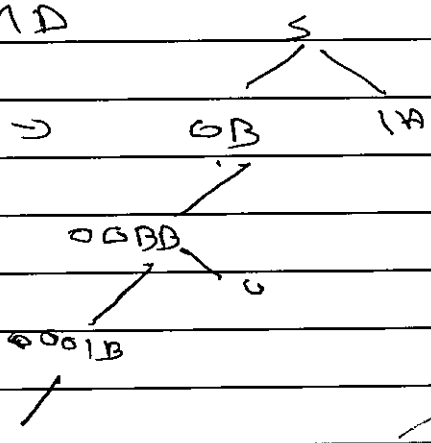
$S \to 0B \mid 1A$

$A \to 0 \mid 0S \mid 1AA$

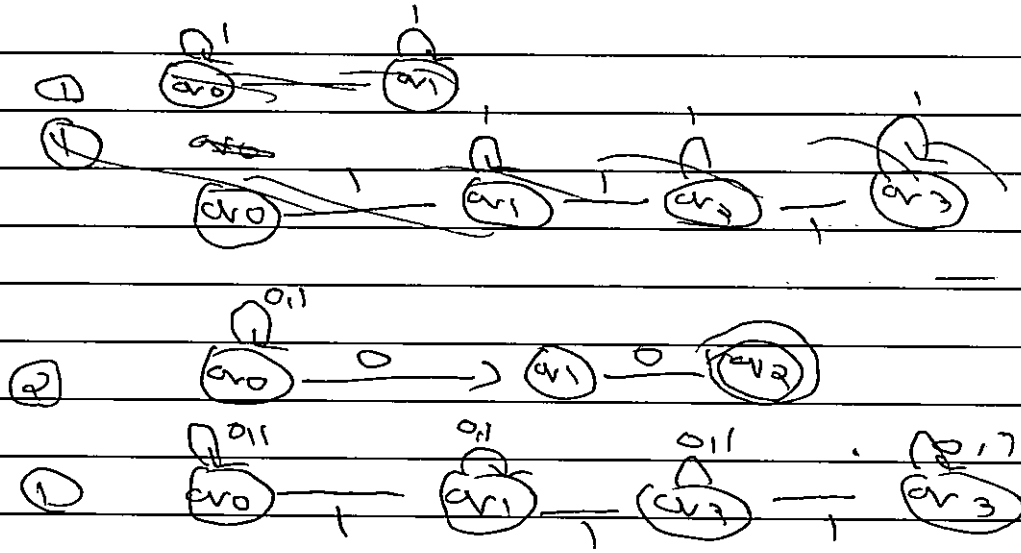
$B \to 1 \mid 1S \mid 0BB$

$w = 00110101$

LMD

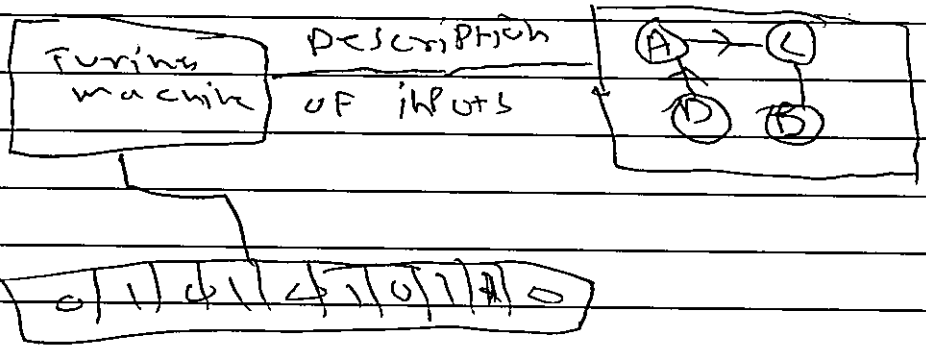


3A



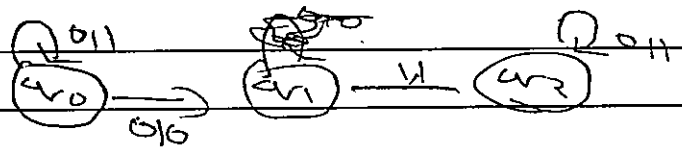
Computation means to get answer or result for a particular problem by a computer or a machine, which is done automatically after getting input. It gets output

