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COURSE TITLE: Theory of Computing

ASSIGNMENT

1. Consider the following grammar G = (V,T, S, P), and identify languages generated by it
2. S→aS|bS|a
3. S→AS|BS|λ, A→a, B→b.
4. S→aAb|aBb|aSb, A →aA|a, B →bB|b

2. The production rule S→aSa|bSb|a|b|λ generates a palindrome Language; PAL={w∈ {a,b}^\* |w=w^R }; define at least ten (20) set of strings produced by this grammar (Note: show how you generate your strings using parse tree).

3. Construct the grammar for set of all strings (w∈{a,b}| |w|mod 2=1).

4. In algebraic form, summarize the language generated by the following grammar

 i. S→aAb, A→aA|bA|λ

ii. S→aSb|ab

iii. S→aSc|aAc, A→aAb|ab

iv. S→AB, B→bB|b, A→aA|a

Solution

1i.S→aS|bS|a

S→a

S→aS→aa

S→bS→ba

S→aS→abS→aba

L(G)={a, aa, ba, aba, aaa, aaba, . . .}

Description:(a + b)m a|m>=0

A set of strings contain zero or more a’s and or b’s ending with an a.

1ii.S→AS|BS|λ, A→a, B→b.

S→λ

S→AS→aS→a

S→BS→bS→b

S→AS→aS→aAS→aaS→aa

S→BS→bS→bBS→bbS→bb

L(G)={λ ,a, b, aa, bb, ab, ba, aaa, . . .}

Description:(a + b)m |m>=0

A set of strings contain zero or more a’s and or b’s.

1iii. S→aAb|aBb|aSb, A →aA|a, B →bB|b

S→aAb→aab

S→aAb→aaAb→aaab

S→aBb→abb

S→aBb→aBbb→abbb

S→aSb→aaAbb→aaabb

S→aSb→aaBbb→aabbb

L(G)={aab, abb, aaab, abbb, aaabb, aabbb, . . .}

Description: a an bm b |m,n>=0|n≠m

A set of strings starting with a and ending with b containing zero or more a’s and or b’s, where there is always one more than the other.

1. S→aSa|bSb|a|b|λ

S→λ

S→a

S→b

S→aSa→aa

S→bSb→bb

S→aSa→aaa

S→aSa→aba

S→bsb→bab

S→bSb→bbb

S→aSa→aaSaa→aaaa

S→aSa→abSba→abba

S→bSb→baSab→baab

S→bSb→bbSbb→bbbb

S→aSa→aaSaa→aaaaa

S→aSa→aaSaa→aabaa

S→aSa→abSba→ababa

S→aSa→abSba→abbba

S→bSb→baSab→baaab

S→bSb→baSab→babab

S→bSb→bbSbb→bbabb

L(G)={λ, a, b, aa, bb, aaa, aba, bab, bbb, aaaa, abba, baab, bbbb, aaaaa, . . .}

Algebra= {ax by an bm by ax|x,y,n,m>=0}

1. (w∈{a,b}| |w|mod 2=1).

length={1, 3, 5, 7, 9, …}

S→aSS/bSS/a/b

S→a

S→b

S→aSS→aaS→aaa

S→aSS→aaS→aab

S→aSS→abS→aba

S→aSS→abS→abb

S→bSS→baS→baa

S→bSS→baS→bab

S→bSS→bbS→bba

S→bSS→bbS→bbb

L(G)={a, b, aaa, aab, aba, abb, baa, bab, bba, bbb, . . .}

Algebra= ((a+b)(a+b))m(a+b)|m>=0

4i. S→aAb, A→aA|bA|λ

S→aAb→ab

S→aAb→aaAb→aab

S→aAb→abAb→abb

S→aAb→aaAb→aabAb→aabaAb→aabab

a(a+b)m b|m>=0

4ii. S→aSb|ab

S→ab

S→aSb→aabb

S→aSb→aaSbb→aaabbb

anbn|n>=1

4iii S→aSc|aAc, A→aAb|ab

S→aAc→aabc

S→aAc→aaAbc→aaabbc

S→aSc→aaAcc→aaabcc

amanbncm| n,m>=1

4iv S→AB, B→bB|b, A→aA|a

S→AB→aB→ab

S→AB→aB→abB→abb

S→AB→aAB→aAb→aab

S→AB→aB→abB→abbB→abbb

ambn|n,m>=1