CMSC 430 Exam 1 (Page 1)

① ⓐ Show $\{a^{3n} \mid n \geq 0\}$ is regular.

ⓑ Show it is context free.

$S \to aA \mid \lambda$
$A \to aB$
$B \to aS$

ⓒ Show $\{a^{n^3} \mid n \geq 0\}$ is not context free.

Assume context free. Then $\exists p$ such that if $k^3 > p$ then $a^{k^3} = a^u a^v a^w a^x a^y$ such that $a^u a^{v^i} a^w a^{x^i} a^y = a^{k^3}$

or $u+w+y+(v+x)i = k^3$ for all i.

or $A + Bi = k^3$ for all i.

But $(k+1)^3 - k^3 = 3k^2+3k+1 > k$ so difference between $(k+1)^3$ and k^3 can be as large as desired.

Choose i such that $A + Bi = l^3$ and $l > B$. then $A + B(i+1) = m^3 < (l+1)^3$, but that is impossible, thus assumption the language is context free is wrong.

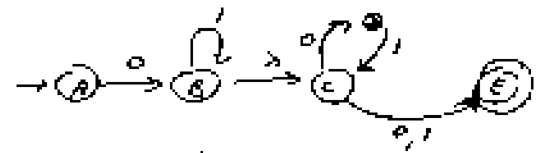
Note: Pumping lemma can be used to show something is not context free, not to show that something is.

②

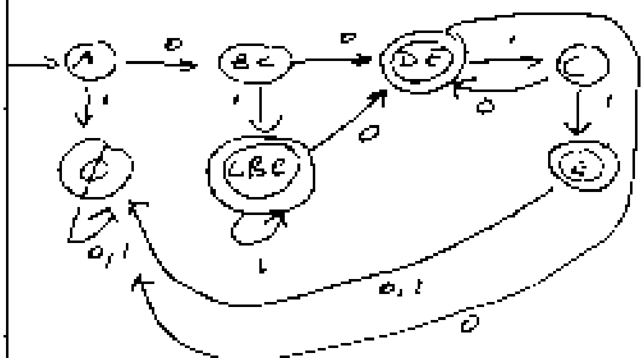
		First	Follow	a	b	c	d
1	$S \to c$	c		2		1	
2	$S \to aSYS$	a	d b				
3	$Y \to dS$	d	b		4		3
4	$Y \to \lambda$	λ					

No conflicts in table, so LL(1).

③ ⓐ First FSA



make it deterministic

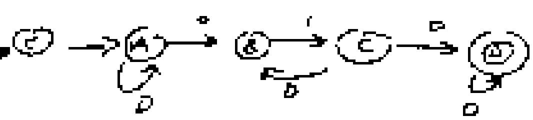


ⓑ $S \to SSS \mid a$ generates strings: a, aaa, aaaaa ...

or a^{2n+1}

So

ⓒ



DFSA: