CSE 303 ToC 115 060128
HW 8

Problem 1:-

1) $L = \{0^n 1^{2n} \mid n \geq 0\}$.

We have that no of 1's in any String in ~~the~~ L should be twice the no of 0's. And 0's should be in the beginning followed by 1's.

The CFG for L is given below

$$S \to \varepsilon \mid 0S11$$

So if we ~~so~~ take any string in L say $0^k 1^{2k}$, $k \geq 0$ we can derive it using the following derivation

$$S \overset{*}{\Rightarrow} 0S11 \overset{*}{\Rightarrow} 00S1111 \ldots \overset{*}{\Rightarrow} 0^k S 1^{2k} \Rightarrow 0^k 1^{2k}.$$

(k times)

Thus any string in L can be generated.

Problem 2:-

$L = \{x \in \{a,b\}^* \mid x \text{ has same nos of } a \& b\}$

$$S \to aSb$$
$$S \to bSa$$
$$S \to SS$$
$$S \to \varepsilon$$

For strings starting with a & ending with b, we use $S \to aSb$.

For strings starting with b & ending with a, we use $S \to bSa$.

For strings starting & ending with same character, we use $S \to SS$.

Eg take $w = abba$.

$S \Rightarrow SS \Rightarrow aSbS \Rightarrow abS \Rightarrow abbSa \Rightarrow abba$.

Take $w = abbaab$.

$S \Rightarrow aSb \Rightarrow abSab \Rightarrow abbaab$

Problem 3:-

$S \to aS \mid asbS \mid \varepsilon$.

This CFG generates all strings starting with "a" and the empty string.

The rules $S \to aS$, $S \to asbS$ always have a at the beginning. So any string with a at the begining will be covered.

For eg: $w = aaabbbaba$.

~~$S \Rightarrow aS \Rightarrow aaS \Rightarrow aaaSbS$~~

$S \Rightarrow aSbS \Rightarrow a\,aSbS\,bS \Rightarrow aaSbbS$

$\Rightarrow aaaSbbS \Rightarrow aaa\,bbS \Rightarrow aaabb\,aSbS$

$\Rightarrow aaabbabS \Rightarrow aaa\,bbabaS \Rightarrow aaa\,bbaba$

Problem 4:-

~~The~~ To ~~all~~ generate all regular exp over $\{a,b\}$

it is $\{a \cup b\}^*$.

i.e all strings that can be generated over $\{a,b\}$

The CFG for this is

$S \rightarrow aS \mid bS$

$S \rightarrow \varepsilon$

We add one alphabet which can either be a or b & then repeat. For terminating we use ε.

Eg:- aabbba.

$S \Rightarrow aS \Rightarrow aaS \Rightarrow aabS \Rightarrow aabbS \Rightarrow aabbbS$

$\Rightarrow aabbba.$