Turing model is a can be said as a digital computer which we are using today. Turing machine is most powerful machine and compared as from today's digital computer. In turing machine we use input tape to perform computing through which is compute output

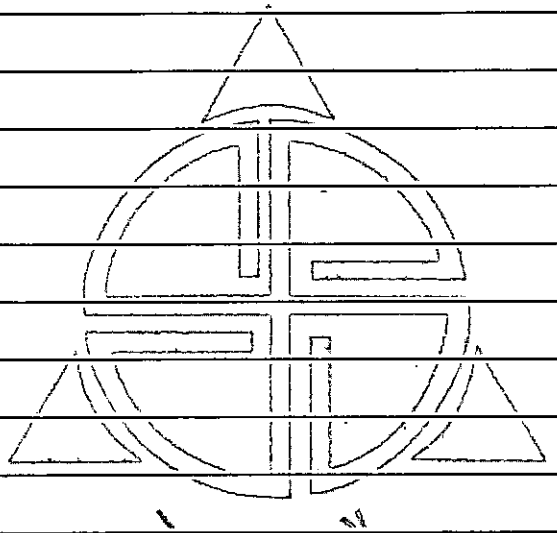


input tape Reads binary no. from input tape

25 $(0+1)^*\ (0 \cup 11)\ (0+1)^*$



26 $0^*.1.1^*.00$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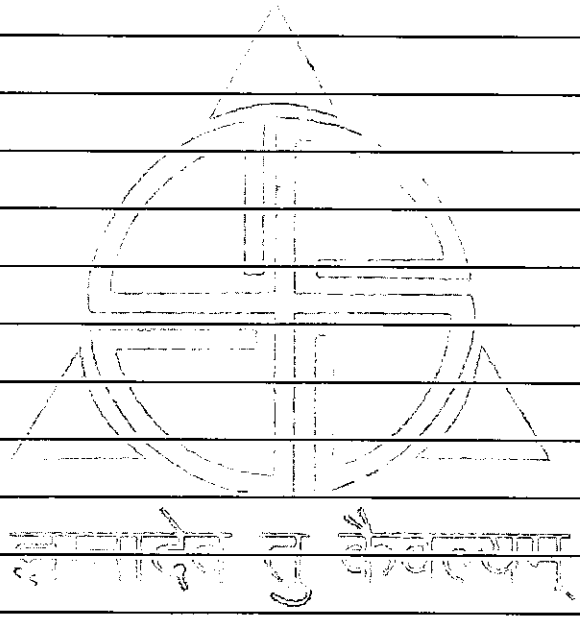

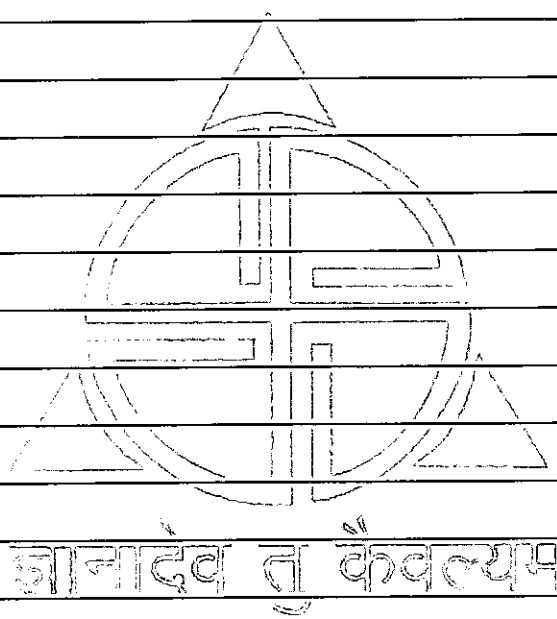
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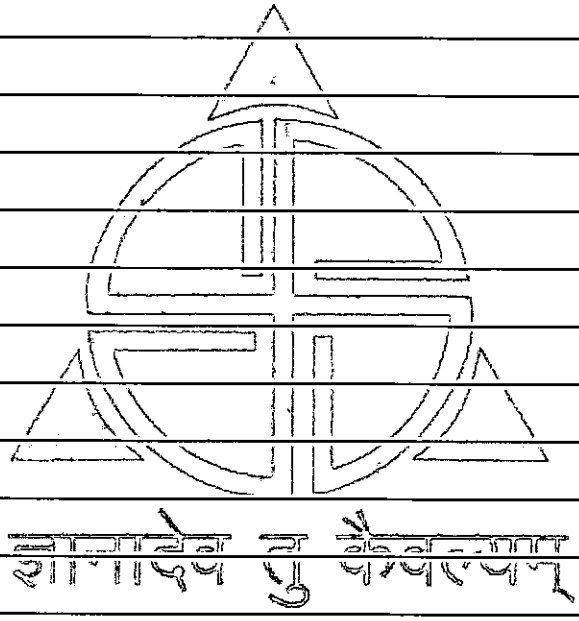

