Automata Theory and Computability - 15CS54

Module-4: Review Questions

Sl. No.	Questions	Marks
CFL – Closure properties		
1	Prove that context-free languages are closed under: • Union • Concatenation • Kleene star • Reverse	4 each
2	Prove that context-free languages are not closed under: • intersection • complement • difference	3 each
3.	Prove that CFL's are closed under intersection and difference with the Regular languages	6
Pumping theorem for CFL (Proving a Language is not context free)		
4.	State and prove pumping theorem for context free languages.	6
5.	Prove that L = { $a^n b^n c^n$, n≥0} not context free	6
6.	The Language of Strings with n^2 a's i.e. L = {a^{n^2} : n ≥ 0} is not CFL.	6
7.	Prove that L = {$a^n b^m a^n$: m, n ≥ 0, m≥n} is not context free.	6
8.	Prove L = {wcw, w is in {a,b}* } if not CFL	6
9.	Using the pumping theorem in conjunction with the closure properties, prove WW = {ww, w ∈ {a, b }*} is not context free	6
10.	Using the pumping theorem in conjunction with the closure Properties, a simple arithmetic language L = { x#y = z : x, y, z ∈ {0,1}* and if x, y, z are viewed as positive binary numbers without leading zeros, xy = z^R } is not context-Free	6
Deterministic CFL		
11	Prove that every deterministic CFL is context free. (It is assumed that the strings in L ends with $)	6
12	Prove that every deterministic CFL's are closed under complement.	5
13	Prove that every deterministic CFL's are not closed under union and intersection	5 each
14	Write a note on hierarchy of CFL.	6

Turing Machine		
15.	Briefly explain Turing Machine model. Give its definition.	5
16.	Briefly explain representations of TM with example.	8
17.	Design a Turing machine to recognize all strings consisting of an even number of 1's. Obtain the computation sequence for 11 and 111.	8
18.	Design a Turing machine over {1, b} which can compute a concatenation function over ∑ = {1}. If a pair of words (w_1, w_2) is the input, the output has to be w_1w_2. Give the computation for 11b111	8
19.	Design TM that accepts $\{0^n1^n \mid n \geq 1\}$. Obtain the computation for 0011 and 010.	8
20.	Design TM that accepts $\{1^n2^n3^n \mid n \geq 1\}$. Write the ID's for 1223, 1123, 1233 and 112233.	10
21.	Briefly explain the following techniques of TM construction. a. Turing Machine with Stationary Head b. Storage in the State c. Multiple Track Turing Machine d. Subroutines	8
22.	Design a TM which can multiply two positive integers.	10