Roll No.

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST – I

Sem: Odd Sem 2019-20
Course Code: CSE 208
Course Name: THEORY OF COMPUTATION
Program & Sem: B.Tech, (CSE) & III

Date: 01.09.2019
Time: 11AM to 12PM
Max Marks: 40
Weightage: 20%

Instructions:

(i) Answer all the questions from each part

Part A [Memory Recall Questions]

Answer all the Questions. Each Question carries two marks. (5Qx2M=10M)

1. Define the Language of an automata with an example. (C.O.NO.1)[Knowledge]
2. Define the following with an example for each. (C.O.NO.1)[Knowledge]
   a. Strings
   b. Alphabet
3. Describe the deterministic finite automata with five component values. (C.O.NO.1)[Knowledge]
4. List the applications of finite automata. (C.O.NO.1)[Knowledge]
5. Describe the transition diagram with an example. (C.O.NO.1)[Knowledge]

Part B [Thought Provoking Questions]

Answer both the Questions. Each Question carries five marks. (2Qx5M=10M)

6. Shreyas is working on an abstract machine design. He wants to design a deterministic machine in such a way that only the strings with even occurrence of 1's and odd occurrence of 0's must be accepted by the accepter. Construct the DFA for the above scenario and provide the transition diagram, transition table, five component values. Using extended transition function show the acceptance of the string "10010"

(C.O.NO.2.)[Comprehension]

7. Anu is having a collection of symbols with a's and b's. A deterministic automata has to be designed to accept the strings having "aa" but not "aaa". The occurrence of the symbol 'b' can be anywhere in the path of the string. The solution to the above problem must be provided with transition diagram, transition table, five component values and also show one valid string acceptance using extended transition function.

(C.O.NO.2.)[Comprehension]

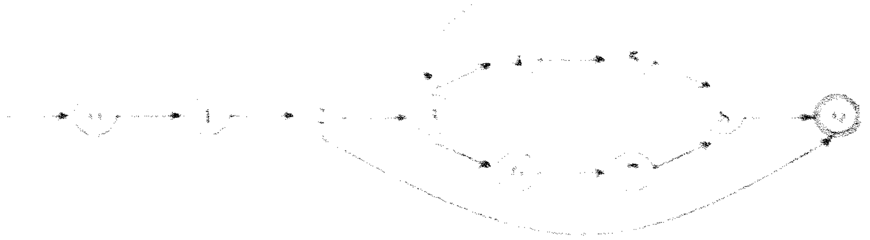
Part C [Problem Solving Questions]

Answer both the Questions. Each Question carries ten marks. (2Qx10M=20M)

8. Convert the following Non Deterministic finite automata into deterministic finite automata. (C.O.NO.2)[Application]

	0	1
$\rightarrow p$	$\{p, q\}$	$\{p\}$
q	$\{r\}$	$\{r\}$
r	$\{s\}$	$\emptyset$
$*s$	$\{s\}$	$\{s\}$

9. Convert the following €-NFA to its equivalent DFA. (C.O.NO.2)[Application]



SCHOOL OF ENGINEERING

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

Semester: 3rd

Course Code: CSE 208

Course Name: Theory of Compulation

Date: 01/10/2019

Time: 11AM to 12PM

Max Marks: 40

Weightage: 20%

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels			Thought provoking type [Marks allotted] Bloom's Levels			Problem Solving type [Marks allotted]			Total Marks
			K			C			A			
1	1	Module-1		02								02
2	1	Module-1		02								02
3	1	Module-2		02								02
4	1	Module-1		02								02
5	1	Module-2		02								02
6	2	Module-2					05					05
7	2	Module-2					05					05
8	2	Module-2								10		10
9	2	Module-2								10		10
	Total Marks			10			10			20		40M

I hereby certify that all the questions are set as per the guide lines [Manjakshi B C].