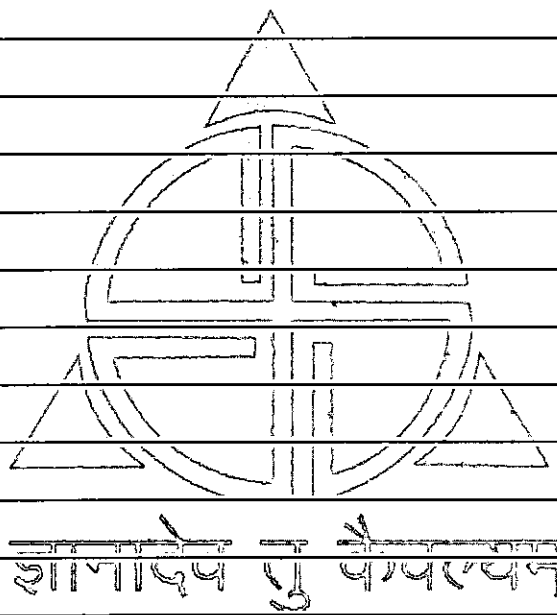

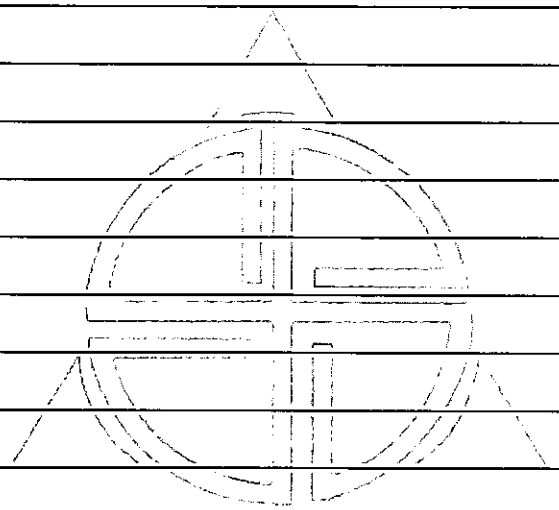

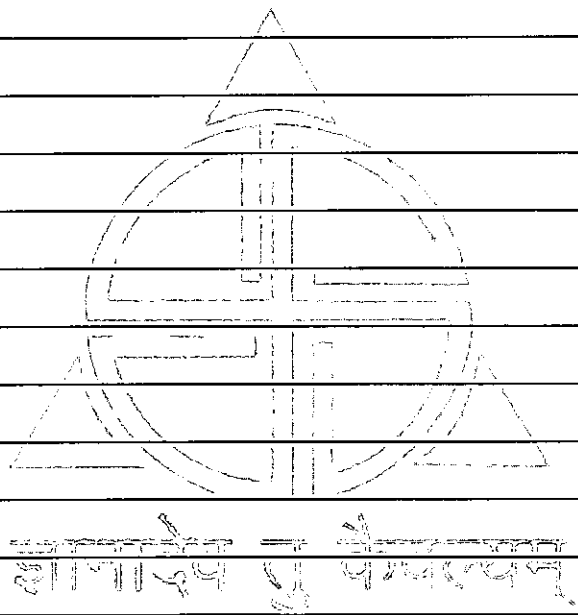

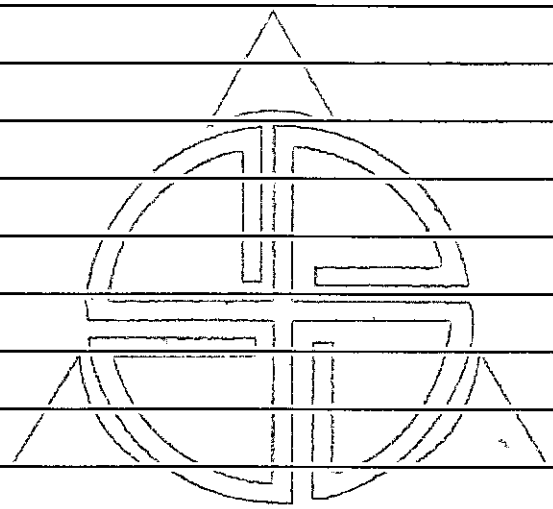

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