



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058, India
(Autonomous College Affiliated to University of Mumbai)

Mid Semester Examination

September 2018

Max. Marks: 20

Duration: 01 hr

Class: T.E.

Semester: V

Course Code: IT54/CE55

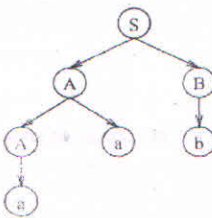
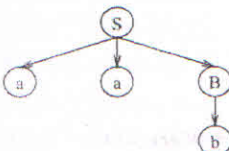
Branch: Information Technology/Computer

Engineering

Name of the Course: Theoretical Computer Science

Synoptic

Please find the sample solution and marks distribution

Q. no	
Q.1(a)	Mealy machine- state transition table – 2Marks Mathematical transition – 1Marks Transition diagram – 1 marks
Q.2(a)	<p>Consider the following grammar</p> $S \rightarrow AB aaB$ $A \rightarrow a Aa$ $B \rightarrow b$ <p>(i). Show that the grammar is ambiguous (ii). Construct an unambiguous grammar that describe the same language</p> <p>Answer -</p> <p>1 We may derive aab using either $S \rightarrow AB$ or $S \rightarrow aaB$, which give rise to different trees:</p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p>2 We can remove the production $S \rightarrow aaB$ to eliminate the ambiguity, which leads to the following grammar:</p> $S \rightarrow AB$ $A \rightarrow a Aa$ $B \rightarrow b$ <p>We can further simplify this grammar, by eliminating the variables A and B:</p> $S \rightarrow aS ab$
	Or
Q.2 (a)	Convert the following CFG to CNF $S \rightarrow ABA$

	$A \rightarrow aA \mid \epsilon$ $B \rightarrow bB \mid \epsilon$ <ol style="list-style-type: none"> 1. Elimination of ϵ – 2 Mark 2. Elimination of unit production – 1mark 3. Conversion of simplified CFG to CNF – 2 marks 																								
Q 3 a	<p>Write Regular expressions for the following languages over $\{a,b\}$ (3marks)</p> <ol style="list-style-type: none"> a. The set of Strings of length $\cong 2 \text{ Mod } 3$ over the input (a,b) Ans: $((a+b). (a+b). (a+b))^* (a+b). (a+b)$ (1 mark) b. The set of strings such that two a's should not come together Ans: $(b+ab)^*. (\epsilon+a). (b+ba)^*$ (1 mark) c. $L = \{ uvw \mid u, w \text{ belongs to } \Sigma^* \text{ and } v =2 \}$ Ans: $(a+b)^*. (a+b). (a+b). (a+b)^*$ (1 mark) 																								
Q 3 b	<p>Design CFG for the following languages (2 Marks)</p> <ol style="list-style-type: none"> a. $L = \{ a^m b^n \mid m \geq 2, n \geq 3 \}$ (1 mark) Ans: $S \rightarrow aaAbb$ $A \rightarrow aA \mid Ab \mid \epsilon$ b. $L = \{ a^i b^j c^k \mid \text{such that } k = i+j \text{ where } i, j \geq 1 \}$ (1 mark) Ans: $S \rightarrow aSc \mid aAc$ $A \rightarrow bAc \mid bc$ 																								
Q 4	<p>Consider the following ϵ-NFA:</p> <table border="1" style="margin: 10px auto;"> <thead> <tr> <th>δ</th><th>ϵ</th><th>a</th><th>b</th></tr> </thead> <tbody> <tr> <td>1</td><td>2</td><td>3</td><td>-</td></tr> <tr> <td>2</td><td>-</td><td>2</td><td>-</td></tr> <tr> <td>3</td><td>4</td><td>-</td><td>3</td></tr> <tr> <td>4</td><td>-</td><td>5</td><td>2</td></tr> <tr> <td>5</td><td>1</td><td>-</td><td>-</td></tr> </tbody> </table> <ol style="list-style-type: none"> a) Construct NFA without ϵ- transitions (3 marks) Converted Transition table of NFA without ϵ (2 marks) Transition diagram for NFA without ϵ (1 mark) b) Convert the automation to DFA (3 marks) Converted Transition table of DFA (2 marks) Transition diagram for DFA (1 mark) 	δ	ϵ	a	b	1	2	3	-	2	-	2	-	3	4	-	3	4	-	5	2	5	1	-	-
δ	ϵ	a	b																						
1	2	3	-																						
2	-	2	-																						
3	4	-	3																						
4	-	5	2																						
5	1	-	-																						

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