Reviewer's Comments:

Annexure- II: Format of Answer Scheme

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

SCHOOL OF ENGINEERING

SOLUTION

Semester: 3rd
Course Code: CSE 208
Course Name: Theory of Computation

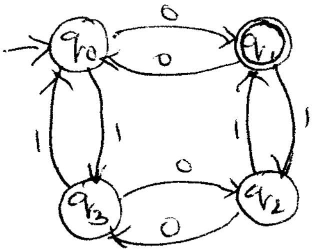
Date: 01/10/2019
Time: 11AM to 12PM
Max Marks: 40
Weightage: 20%

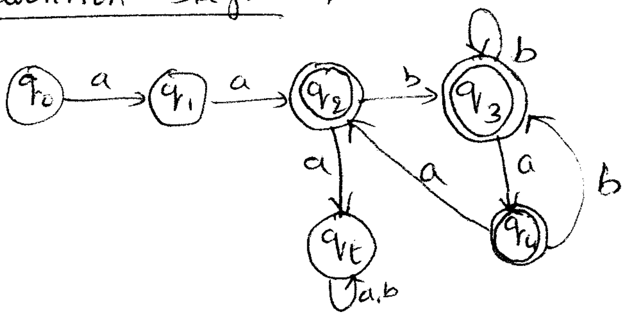
Part A (5 x 2 =10 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1.	The set of all strings from some Σ^* is called the language of an automata. Eg: $L = \{awa : w \in (a,b)^*\}$	2 M	2 min
2.a	An alphabet is a finite set of symbols. It is denoted as Σ. Eg: $\Sigma = \{a,b\}$, $\Sigma = \{0,1\}$	2 M (1+1)	2 min
b.	Finite sequence of symbols taken from some Σ is called the string. If $\Sigma = \{0,1\}$. The string $= \{0,1,001,010..\}$		
3.	DFA $M = \{Q, \Sigma, \delta, q_0, F\}$ Define each tuple	2 M	2 min
4.	List atleast 4 applications of finite automata	2 M	2 min
5.	With an example description about Transition diagram	2 M	2 min

Part B

(2x 5 = 10 Marks)

<table>
<tr><th>Q No</th><th>Solution</th><th>Scheme of Marking</th><th>Max. Time required for each Question</th></tr>
<tr><td>6.</td><td>
The alphabet Recognized based on the given Scenario is $\Sigma = \{0,1\}$.
Transition Diagram } =


2M
Transition Table
<table>
<tr><th>States</th><th>0</th><th>1</th></tr>
<tr><td>q0</td><td>q1</td><td>q3</td></tr>
<tr><td>q1</td><td>q0</td><td>q2</td></tr>
<tr><td>q2</td><td>q3</td><td>q0</td></tr>
<tr><td>q3</td><td>q2</td><td>q0</td></tr>
</table>
1M
Five Components $\{Q, \Sigma, \delta, q_0, F\}$ values 1M
'10010' string derivation using δ^* 1M
</td><td>5M</td><td>10 min</td></tr>
<tr><td>7.</td><td>
The given alphabet is $\Sigma = \{a,b\}$
<u>Transition Diagram</u>;


2M
Transition table —— 1M
$\{Q, \Sigma, \delta, q_0, F\}$ values —— 1M
Valid String Derivation — 1M.
</td><td>5M</td><td>10 min</td></tr>
</table>

Part C (2 x 10 =20 Marks)

<table>
<tr><th>Q No</th><th>Solution</th><th>Scheme of Marking</th><th>Max. Time required for each Question</th></tr>
<tr><td>8.</td><td>

The DFA Obtained for the given NFA is

<table>
<tr><th>States</th><th>0</th><th>1</th></tr>
<tr><td>→{P}</td><td>{P,q}</td><td>{P}</td></tr>
<tr><td>{P,q}</td><td>{P,q,r}</td><td>{P,r}</td></tr>
<tr><td>{P,q,r}</td><td>{P,q,r,s}</td><td>{P,r}</td></tr>
<tr><td>{P,r}</td><td>{P,q,s}</td><td>{P}</td></tr>
<tr><td>*{P,q,r,s}</td><td>{P,q,r,s}</td><td>{P,r,s}</td></tr>
<tr><td>*{P,q,s}</td><td>{P,q,r,s}</td><td>{P,r,s}</td></tr>
<tr><td>*{P,r,s}</td><td>{P,q,s}</td><td>{P,s}</td></tr>
<tr><td>*{P,s}</td><td>{P,q,s}</td><td>{P,s}</td></tr>
</table>

4 M

Transition Table

Transition Diagram — 4M

Steps of Conversion — 2 M

</td><td>10 M</td><td>15 min</td></tr>
<tr><td>9</td><td>

DFA Transition table - 4 M

DFA Transition Diagram - 4 M

Steps of Conversion - 2 M.

