

## SUBMISSION REPORT

**Subject: THEORY OF COMPUTER SCIENCE**

**Name:** Amey Thakur

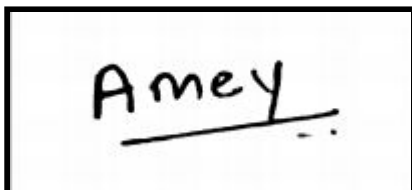
**College ID:** TU3F1819127

**Class:** TE COMPS B

**Roll No.:** 50

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**Signature of students**

**Signature of a subject in charge**

# 1. TCS Assignment - 1 [10/10]

Assignment-1

classroom.google.com/c/MTE2MTgzNDk3OTcy/a/MjE3NjE2MjAxMzA3/details

TE-TCS-sem V-SH-2020  
B

Assignment-1

Rohini Patil • Nov 4 (Edited Nov 19)  
10/10

Due Nov 20

Open Document from Google doc

Class comments

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Your work

Graded

+ Add or create

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Private comments

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AMEY THAKUR TE COMPS B-50  
TCS ASSIGNMENT-1

Q1. Design FSM in which input is valid if it ends in 'bab' over  $\Sigma = \{a, b\}$

Sol<sup>n</sup>:

```

graph LR
    q1((q1)) -- a --> q1
    q1 -- b --> q2((q2))
    q2 -- a --> q3((q3))
    q2 -- b --> q4(((q4)))
    q3 -- a --> q1
    q3 -- b --> q4
    q4 -- a --> q3
  
```

- The finite automation  $M_1$

We can define  $M_1$  formally by writing  $M_1 = (Q, \Sigma, \delta, q_1, F)$  where

- $Q = \{q_1, q_2, q_3, q_4\}$
- $\Sigma = \{a, b\}$
- $\delta$  is described as

	a	b
$q_1$	$q_1$	$q_2$
$q_2$	$q_3$	$q_4$
$q_3$	$q_1$	$q_4$
$q_4$	$q_3$	$q_2$

- $q_1$  is the start state
- $F = \{q_4\}$

## 2. TCS Assignment - 2 [09/10]

Assignment-2

classroom.google.com/c/MTE2MTgzNDk3OTcy/a/MjE3NjlyMzc2Mjgjc/details

TE-TCS-sem V-SH-2020  
B

Assignment-2

Rohini Patil • Nov 4 (Edited Nov 19)  
9/10

Due Nov 20

Tutorial no 2....  
Word

Class comments

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Your work

Graded

Amey\_B-50\_TCS\_...  
PDF

+ Add or create

Resubmit

Private comments

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AMEY THAKUR TE B-50

TCS ASSIGNMENT-2

Q1. Construct DFA equivalent to NFA  
 $(\{P, q, r, s\}, \{0, 1\}, \delta, P, \{q, s\})$  and minimize the  
 given DFA where  $\delta$  is

$\delta$	0	1
$\rightarrow P$	$qr$	$q$
$q^*$	$r$	$qr$
$r$	$s$	$p$
$s^*$	$-$	$p$

Ans:

$\delta(P, 0) = qr - (N)$        $\delta(r, 0) = s$   
 $\delta(r, 1) = q$        $\delta(r, 1) = p$   
 $\delta(q, 0) = r$        $\delta(s, 0) = \emptyset$   
 $\delta(q, 1) = qr$        $\delta(s, 1) = p$

$\delta(qr, 0) = \delta(q, 0) \cup \delta(r, 0) = r \cup s$   
 $\delta(qr, 0) = rs - (N)$

$\delta(qr, 1) = \delta(q, 1) \cup \delta(r, 1) = qr \cup p$   
 $\delta(qr, 1) = pqr - (N)$

$\delta(rs, 0) = \delta(r, 0) \cup \delta(s, 0) = s \cup \emptyset$   
 $\delta(rs, 0) = s$

$\delta(rs, 1) = \delta(r, 1) \cup \delta(s, 1) = p \cup p$   
 $\delta(rs, 1) = p$

$\delta(pqr, 0) = \delta(p, 0) \cup \delta(q, 0) \cup \delta(r, 0) = qr \cup r \cup s$   
 $\delta(pqr, 0) = qrs - (N)$

### 3. TCS Assignment - 3 [09/10]

Assignment-3

classroom.google.com/c/MTE2MTgzNDk3OTcy/a/MjA4MjQ0MDY3OTU0/details

TE-TCS-sem V-SH-2020  
B

Assignment-3

Rohini Patil • Nov 19  
9/10

Due Nov 21

Tutorial no 3....  
Word

Class comments

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Your work

Graded

Amey\_B-50\_TCS\_...  
PDF

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Resubmit

Private comments

Add private comment...

AMEY THAKUR TE B-50

TCS ASSIGNMENT-3

Q1. Design mealy machine to find out 2's complement of a binary number.

Ans:

2's complement = 1's complement + 1

```

graph LR
    start(( )) --> q0((q0))
    q0 -- 0/0 --> q0
    q0 -- 1/1 --> q1((q1))
    q1 -- 0/1 --> q1
    q1 -- 1/0 --> q0
  
```

The finite automation  $M_1$

We can define  $M_1$  formally by writing

$$M_1 = (Q, \Sigma, \delta, \Delta, \lambda, q_0)$$

- $Q = \{q_0, q_1\}$
- $\Sigma = \{0, 1\}$
- $\Delta = \{0, 1\}$
- $\delta : Q \times \Sigma \rightarrow Q$
- $\lambda : Q \times \Sigma \rightarrow \Delta$

Present state	Next state			
	input = 0		input = 1	
	state	output	state	output
$\rightarrow q_0$	$q_0$	0	$q_1$	1
$q_1$	$q_1$	1	$q_0$	0

⑥  $q_0$  is the initial state.

## 4. TCS Assignment - 4 [09/10]

The screenshot shows a Google Classroom page for 'Assignment-4'. The header includes the course name 'TE-TCS-sem V-SH-2020' and the assignment title 'Assignment-4' by Rohini Patil, dated Nov 19 (edited Nov 19). The due date is Nov 22. A Microsoft Word document titled 'Tutorial no 4....' is attached. On the right, the 'Your work' section shows a PDF file 'Amey\_B-50\_TCS\_...' and buttons for '+ Add or create' and 'Resubmit'. Below this is a 'Private comments' section with an 'Add private comment...' button. The bottom left has a help icon.

AMEY THAKUR TE B-50  
TCS ASSIGNMENT - 4

Q1 Write a regular expression for the language in which the first character is a or c followed by any string in b over  $\Sigma = \{a, b, c\}$

Ans:  
 $L = \{a, c, ab, cb, abb, cbb, \dots\}$   
 $R = (a+c) \cdot b^*$

Q2 Write a regular expression for strings containing no double letter over  $\Sigma = \{a, b\}$

Ans:  
 $L = \{a, b, ab, ba, aba, bab, abab, babe, \dots\}$   
 $R = a \cdot (ba)^* b + b \cdot (ab)^* a$

Q3 Give the regular expression for the following.

(i) Set of all strings over  $\{0, 1\}$  that ends with 1 and has no substring 00

Ans:  
 $L = \{1, 01, 101, 1011, 0101, 1111, \dots\}$   
 $R = (10+1)^* \cdot 1 + (01+1)^*$

(ii) Set of all strings over  $\{0, 1\}$  with even number of 1's followed by odd number of 0's.

Ans:  
 $L = \{0, 110, 11000, \dots\}$   
 $R = (11)^* \cdot (00)^* 0$

(iii) For the language which ends in either 01 or 101 over  $\Sigma = \{0, 1\}$

Ans:  
 $L = \{01, 101, \dots\}$   
 $R = (0+1)^* \cdot 01$

## 5. TCS Assignment - 5 [10/10]

Assignment-5

classroom.google.com/c/MTE2MTgzNDk3OTcy/a/MjA4MjQ0MDY4MDc4/details

TE-TCS-sem V-SH-2020

Assignment-5

Rohini Patil • Nov 19

10/10

Due Nov 22

Your work

Graded

Amey\_B-50\_TCS\_... PDF

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AMEY THAKUR TE B-50

TCS ASSIGNMENT - 5

Page No.:

Date:

youva

Q1 Explain the closure properties for Regular Languages

Ans:

① Closure under Union

- If  $L$  and  $M$  are regular languages, so is  $L \cup M$ .

