**Tutorial -4**

**Q1:** Consider the CFG

**A group of black letters

AI-generated content may be incorrect.**

Give parse trees and derivations for each string.

1. a
2. a+a
3. a+a+a
4. ((a))

Q2: Use the languages A={ambncn∣m,n>0} and B={anbncm∣m,n>0} to show that the class of context-free languages is not closed under intersection.

Q3:

Give context-free grammars that generate the following languages. In all parts the alphabet is {0,1}.

* {w| w contains at least three 1s}
* {w I w starts and ends with the same symbol}
* {w | the length of w is odd}
* {w| the length of w is odd and its middle symbol is a 0}
* {w| w = wR, that is, w is a palindrome}
* The empty set

Q4:Give descriptions and state diagrams of pushdown automata for the languages of Q3

Q5: Give context-free grammars generating the following languages.

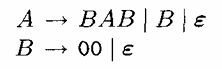
* The set of strings over the alphabet {a,b} with more a's than b's
* The complement of the language {anbn I n > 0}
* {W#x| WR is a substring of x for w,x in {0,1}\*}
* {X1#X2# .. #Xk | k => 1, each xi  in {a, b}\* and for some i and j, xi = xjR}

Q6: Draw the PDAs for the Grammers of Q5

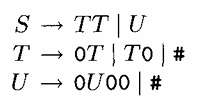
Q7: Give a context-free grammar that generates the language k A = {aibjck I i = j or j = k where i,j, k > 0}. Is the grammar ambiguous? Why or why not?

Give the description of a pushdown automaton that recognizes the language A.

Q8: Convert the following CFG into an equivalent CFG in Chomsky normal form



Q9: Let G = (V,∑,R,S) be the following grammar. V = {S, T, U}; ∑={0,#} and R is the set of Rules



Describe L(G) in English and show that is not regular

Q10:

Give a counterexample to show that the following construction fails to prove that the class of context-free languages is closed under star. Let A be a CFL that is generated by the CFG G = (V,∑,R, S). Add the new rule S →SS and call the resulting grammar G'. This grammar is supposed to generate A\*