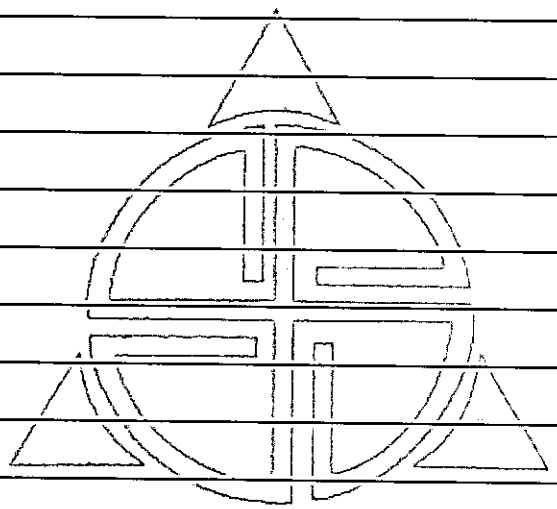

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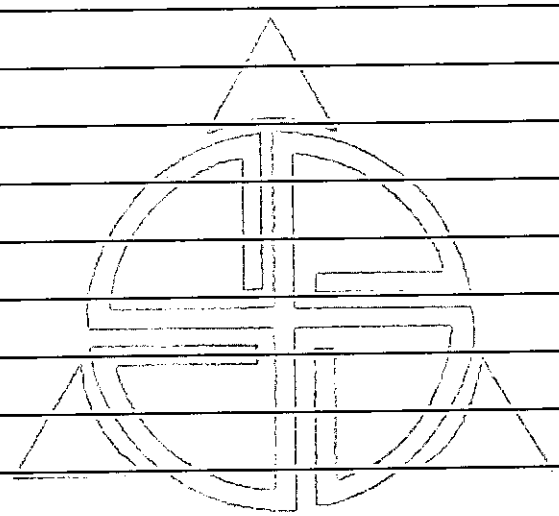
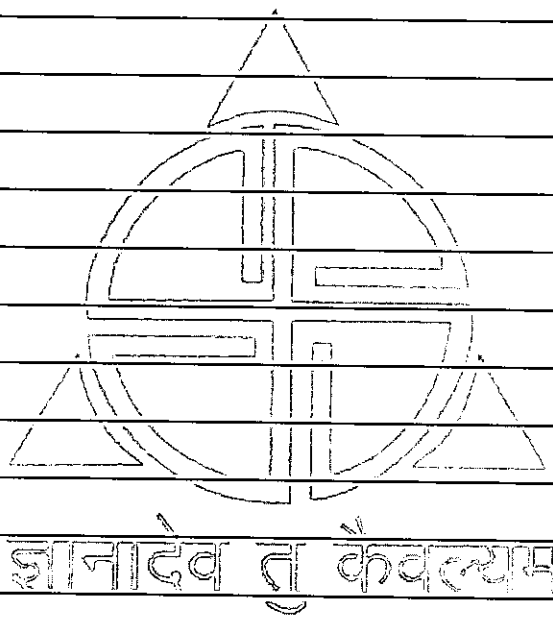