- Proof: Let  $L$  and  $M$  be the languages of regular expressions  $R$  and  $S$  respectively.

- Then  $R + S$  is regular expression whose language is  $L \cup M$ .

② Closure under Concatenation and Kleene Closure

- The same idea can be applied using Kleene closure:

-  $RS$  is a regular expression whose language is  $LM$ .

-  $R^*$  is a regular expression whose language is  $L^*$ .

③ Closure under Intersection.

- If  $L$  and  $M$  are regular languages, so is  $L \cap M$ .

- Proof: Let  $A$  and  $B$  be two DFA's whose regular languages are  $L$  and  $M$  respectively.

- Now, Construct  $C$ , the product automaton of  $A$  and  $B$ . Make the final states of  $C$  be the pairs consisting of final states of both  $A$  and  $B$ .



## 6. TCS Assignment - 6 [09/10]

Assignment-6

Rohini Patil • Nov 19

9/10 Due Nov 22

Tutorial no 6.... Word

Class comments

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Your work Graded

Amey\_B-50\_TCS\_... PDF

+ Add or create

Resubmit

Private comments

Add private comment...

AMEY THAKUR TE B-50

TCS ASSIGNMENT - 6

Page No.:   
 Date:   
 youva

Q1) What is Ambiguous Grammar? Give one example.

Ans:

Ambiguous Grammar

A Grammar is said to be Ambiguous if there exists two or more derivation tree for a string (w) (that means two or more left derivation trees)

Example:  $G = (\{s\}, \{a, b, +, *\}, P, s)$  where P consists of

$S \rightarrow s + s \mid s * s \mid a \mid b$

The string  $a + a * b$  can be generated as:

$S \rightarrow s + s$	$S \rightarrow s * s$
$\rightarrow a + s$	$\rightarrow s + s * s$
$\rightarrow a + s * s$	$\rightarrow a + s + s$
$\rightarrow a + a * s$	$\rightarrow a + a * s$
$\rightarrow a + a * b$	$\rightarrow a + a * b$

Thus, this Grammar is Ambiguous.

(ii) 00011

Leftmost derivation	Rightmost derivation
$S \rightarrow A1B$	$S \rightarrow A1B$
$\rightarrow 0A1B \quad (A \rightarrow 0A)$	$\rightarrow A11B \quad (B \rightarrow 1B)$
$\rightarrow 00A1B \quad (A \rightarrow 0A)$	$\rightarrow A11 \quad (B \rightarrow \epsilon)$
$\rightarrow 000A1B \quad (A \rightarrow 0A)$	$\rightarrow 0A11 \quad (A \rightarrow 0A)$
$\rightarrow 0001B \quad (A \rightarrow \epsilon)$	$\rightarrow 00A11 \quad (A \rightarrow 0A)$
$\rightarrow 00011B \quad (B \rightarrow 1B)$	$\rightarrow 000A11 \quad (A \rightarrow 0A)$
$\rightarrow 00011 \quad (B \rightarrow \epsilon)$	$\rightarrow 00011 \quad (A \rightarrow \epsilon)$

## 7. TCS Assignment - 7 [09/10]

The screenshot shows a Google Classroom interface. At the top, the browser tab is 'Assignment-7' and the address bar shows the classroom URL. The page header indicates the course is 'TE-TCS-sem V-SH-2020'. The assignment title is 'Assignment-7' by Rohini Patil, dated Nov 19 (last edited Nov 27), with a due date of Nov 28, 11:30 AM. A 'Tutorial no 7.... Word' document is attached. On the right, the 'Your work' section shows a graded PDF submission 'Amey\_B-50\_TCS\_...' with a 'Resubmit' button. Below this, there are sections for 'Class comments' and 'Private comments', both with input fields and send buttons.

