CPSC 323

Assignment No.9 (non-regular languages, Push Down Automata)

Name(s) ……..

Please write only on one side of your papers

1. (18 points) Find a CFG for each of the following non-regular languages and trace the given word to determine whether it is accepted or rejected by the CFG

   a. $L=\{a^n b^p c^m | p=2m+n,\ m=0,1,2,\ldots\ldots \text{ and } n=1,2,3,\ldots\ldots..\}$

      Trace $w1=a^2b^4c$

   b. $L=\{a^p b^n c^m |\ p=2n+3m;\ n=0,1,2,3,\ldots.. \text{ and } m=1,2,3,\ldots\ldots\}$

      Trace $w1=a^6b^3c^3$

   c. $L=\{a^n b^m |\ m>=n;\ n=1,2,3\ldots\ldots\ldots\ \}$

      Trace $w=a^3b^5$

2. (6 points)
   A. Construct a PDA for $L=\{ a^n b^m c^r |\ m=2r+n,\ r=1,2,\ldots..\ n=0,1,2,\ldots\ldots.\}$
   B. Write a CFG for L

3. (6 points)
   A. Construct PDA for $L=\{a^n b^m |\ n>m,\ m=1,2,\ldots\ldots.\}$
   B. Write a CFG for L

4. (6 points) Given regular language $L=ab^* + b^*$. Construct
   a. FA to accept L
   b. PDA to accept L

(1a)

$$L = \{ a^n b^p c^m \mid \begin{array}{l} p = 2m+n \\ m = 0,1,\ldots \\ n = 1,2,\ldots \end{array} \}$$