सत्यमेव जयते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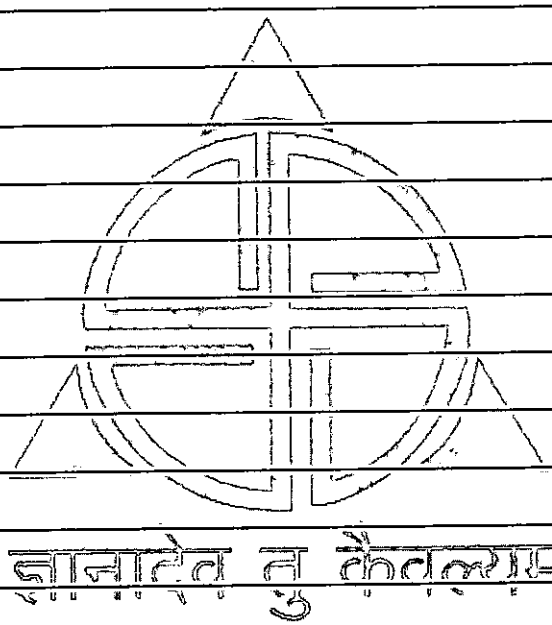
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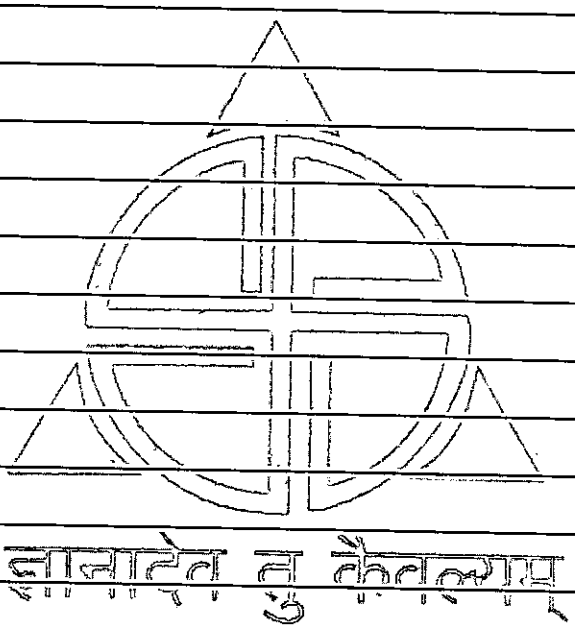