The handwritten work is on lined paper. At the top, the student's name 'AMEY THAKUR TE B-50' and 'TCS ASSIGNMENT - 7' are written. To the right is a box for 'Page No.' and 'Date', with a 'youva' logo. The question asks for a context-free grammar generating strings of 'a's'. The student provides the definition of a CFG as a 4-tuple  $G = \{V, \Sigma, S, P\}$  and lists the components:  $V$  (Non-Terminal symbols),  $\Sigma$  (Terminal symbols),  $S$  (Start symbol), and  $P$  (Production Rule). The grammar for strings of 'a's is given as  $G = \{ (S), (a), (S), (S \rightarrow aS \mid a) \}$ . The derivations shown are:  $S \rightarrow aS \rightarrow aaS \rightarrow aaaS$  (using  $S \rightarrow aS$ ) and  $S \rightarrow a$  (using  $S \rightarrow a$ ).



Assignment-8

classroom.google.com/c/MTE2MTgzNDk3OTcy/a/MjMyMTEyNzI1NDI0/details

TE-TCS-sem V-SH-2020

B

Assignment-8

Rohini Patil • Nov 19 (Edited Nov 27)

9/10

Due Nov 28, 11:30 AM

Tutorial no 8....

Word

Class comments

Add class comment...

Your work

Graded

Amey\_B-50\_TCS\_...

PDF

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Private comments

Add private comment...

9

Assignment-9&10

+

→

classroom.google.com/c/MTE2MTgzNDk3OTcy/a/MjMyMTEyODYzMDg2/details

☆

A

TE-TCS-sem V-SH-2020

B

A

Assignment-9&10

Rohini Patil • Nov 19 (Edited Nov 27)

9/10

Due Nov 28, 11:30 AM

Tutorial no 9 ...

Word

Class comments

Add class comment...

▶

Your work

Graded

Amey\_B-50\_TCS\_...

PDF

✕

Amey\_B-50\_TCS\_...

PDF

✕

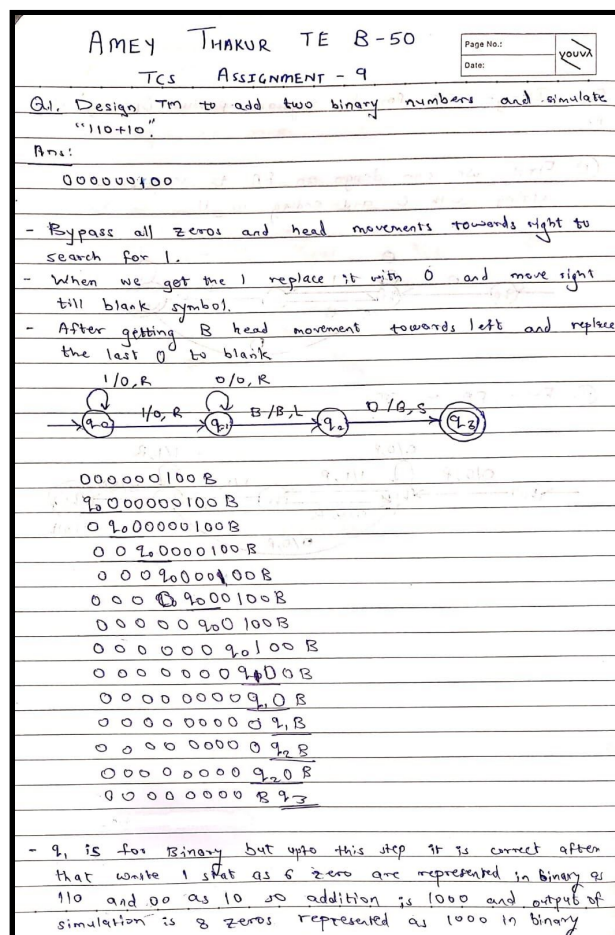
+ Add or create

Resubmit

Private comments

Add private comment...