1. Eclose({0}) = {0} = A

<table>
<tr><th>States</th><th>a</th><th>b</th></tr>
<tr><td>→ A
{0}</td><td>{1}=B</td><td>q_t</td></tr>
<tr><td>B={1}</td><td>q_t</td><td>{2,3,4,6,9}=C</td></tr>
<tr><td>* C={2,3,4,6,9}</td><td>{5,8,9,3,4,6}=D</td><td>{7,8,3,4,6,9}=E</td></tr>
<tr><td>* D
{3,4,5,8,9}</td><td>D</td><td>E</td></tr>
<tr><td>* E
{3,4,6,7,8,9}</td><td>D</td><td>E</td></tr>
</table>

</td><td>10</td><td>15 min</td></tr>
</table>

Roll No.

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST –2

Sem & AY: Odd Sem 2019-20
Course Code: CSE 208
Course Name: THEORY OF COMPUTATION
Program & Sem: B.Tech. (CSE) & III Sem

Date: 19.11.2019
Time: 11:00 AM to 12:00 PM
Max Marks: 40
Weightage: 20%

Instructions:

(i) *Read Questions carefully before answer the questions.*
(ii) *Question Paper Contains three Parts.*

Part A [Memory Recall Questions]

Answer all the Questions. Each Question carries two marks. **(5Qx2M=10M)**

1. Define CFG. (C.O.NO.3)[Knowledge]
2. Define Regular Expressions. (C.O.NO.3)[Knowledge]
3. Define PDA. (C.O.NO.4)[Knowledge]
4. Obtain Regular Expression for L= $\{0^n 1^m$: n>=3, m is odd$\}$. (C.O.NO.3)[Knowledge]
5. Obtain CFG for L= $\{w\, w^R : w\, \epsilon\, \{0,,1\}^* \}$. (C.O.NO.3)[Knowledge]

Part B [Thought Provoking Questions]

Answer both the Questions. Each question carries ten marks. **(2Qx10M=20 M)**

6. Peter want to construct a PDA to accept the Language L= $\{w \mid w\, \epsilon\, \{a,b\}^*$ and $n_a (w) = n_b (w)\}$. (C.O.NO.4)[Comprehension]
7. Show that Language L= $\{a^n b^n$, n>=0$\}$ is not regular using pumping lemma. (C.O.NO.3)[Comprehension]

Part C [Problem Solving Questions]

Answer both the Questions. Each question carries five marks. **(2Qx5M=10M)**

8. Convert the regular expression r= (a+b)* abb into nfa with Ɛ transitions. (Use thomson construction). (C.O.NO.3)[Application]
9. Consider the following CFG, $S \rightarrow aS|aSbS|\epsilon$, Show that deviation for the string aab is ambiguous. (C.O.NO.3)[Application]

SCHOOL OF ENGINEERING

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

Semester: III
Course Code: CSE 208
Course Name: THEORY OF COMPUTATION

Date: 19-11-2019
Time: 11:00 AM to 12:00 PM
Max Marks: 40
Weightage: 20%

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels			Thought provoking type [Marks allotted] Bloom's Levels			Problem Solving type [Marks allotted]			Total Marks
			K			C			A			
1,2,4, 5, 7,8,9	3	3	8			10			10			28
3.6	4	4	2			10						12
	Total Marks		10			20			20			40

K =Knowledge Level C = Comprehension Level, A = Application Level

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

Annexure- II: Format of Answer Scheme

SCHOOL OF ENGINEERING

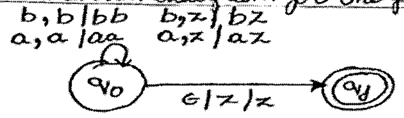
SOLUTION

Date: 19-11-2019
Semester: III
Time: 11:00 AM to 12:00 PM
Course Code: CSE 208
Max Marks: 40
Course Name: THEORY OF COMPUTATION
Weightage: 20%

Part A (5Q x 2M = 10 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	CFG G= (V,T,S,P) P has form A→x	Definition: 2 M	2 Min
2	Regular Expression definition	Definition: 2 M	2 Min
3	PDA M=(Q,Σ,T, δ,q0,z,F)	Definition: 2 M	2 Min
4	R= $0000^{*}(11)^{*}1$	Correct RE- 2 M	2 Min
5	S→0S0 S→1S1 S→ ε	Correct CFG- 2 M	2 Min

