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Homework 3

I pledge my honor that I have abided by the Stevens Honor System.

**Construction of Context Free Languages**

1) Define a context ­free grammar that accepts any valid mathematical expression over the alphabet {0, 1, 2, 3, 4, 5, 6, 7, 8, 8, +}.

V := {E, N, D}

Σ := {0, 1, 2, 3, 4, 5, 6, 7, 8, 9, +}

R := {

}

S := E

2) Define a context­ free grammar that accepts any palindrome over the alphabet {0, 1}.

V := {P}

Σ := {0, 1}

R := {

}

S := P

**Construction of Pushdown Automata**

1) Define a pushdown ­automaton which accepts any string over the alphabet {0, 1} for which there are the same number of “0”s as “1”s.

Q := {st, q1, q2, fin}

Σ := {0, 1} Γ := {0, 1, $}

q0 := st F := {st, fin}

δ :=

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Input | 0 | | | | 1 | | | | ε | | | |
| Stack | 0 | 1 | $ | ε | 0 | 1 | $ | ε | 0 | 1 | $ | ε |
| st |  |  |  |  |  |  |  |  |  |  |  | (q1, $) |
| q1 |  | (q1, ε) |  | (q1, 0) | (q1, ε) |  |  | (q2, 1) |  |  | (fin, ε) |  |
| q2 |  | (q1, ε) |  | (q1, 0) |  |  |  | (q2, 1) |  |  |  |  |
| fin |  |  |  |  |  |  |  |  |  |  |  |  |

2) Let be strings over the alphabet {0, 1, $}. Define a pushdown ­automaton which accepts any string where is a subsequence of , and both and do not contain “$”.

Ex: “**110**​$**0**​0**1**​00**1**​”

Ex: “**0101**​$0**10**​0**1**​11**0**​101”

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Input | 0 | | | | 1 | | | | $ | | | | ε | | | |
| Stack | 0 | 1 | $ | ε | 0 | 1 | $ | ε | 0 | 1 | $ | ε | 0 | 1 | $ | ε |
| st |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | (q1, $) |
| q1 |  |  |  | (q1, 0) |  |  |  | (q1, 1) |  |  |  | (q2, ε) |  |  |  |  |
| q2 | (q2, ε) |  |  | (q2, ε) |  | (q2, ε) |  | (q2, ε) |  |  |  |  |  |  | (fin, ε) |  |
| fin |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

**Pumping Lemma**

1) Let . Prove that the set is not context­free.

w =

00…00 0 1 0 00…001

\ u / \/ \x/ \/ \ z /

Therefore, is not context free.