Nathan Brooks
CS4110
Homework 7
Due October 26

P01. CFG = PDA

Convert the giv en CFG to its CNF (I separated them out to make it easeir to convert)
S → XaaX
X → aX
X → bX
X → /\
[*Chompsky Normal Form: every non-terminal* → double non-terminal (XX) or a single terminal (x)]

First remove any nullable non-terminals
nullable non-terminals: X
remove(X → /\)

Before, X could be replaced by /\. From these rules that could contain null string:
S → XaaX
X → aX
X → bX
We can make new rules:
S → Xaa
S → aaX
S → aa
X → a
X → b

So with no null productions our rules are now:
S → XaaX | Xaa | aaX | aa
X → aX | bX | a | b

There are no Unit Productions (non-terminal → one non-terminal), so we can skip this step.

Now we need to replace any rule that does not have the form XX or x by introducing new non-terminals
A → XC
B → CX
C → a
D → b

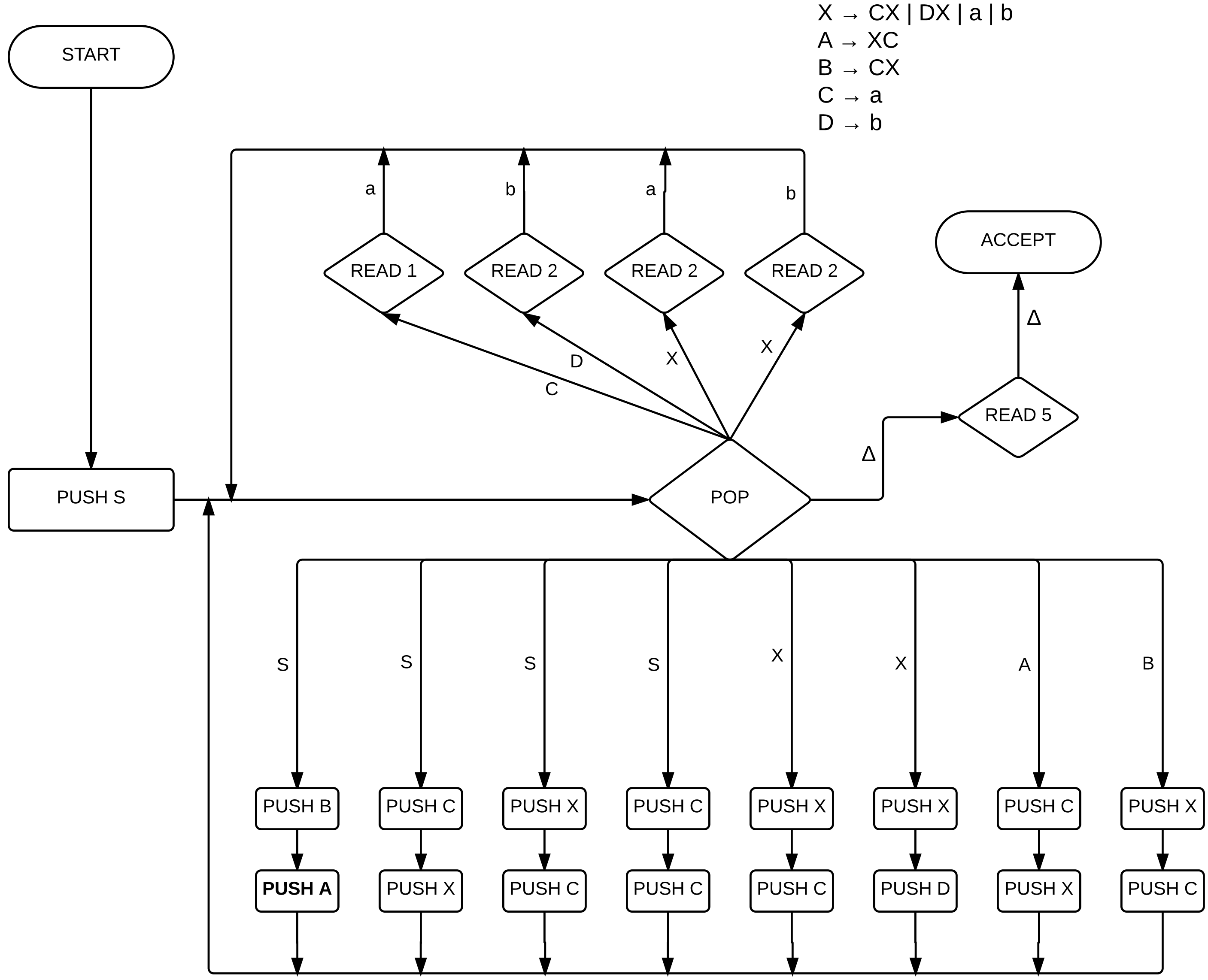
and now our rules, including the modified versions, are:

S → AB | XC | CX | CC
X → CX | DX | a | b
A → XC
B → CX
C → a
D → b

Part B on next page

Construct a PDA that accepts the same language generated by the given CFG using the algorithm of Theorem 30:

$S \rightarrow AB \mid XC \mid CX \mid CC$
$X \rightarrow CX \mid DX \mid a \mid b$
$A \rightarrow XC$
$B \rightarrow CX$
$C \rightarrow a$
$D \rightarrow b$



P02. CFL

Find a CFG for this language: All words that start with an a or are of the form a^n b^n

Just defining it so I can see it in a different way:

S → a (a + b)* | a^n b^n

S → a | aX | W
X → aX | bX | a | b
W → aWb | ab | /\