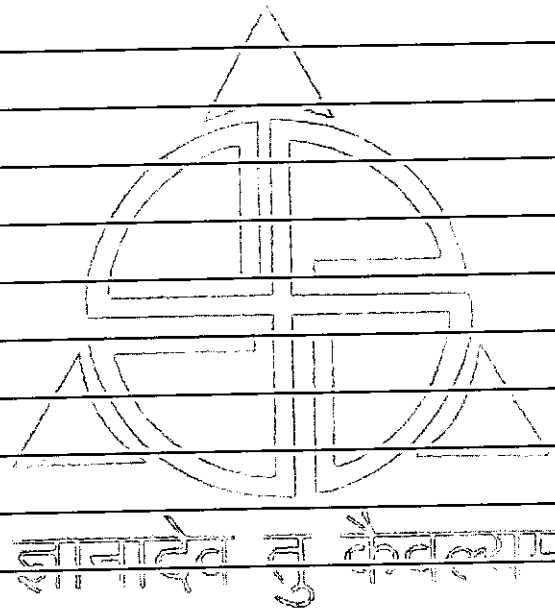
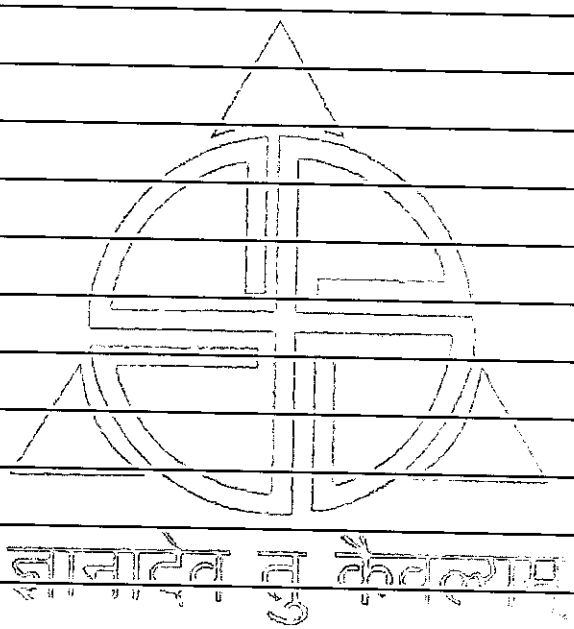
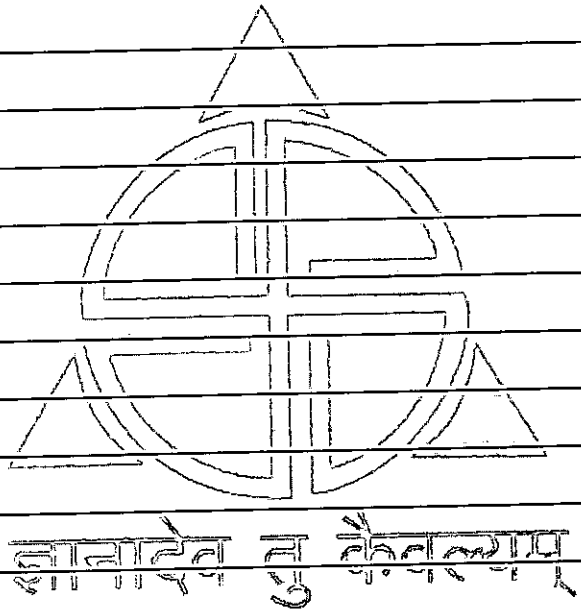
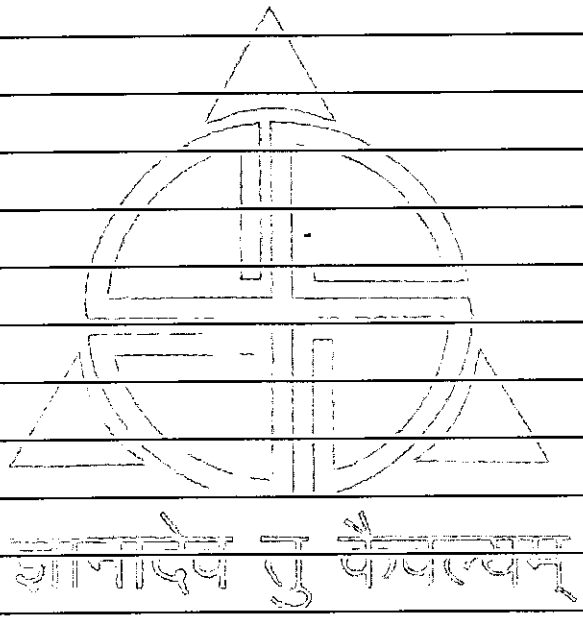
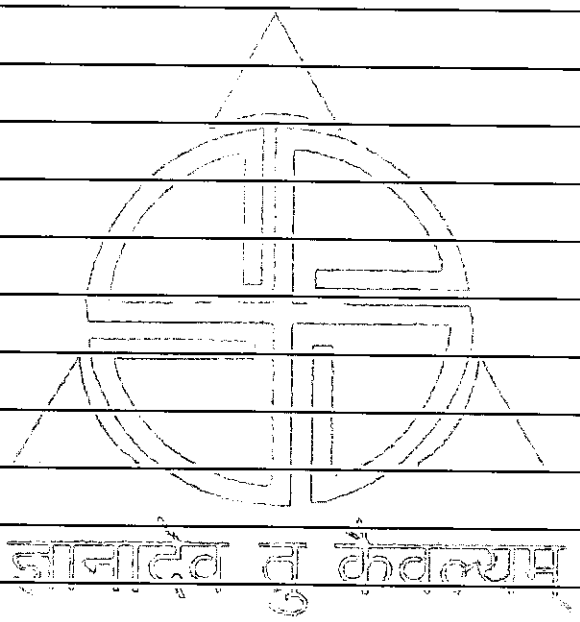