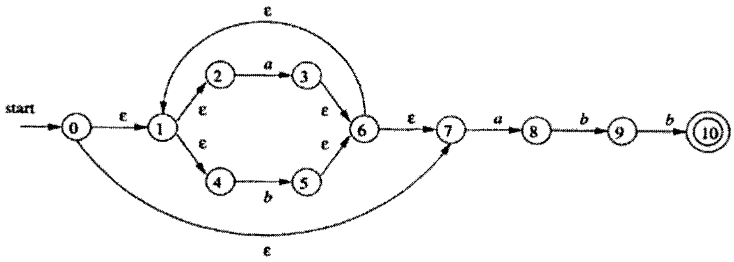
Part B (2Q x 10M = 20 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
6	1. $\delta(q_0, a, z) = (q_0, az)$ 2. $\delta(q_0, b, z) = (q_0, bz)$ 3. $\delta(q_0, a, a) = (q_0, aa)$ 4. $\delta(q_0, b, b) = (q_0, bb)$ 5. $\delta(q_0, a, b) = (q_0, \epsilon)$ 6. $\delta(q_0, b, a) = (q_0, \epsilon)$ 7. $\delta(q_0, \epsilon, z) = (q_f, z)$ Transition diagram for the given PDA :-  	Transitions- 5 M Transition Diagram- 2 M Components- 1 M String Acceptance- 1M String Rejection- 1 M	15 Min

7	- At first, we assume that **L** is regular and m is the number of states. - Let w = $a^m b^m$. Thus |w| = 2m ≥ m. - By pumping lemma, let w = xyz, where |xy| ≤ m. - Let x = a^p, y = a^q, and z = $a^r b^m$, where p + q + r = m, p ≠ 0, q ≠ 0, r ≠ 0. Thus |y| ≠ 0. - Let k = 2. Then $xy^2z = a^p a^{2q} a^r b^m$. - Number of as = (p + 2q + r) = (p + q + r) + q = m + q - Hence, $xy^2z = a^{m+q}\,b^m$. Since q ≠ 0, xy^2z is not of the form $a^m b^m$. - Thus, xy^2z is not in L. Hence L is not regular.	String Selection – 2M Application of Pumping Lemma- 6 M Steps – 2 Marks	15 Min

Part C

(2Q x 5 M =10 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
8		NFA - 3 M Steps – 2 M	10 Min
9	Two Left most derivations S => aSbS => aaSbS => aabS => aab S => aS => aaSbS => aabS => aab Thus grammar is ambiguous.	Derivations – 3 M Derivation Tree – 2M	10 Min

Roll No												

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Semester: Odd Semester: 2019 - 20
Course Code: CSE 208
Course Name: THEORY OF COMPUTATION
Program & Sem: B.Tech (CSE) & III

Date: 27 December 2019
Time: 1:00 PM to 4:00 PM
Max Marks: 80
Weightage: 40%

Instructions:

(i) Read the all questions carefully and answer accordingly.

Part A [Memory Recall Questions]

Answer all the Questions. **(5QX2M=10M)**

1. Define automata (C.O.No.1) [Knowledge]
2. Write down the definition for CNF (C.O.No.3) [Knowledge]
3. Define ambiguous (C.O.No.3) [Knowledge]
4. State pumping lemma (C.O.No.3) [Knowledge]
5. Draw the diagram for Turing machine (C.O.No.5) [Knowledge]

6. Fill in the blanks **(10QX1M=10M)**

a. V stands for .... in CFG (C.O.No.3) [Knowledge]

b. DFA has ...... tuple (C.O.No.2) [Knowledge]

c. PDA stands for .... (C.O.No.4) [Knowledge]

d. CFG stands for.............. (C.O.No.3) [Knowledge]

e. Write down the symbol for epsilon closure.... (C.O.No.2) [Knowledge]

f. Write down the symbol for epsilon plus... (C.O.No.2) [Knowledge]

g.TM stands for..... (C.O.No.5) [Knowledge]

h. NPDA stands for.......... (C.O.No.4) [Knowledge]

i. In TM, blank symbol is .... (C.O.No.5) [Knowledge]

j. GNF stands for .... (C.O.No.3) [Knowledge]

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO (% age of CO)	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels	Thought provoking type [Marks allotted] Bloom's Levels	Problem Solving type [Marks allotted]	Total Marks
			K	C	A	
PART A Q. NO1 2 3 4 5 6	CO 01 CO 02 CO 03 CO 04 CO 05	All the 5 modules	20			20
PART B Q.NO.2	CO 02	MODULE 02 Introduction to Finite Automata			10	10
PART B Q.NO.3	CO 03	MODULE 03 Regular Expressions and Context Free Grammars		10		10
PART B Q.NO.4	CO 04	MODULE 04 Push Down Automata			10	10

