CpSc 3500 — Goddard

Warmup 3: Context-Free Languages

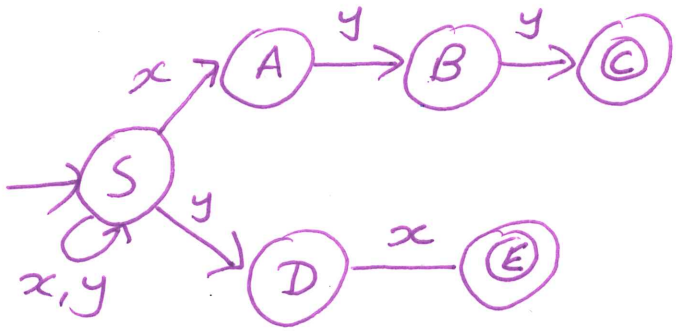
1. State whether each of the following is true or false. No justification required.

   (a) There exists a language accepted by a DFA but by no PDA. FALSE

   (b) There exists a language accepted by a nondeterministic FA but by no deterministic PDA. FALSE

   (c) The context-free language are closed under the three Kleene operations. TRUE

2. Give a regular grammar for the language generated by the RE $(x+y)^*(xyy+yx)$



$S \to xS \mid yS \mid xA \mid yD$

$A \to yB$

$B \to yC \mid y$

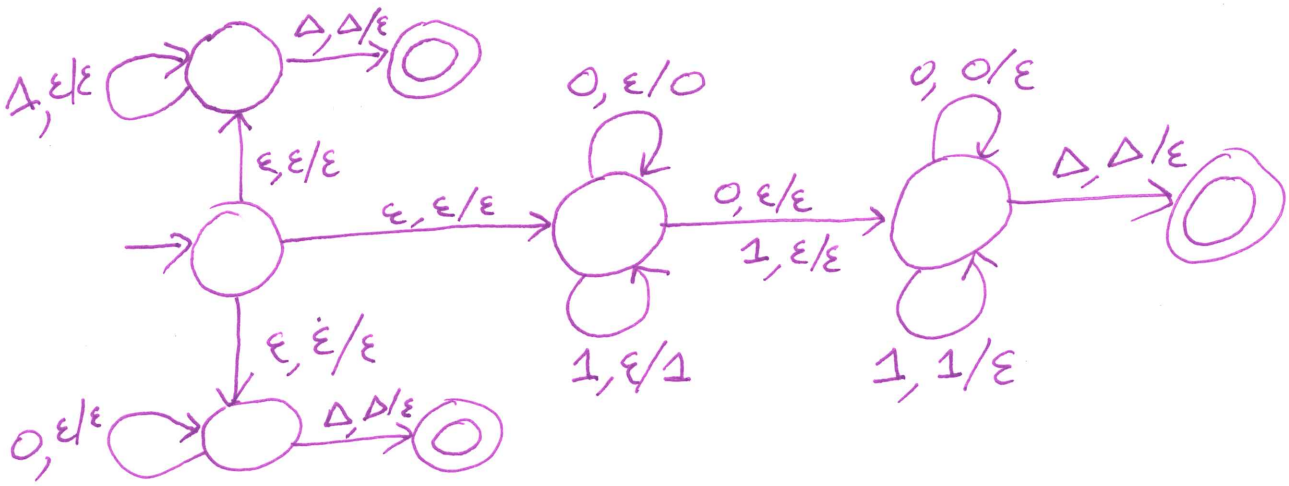
$D \to xE \mid x$

3. Show that the context-free languages are closed under reversal. That is, show algorithmically that if language L is context-free, then so is L^R, where L^R consists of the reverses of all strings in L.

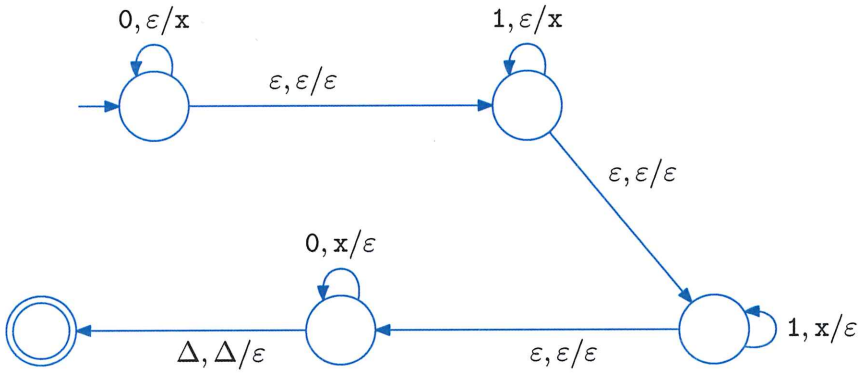
Take the CFG and write each production RHS reversed

e.g. $S \to \emptyset PQ1$ becomes $S \to 1QP\emptyset$

4. Let X be the set of all binary strings that are odd-length palindromes or all of whose symbols are the same. (For example, 01110 and 1111 are in X.) Draw a PDA for X.



5. Consider following PDA.



(a) Give two strings of length 4 accepted by the PDA.

(b) Give two strings of length 4 NOT accepted by the PDA.

(c) Describe in succinct-ish English the language of this PDA. Be precise.

all even-length binary strings of the form $0^*1^*0^*$ where each block of 0's is at most half the string