सत्यमेव जयते

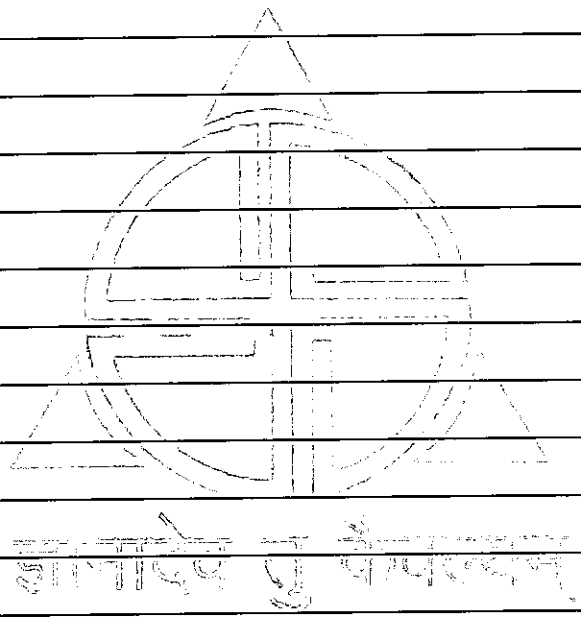


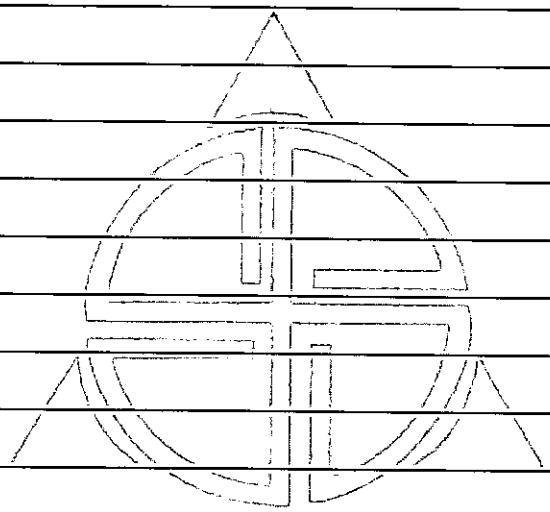


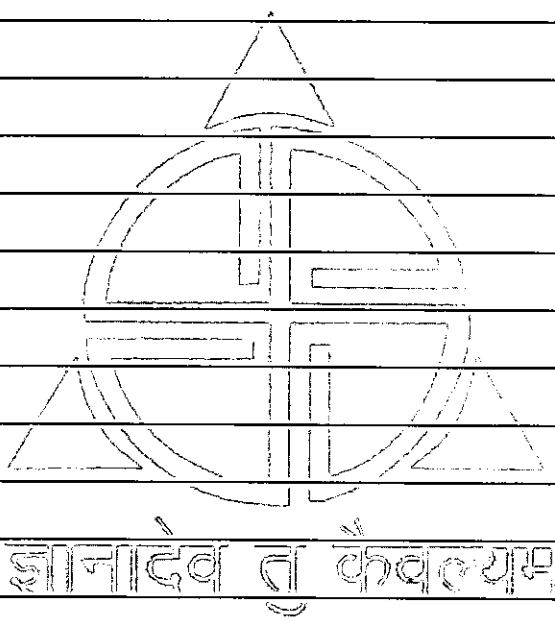





सत्यमेव जयते




ज्ञानादेव तु