THEORY OF COMPUTATION

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*Assignment - 2*

***Abstract*— This document gives solutions to the TOC Assignment - 02**

***Keywords***— **Push Down Automata,Context Free Grammar , Algorithm , Time Complexities**

1. Algorithm - 1 to convert PDA to corresponding CFG

Direct conversion of PDA to CFG

PDA acceptance by empty stack

1. Name non terminals to match stack-emptying possibilities

For all states q1, q2 ∈ Q and all stack symbols g ∈ Γ, introduce a non-terminal [q1, g, q2] (most of these nonterminals will prove to be useless later).

1. Let start symbol S set up all stack-draining options

For all states q ∈ Q, introduce one production S → [q0, z0, q].

1. Capture how PDA transition helps drain the stack

If δ(p, a, g) contains -q, g1, . . . , gn, introduce one generic rule [p, g, q0] → a [q, a, q1][q1, g1, q2] . . . [qn, gn, q0]

1. Final result from figure

We apply this algorithm to the PDA,we get an extremely large CFG. We hand simplify, by throwing away rules as well as non-terminals that are never used

1. Algorithm - 2 to convert PDA to corresponding CFG

PDA P = (Q, Σ, Γ, δ, , {}) empties stack before accepting

We construct a CFG G that has the following rules:

1. ∀p ∈ Q put rule → ε
2. ∀p, q, r ∈ Q put rule →
3. ∀p, r, s, q ∈ Q put rule → ab if

* (r, u) ∈ δ(p, a, ε) and
* (q, ε) ∈ δ(s, b, u).

1. The start variable is A

II Comparison of Two Algorithms

2. Suppose that L ⊆ and for some positive integer n, there are n strings in ,any two of which are distinguishable w.r.t L . Then there are no FA recognizing L with fewer than n states.

Proof : Suppose that are n strings, any two of which are distinguishable w.r.t L

If M = (Q,Σ,δ,,A) is any FA with fewer than n states, then by the pigeonhole principle,states ,,......., cannot all be distinct and for some i ≠ j , =.

Since and are distinguishable w.r.t L. M cannot recognize L.

II Time Complexity of two Algorithms

Complexity of First algorithm is O().

Complexity of Second algorithm is O().

*References*

1. Theory of Computation Siper’s book
2. Theory of Computation by Ullman Motwani Hopcraft
3. Wikipedia of PDA to CFG