Format of Answer Scheme

SCHOOL OF ENGINEERING

SOLUTION

Date: 27.12.2019

Time: 1 pm TO 4 PM

Max Marks: 80

Weightage: 40%

Semester: Odd Sem. 2019-20

Course Code: CSE208 [CSE-208]

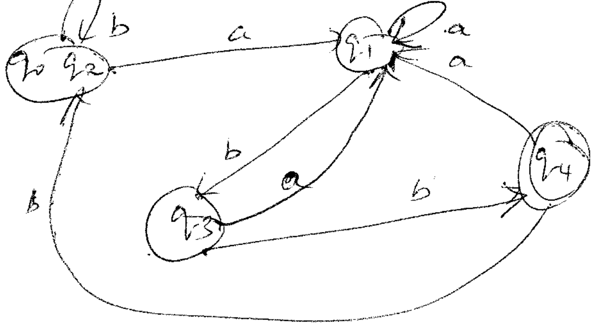
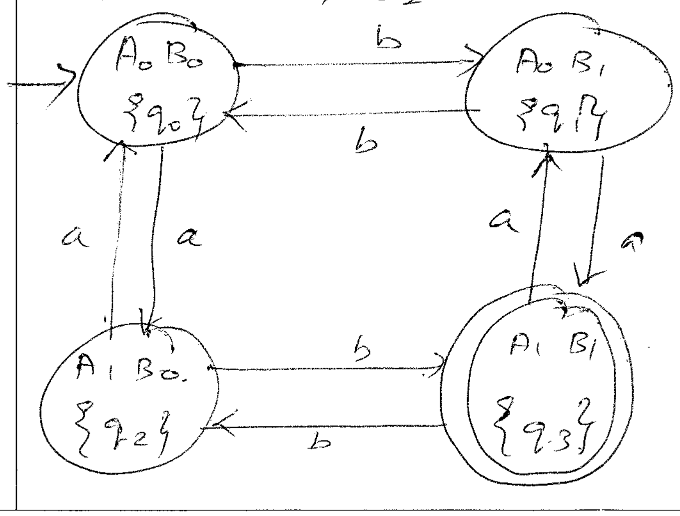
Course Name: THEORY OF COMPUTATION

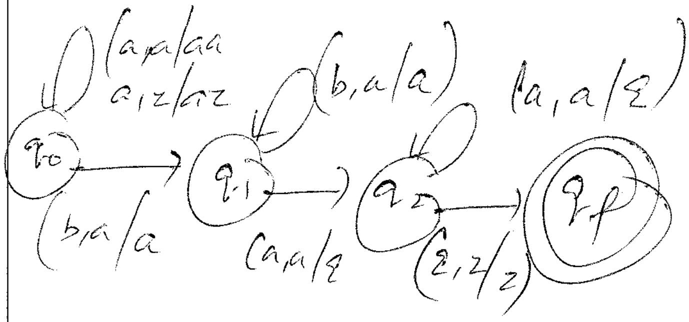
Program & Sem: B.Tech - CSE & III SEM

Part A (0Q x 0M = 0Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1.a	An Automata is an abstract model of a digital computer. As such, ever automaton Includes some essential features. It has a mechanism for reading Yp. It will be assumed that the Yp is a string over a given alphabet, written on an Yp file, which the automaton can read but not change	2	4min
2.b	$N \cdot T \rightarrow NT * N \cdot T$ $N \cdot T \rightarrow a$	2	4 min

