University of Mumbai
Examinations Summer 2022

Time: 2 hour 30 minutes   Subject: TCS   Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	If L1 and L2 are context free language and R is a regular set, then which one of the languages below is not necessarily a context free language?
Option A:	$L_1 L_2$
Option B:	$L_1 \cup L_2$
Option C:	L1 ∩ L2
Option D:	$L_1 \cap R$
2.	A Context Free Grammer G = (V , T , P , S) is said to be in _____, if every productions is of the form : A → aα where a € T is a Terminal and α is a string of zero or more variables.
Option A:	Unit production.
Option B:	Chomsky Normal form.
Option C:	Null production.
Option D:	Greibach Normal form.
3.	Consider the following statements : I : Each Turing Acceptable language is need not to be Turing Decidable. II : Every Turing Decidable is Turing acceptable.
Option A:	Only I is true.
Option B:	Only II is true.
Option C:	Both are false.
Option D:	Both are true.
4.	FSM can recognize :
Option A:	Only Context free grammer
Option B:	Only Context sensitive grammer
Option C:	Only regular grammar
Option D:	Any grammar
5.	Recursively enumerable languages are not closed under :

30
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Option A:	Concatenation
Option B:	Complementation
Option C:	Homomorphism
Option D:	Union

6.	If P , Q , R be the three regular expressions then the equation R = Q + RP has a unique solution given by :
Option A:	R = RP
Option B:	R = QP*
Option C:	R = Q*P
Option D:	R= P*R

7.	Every Context free language can not be recognized by a _____ , but it can be recognized by _____ .
Option A:	NPDA , DPDA .
Option B:	DPDA , NPDA .
Option C:	NPDA , NPDA .
Option D:	DPDA , DPDA .

8.	If a language is denoted by a regular expression L = (x)* (x | y x) , then which of the following is not a legal string within L ?
Option A:	yx
Option B:	xyx
Option C:	x
Option D:	x y x y x

9.	Algorithmically , Which of the following conversion is not possible ?
Option A:	Regular grammar to context-free grammar
Option B:	Non-deterministic PDA to deterministic PDA
Option C:	Non-deterministic TM to deterministic TM
Option D:	Non-deterministic FSA to deterministic FSA

10.	_____ is the Type 1 grammer according to Chomsky Hierarchy.

81

Option A:	Unrestricted Grammer.
Option B:	Regular Grammer.
Option C:	Context free Grammer.
Option D:	Context sensitive Grammer.

Q2	
A	*Solve any TWO* *5 marks each*
i	*Compare and Contrast Moore and Mealy Machine.*
ii	*Find the GNF equivalent to CFG :* $S \rightarrow AB$ $A \rightarrow aA \mid bB \mid b$ $B \rightarrow b$
iii	State and explain pumping lemma theorem for regular languages.
B	*Solve any One* **10 marks each**
i	Give the Moore and Mealy machine for the following processes : "For input from $(0 + 1)^*$, if inputs ends in 101 , output x ; if input ends in 110 , output y ; otherwise output z " .

ii	Let G be the grammer :
	$S \rightarrow aB \mid bA$
	$A \rightarrow a \mid aS \mid bAA$
	$B \rightarrow b \mid bS \mid aBB$
	Find : i) Left most derivation
	       ii) Right most derivation
	      iii) Parse tree
	      iv) Is the grammer unambiguoous ? , for the given string 00110101 .

Q3	
A	*Solve any TWO* *5 marks each*
i	*Explain Non-deterministic PDA.*
ii	*Obtain DFA to accept strings of 0's and 1's with even no. of 0's and even no. of 1's.*

iii	Explain halting problem of Turing Machine.	
B	**Solve any One**	**10 marks each**
i	Design a Turing Machine to accept the language given by a regular expression $0(0+1)*11$.	
ii	Construct the PDA accepting following language : $L = a^n b^m c^n \mid m, n >= 1$.	

Q4		
A	*Solve any TWO*	*5 marks each*
i	*Explain Chomsky Hierarchy.*	
ii	*Describe Finite State Machine.*	
iii	Construct left linear and right linear grammer for the regular expression : $(((01 + 10) * 11) * 00)*$	
B	**Solve any One**	**10 marks each**
i	Design a TM which recognizes words of the form $a^n b^n c^n \mid n >= 1$.	
ii	Convert the following RE to ϵ- NFA and then convert it to DFA : $R = ((0 + 1) * 1 0 + (0 0) * (1 1) *) *$.	

33

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