▶



## 10. TCS Assignment - 10 [09/10]

Assignment-9&10

classroom.google.com/c/MTE2MTgzNDk3OTcy/a/MjMyMTEyODYzMDg2/details

TE-TCS-sem V-SH-2020  
B

Assignment-9&10

Rohini Patil • Nov 19 (Edited Nov 27)  
9/10

Due Nov 28, 11:30 AM

Tutorial no 9 ...  
Word

Class comments

Add class comment...

Your work

Graded

Amey\_B-50\_TCS\_...  
PDF

Amey\_B-50\_TCS\_...  
PDF

+ Add or create

Resubmit

Private comments

Add private comment...

AMEY THAKUR TE B-50  
TCS ASSIGNMENT - 10

Page No.:  
Date:

Q] Discuss any real life application based on FSM, PDA, TM, Grammar.

Ans:

Finite state machine (FSM)

- Finite automata are good models for computers with an extremely limited amount of memory
- What can a computer do with such a small memory? Many useful things! In fact, we interact with such computers all the time, as they lie at the heart of various electromechanical devices.
- The controller for an automatic door is one example of such a device. Often found at supermarket entrances and exits, automatic doors swing open when sensing that a person is approaching. An automatic door has a pad in front to detect the presence of a person about to walk through a doorway. Another pad is located to the rear of the doorway so that the controller can hold the door open long enough for the person to pass all the way through and also so that the door does not strike someone standing behind it as it opens.
- This configuration is as follows:

front  
pad

rear  
pad

door

TERNA ENGINEERING COLLEGE COMPUTER ENGINEERING DEPARTMENT CLASS:TE(B)SH-2020 SUBJECT:TCS (Quiz)							
Roll no	Name of student	Quiz-1 co-1	Quiz-2 co-2	Quiz-3 co-3	Quiz-4 co-4	Quiz-5 co-5	Quiz-6 co-6
B50	THAKUR AMEY MAHENDRA	8	9	9	10	10	10

### 11. TCS Quiz - 1 [08/10]

TCS\_Quiz 1\_SH-20[co1]

Total points 8/10 ?

Email address \*

ameythakur@ternaengg.ac.in

Name of student \*

AMEY THAKUR

Class \*

TE-B ▼

Roll No \*

50 ▼

### 12. TCS Quiz - 2 [09/10]

TCS\_SH-20[co2]

Your response has been recorded.

### 13. TCS Quiz - 3 [09/10]

TCS\_quiz-3\_sh-20[co3]

Total points 9/10 ?

Email address \*

ameythakur@ternaengg.ac.in

Name of student \*

AMEY THAKUR

Class \*

☐ TE-A

☒ TE-B

☐ TE-C

Roll no \*

50

### 14. TCS Quiz - 4 [10/10]

TCS\_Quiz-4\_sh-20[co4]

Total points 10/10 ?

Email address \*

ameythakur@ternaengg.ac.in

Name of student \*

AMEY THAKUR

class \*

TE-B

Roll no \*

50



### 15. TCS Quiz - 5 [10/10]

TCS\_Quiz\_sh20[co5]

Total points 10/10 ?

Name of student \*

AMEY THAKUR

Class \*

TE-B ▼

Roll no \*

50 ▼

### 16. TCS Quiz - 6 [10/10]

TCS\_quiz\_sh-20[co6]

Total points 10/10 ?

Name of student \*

AMEY THAKUR

Class \*

TE-B ▼

Roll no \*

50 ▼

## 17. Course Exit Survey

TE-A/B/C		Total points
<p>Email address *</p> <p>ameythakur@ternaengg.ac.in</p>		0/0 ?
		0 of 0 points
<p>Class *</p> <p>TE-B</p>		
<p>RollNo *</p> <p>50</p>		
<p>Name of Student *</p> <p>AMEY THAKUR</p>		
course exit_TCS		0 of 0 points