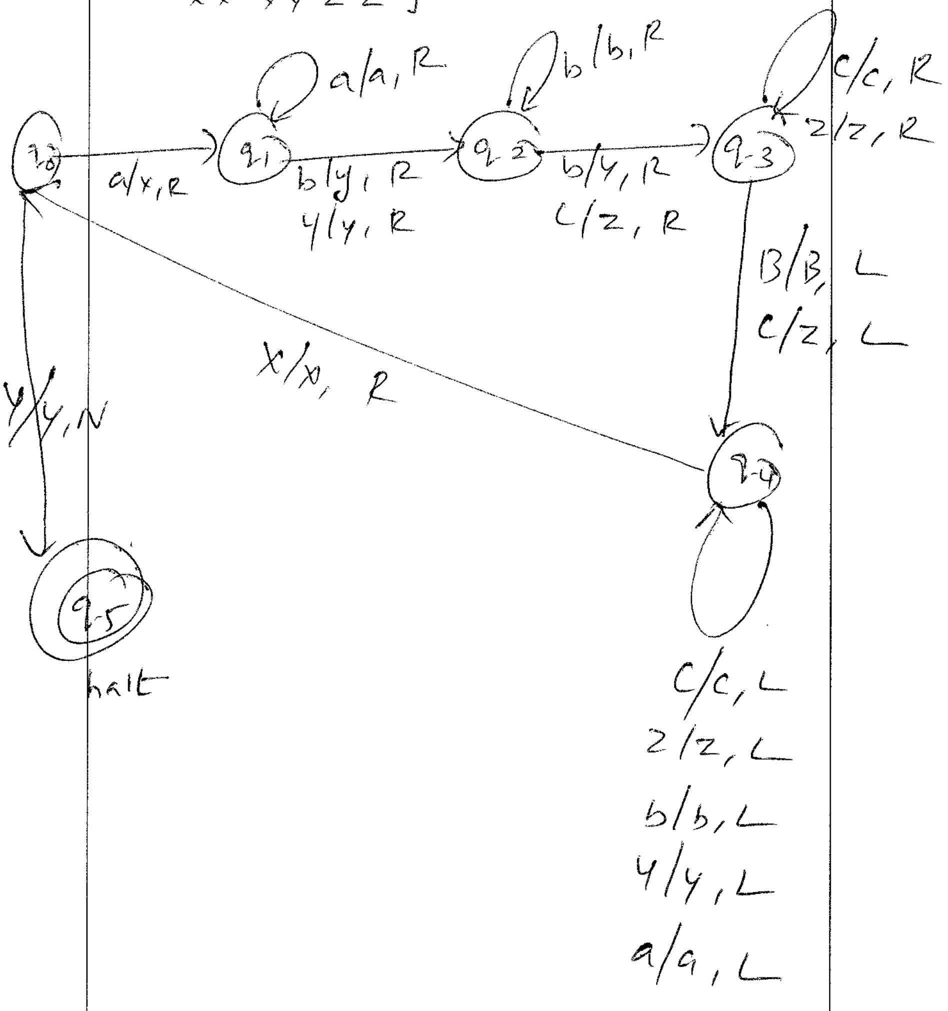
Part B (0Q x 0M = 0 Marks)

<table>
<tr><th>Q No</th><th>Solution</th><th>Scheme of Marking</th><th>Max. Time required for each Question</th></tr>
<tr><td>~~7~~a.</td><td>Given Transition - Table of DFA
0 equivalent {q0 q1 q2 q3} {q4}
1 equivalent {q0 q1 q2} {q3 {q4}
2 equivalent {q0 q2} {q1} {q3} {q4}
3 equivalent {q0 q2} {q1} {q3} {q4}
minimized DFA

minimized Transition table DFA<table><tr><th></th><th>a</th><th>b</th></tr><tr><td>q0 q2</td><td>q1</td><td>q0 q2</td></tr><tr><td>q1</td><td>q1</td><td>q3</td></tr><tr><td>q3</td><td>q1</td><td>q4</td></tr><tr><td>q4</td><td>q1</td><td>q0 q2</td></tr></table></td><td>→ ~~2~~ mark
→ 2 mark
→ 2 mark
→ 1 m
5m</td><td>12.5 min</td></tr>
<tr><td>~~7~~b</td><td>w1 = abababa a w2 = ~~aaabaabab~~
 </td><td>5m</td><td>12.5 min</td></tr>
</table>

9	$\delta(q_0, a, z) = (q_0, az)$ $\delta(q_0, a, a) = (q_0, aa)$ $\delta(q_0, b, a) = (q_1, a)$ $\delta(q_1, b, a) = (q_1, a)$ $\delta(q_1, a, a) = (q_2, \varepsilon)$ $\delta(q_2, a, a) = (q_2, \varepsilon)$	2m	
	7 tuples.	2m	
		2m	25min
	Accepting String.	2m	
	Rejecting string	2m	
		10m	

Part C

(0Q x 0M = 0Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
16.a	Sample i/p Sample o/p	1m	
	7 tuples	2m	
	n = 2 a a b b c c x a y b z c x x y y z z		
		6m	30min
	Turing machine	6m	