Julia Nelson Problem Set 7 "Pledge"

Problem 1 2 stacks → S1 and S2

Start reading tape

- if string empty → Accept
- all strings must appear in a, b, c, d (alphabetical) order

first state → if input is "a"
- push onto S1
- continue until you see a different symbol than "a"
- if not "a" move to next state

2nd State → if input is a "b"
push onto S2
continue this until next symbol is not "b"
move to next state

3rd State → if input is "c"
~~Do same to~~
POP the a's from S1
for every c in input
→ if no a exists to POP off of S1, REJECT string
→ ~~if~~ if S1 not empty by end of "c"'s REJECT
else move on

4th State → if next input is "D"
POP a "b" off of S2. → if no more "b"'s on S2, but still more input, REJECT
→ if no more input but "b"'s still on S2, REJECT
else Move to next State

→ if BOTH stacks empty by end → Accept
→ if ~~One~~ or more stacks not empty or there is more input left but no more on stacks → REJECT (after popping)

5th State → Accept string

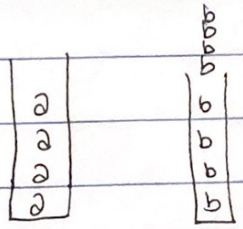
Problem 2

$L_{MUTE} = \{a^i b^{i*j} c^j : i,j \geq 0\}$

There is no pattern to push/pop on stacks (unlike i+j) therefore it cannot be recognized by a 2PDA

let $i = 4$ and $j = 2$

$\{a^4 b^{4*2} c^2\} = a\,a\,a\,a\,b\,b\,b\,b\,b\,b\,b\,b\,c\,c$



if you were to put a's on stack then Pop when "b's appear, you can have too little amount of a's so there would still be b's And not enough c's to pop b's off

let $i = 1$ $j = 2$ a b b c c

No pattern found throughout → cannot generalize

NOT CFL and cannot be recognized by 2PDA

Problem 3

KNOWN → if L is CFL without ε there is a CNF grammar for L

KNOWN → if $L \neq \emptyset$ and L is regular then L can be expressed as the union of n regular languages $A_1, \ldots A_n$ where each is accepted by a DFA with only 1 final state

Knowing these, we can construct a new Context Free Grammar in CNF

$$G' = (V', \Sigma, R', S')$$

$$V' = \{ \langle q, A, r \rangle \mid A \in V \text{ and } q, r \in Q \}$$

$$S' = \langle q_0, S, q_n \rangle$$

$$R' = \{\langle q, A, r \rangle \to \varepsilon \mid A \to t \in R,\ t \in \Sigma \cup \{\varepsilon\},\ \delta(q,t) = r\} \cup$$

$$\ldots \{\langle q, A, r \rangle \to \langle q, B, s \rangle \langle s, C, r \rangle \mid A \to BC \in R \text{ and } q, r, s \in Q$$

$\langle q, A, r \rangle$ generates strings w by A in G so starting in q, and ending in state r

> let L_1 be a CFL and Σ^* be regular
>
> $L \cap \Sigma^* = L$ which is a CFL

BASIC DESCRIPTION:

→ construct M_1 NPDA for L_1, the CFL and a DFA, M_2 for the Reg lang L_2.

→ construct new NPDA, M, that accepts $L_1 \cap L_2$

→ M simulates M_1 and M_2 M_1 accepts W and M_2 accepts W

$(q_1, p_1) \xrightarrow{a,b \to c} (q_2, p_2)$