कैवल्यम्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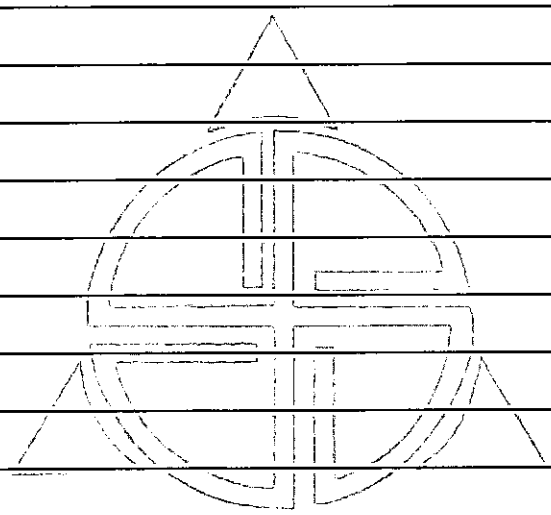
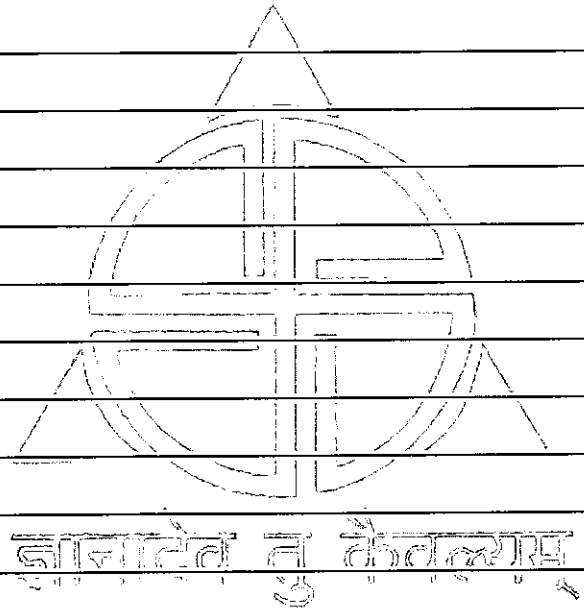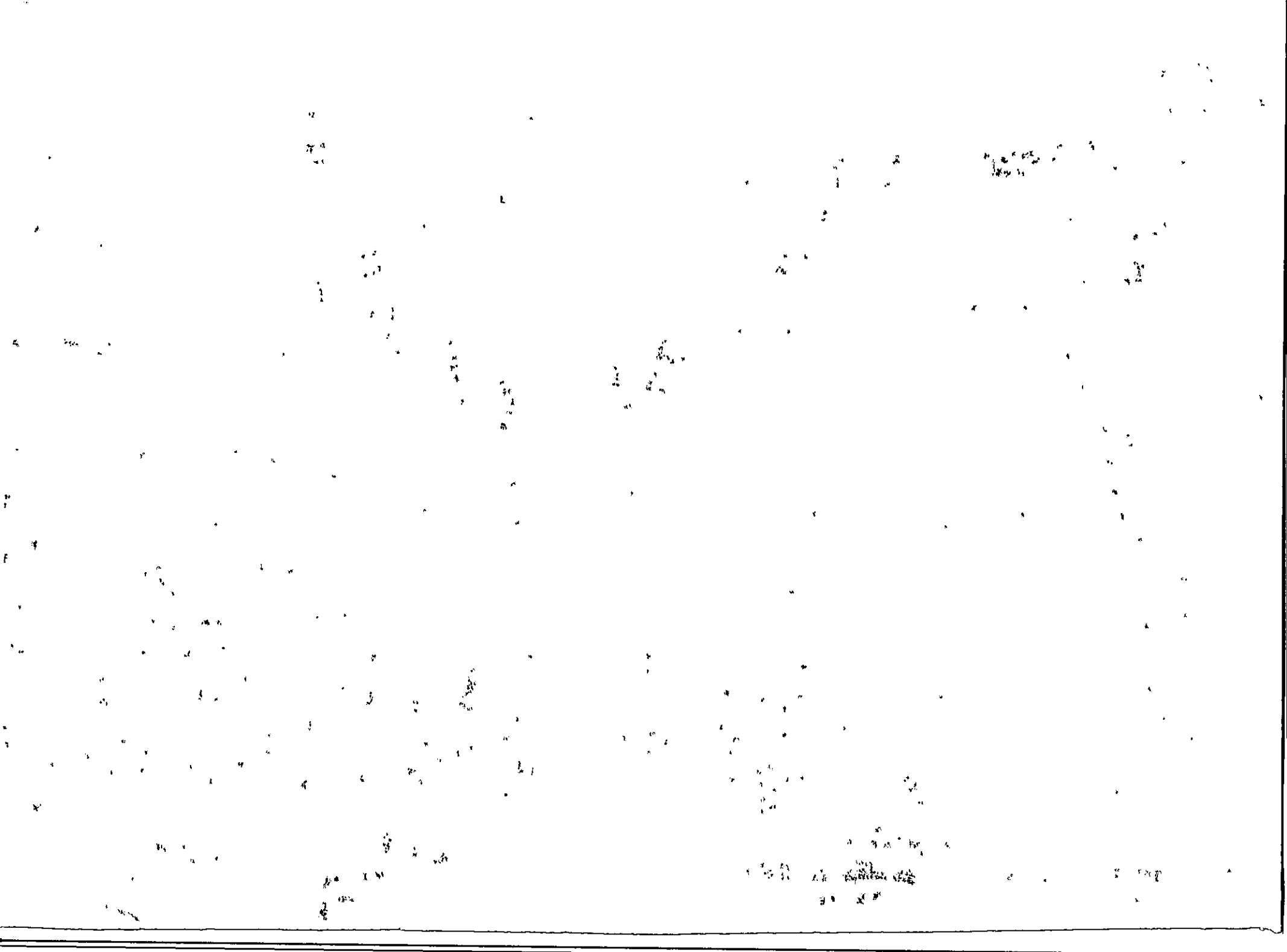
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