$$a^n \; b^{2m+n} \; c^m$$

$$\underbrace{a^n \; b^n}_{X} \; \underbrace{b^{2m} \; c^m}_{Y}$$

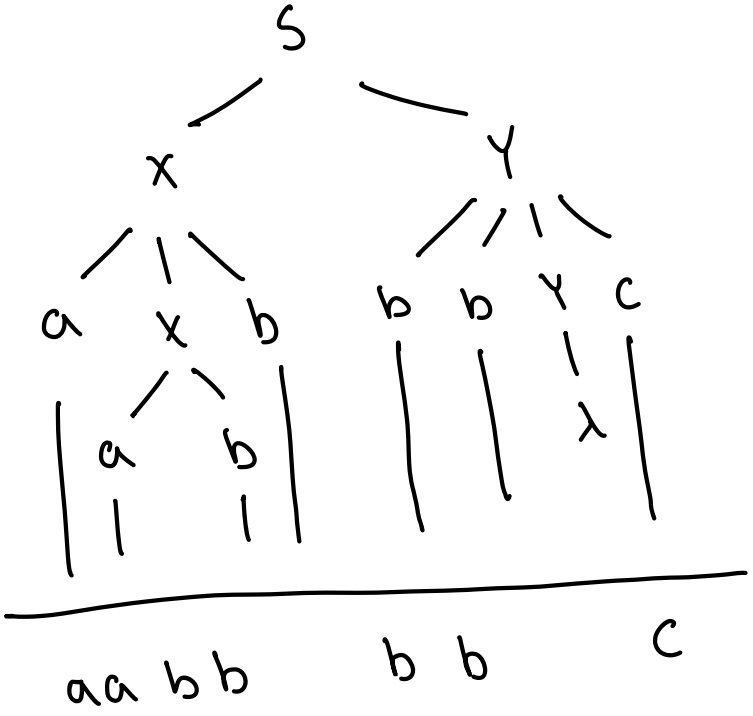
cfg: $S \rightarrow XY$

$X \rightarrow abX \mid ab$

$Y \rightarrow bbYc \mid \lambda$

Trace: $w1 = a^2b^4c$

$a^2b^2b^2c$



a^2b^4c accepted

(1b) $L = \{ a^p b^n c^m \mid p = 2n+3m,\ n = 0,1,\ldots,\ m = 1,2\ldots \}$

$a^{2n+3m}\ b^n\ c^m$

$a^{3m}\ a^{2n}\ b^n\ c^m$

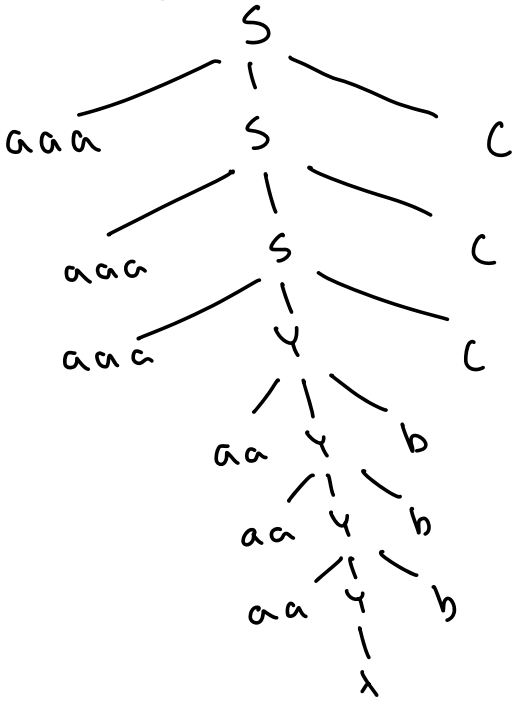
Y

S

cfg: $S \rightarrow aaaSc \mid aaaYc$

$Y \rightarrow aaYb \mid \lambda$

Trace: $w1 = a^6 b^3 c^3$



aaa aaa aaa aa aa aa bbb ccc

$a^6 b^3 c^3$ rejected

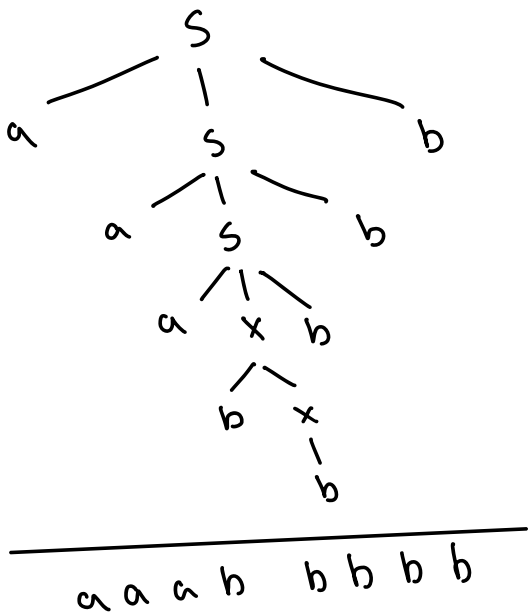
(1c) $L = \{ a^n b^m \mid \begin{matrix} m>n \\ n=1,2,\ldots \end{matrix} \}$

$a^n b^m$

cfg: $S \rightarrow aSb \mid aXb$

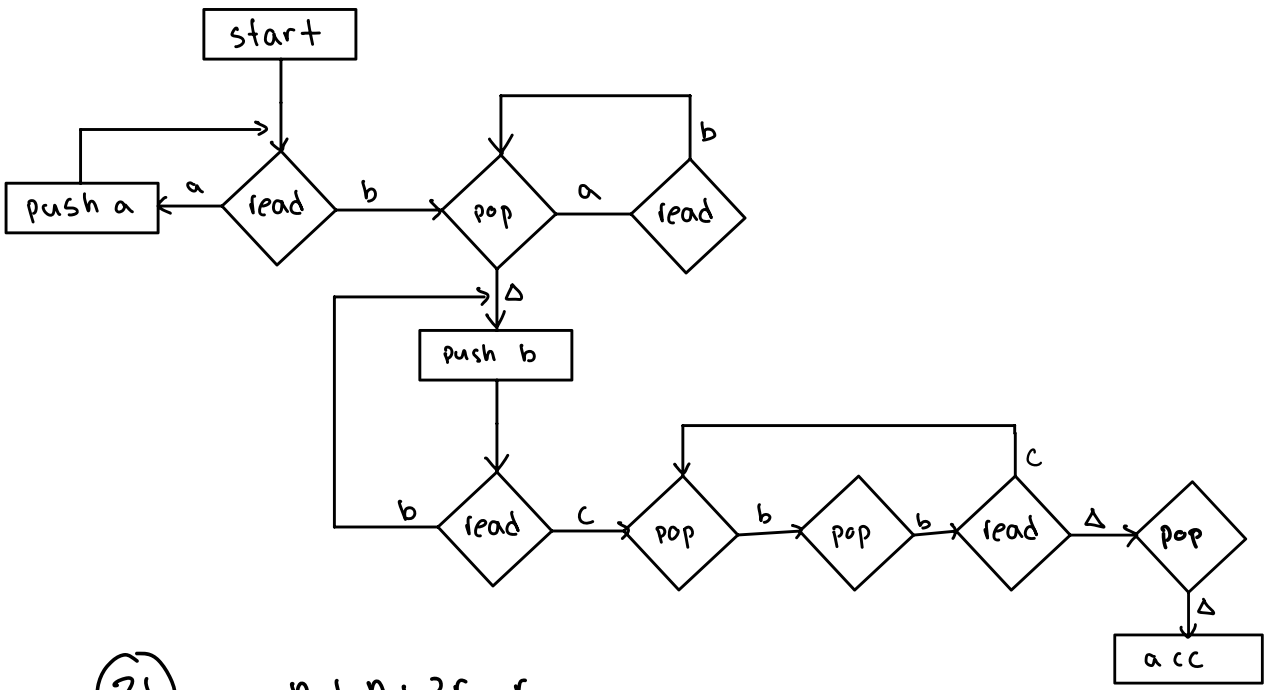
$X \rightarrow bX \mid b$

Trace: $w = a^3 b^5$



$a^3 b^5$ accepted

(2a) $L = \{ a^n b^m c^r \mid \begin{matrix} m = 2r+n \\ r = 1, 2, \cdots \\ n = 0, 1, \cdots \end{matrix} \}$



(2b) $a^n \underbrace{b^n}_{x} \underbrace{b^{2r} c^r}_{Y}$

cfg: $S \rightarrow XY$

$X \rightarrow aXb \mid \lambda$

$Y \rightarrow bbYc \mid bbc$

(3a) $L = \{ a^n b^m \mid \begin{matrix} n>m \\ m=1,2,.. \end{matrix} \}$

aaaaxxbb