Assign 6 Akash Vasisht

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

1) assume L regular
2) $N = 2 \quad 2 \geq 0$

$0^2 1^2 2^2$

$x = 00 \quad |x| = 2$
$y = 11 \quad |y| = 2$
$z = 22 \quad |z| = 2$

Case 1 $n = 6$
$|xy| \leq n$
$4 \leq 6$

Case 2 $|y| \geq 1$
$2 \geq 1$

Case 3 $L = xy^iz$
$L = 00(11)^2 22$
$L = 00111122$
x Failed

Assumption incorrect
since lang. 0's 1's & 2's
must be equal.

1b) $L = \{www \mid w \in (a,b)^*\}$

1) assume regular

$w = ab \quad L = \{ababab\}$
x y z

$x = ab \quad y = ab \quad z = ab$
$|x| = 2 \quad |y| = 2 \quad |z| = 2$

Case 1 $n = 6$
$|xy| \leq n$
$4 \leq 6$

case 2 $|y| \geq 1$
$2 \geq 1$

Case 3 $L = xy^iz \quad i \geq 0$
$i = 2$
$L = ab(ab)^2 ab = abababab$

Not regular since string must be divisable by 3

1) $L = \{a^{2^n} \mid n \geq 0\}$ (a^{2^n} string of 2^n a's)

String $w = a^{2^2}$ aaaa   1) $|y| > 0$

a^4 x y z   2) $|xy| \leq P$

3) xy^iz $i=2$

$a(a^2)aaa$

$a^5 \notin L$

Not regular

2) When it says "but if we consider ..."

xy^2z will have more 0's than 1's

But its wrong 0^*1^* means 000

or 1111

Meaning the number of 0's & 1's don't have to be equal

3) $w \in L$ $w = a^4b^2$ $4 \leq 2^2$

w = aaaa bb

1) v / x contains only one type of alphabet

w = aaabb Pumping v we get

$w' = a$ aaaa b b

$w' = a^7 b^2$ $7 \nleq 2^2$

w' doesn't belong to L $a_1 n \leq)^2$

2) $v \mid x$: contains more than one alphabet

$w =$ aa aab b
u v w

$w' =$ aa aabaab b
u v w

w' do not belong to L

3b) $w \in L$ $w = a^2 b^3 c^4$ $4>2, 4>3$

1) v & x contain one type alphabet

$w =$ a a b b b c c c c
u v u y y

$w' = a^3 b^5 c^4$ $n=3$ $j=5$ $k=4$

w does not belong to L

2) $v \mid x$ contain more than one type

$w =$ a ab b bc ccc
u v w x y

$w' =$ a abab b bcbc ccc

$w' = a^2 bab^3 cbc$

w' does not belong to L as it is not form $a^n b^j c^k$

4) No, suppose $L2 = \{a^n b^n \mid n \geq 0\}$ which is context free lang. & L1 is regular so $L1 = (a+b)^*$ the union of L1 & L2
$= L1 \cup L2 = (a+b)^* \cup \{a^n b^n \mid n \geq 0\} = (a+b)^*$
which is regular, if L1 & L1UL2 are regular then L2 need not to be regular.

5) Let P be pumping length $w = a^{P \cdot 2} b^P$

$|w| > P$ $P 7 2$ $|w| = 2P \cdot 2$

since $n = P-2$ $\downarrow$ $K - P$

1) $|xy| \leq P$

2) $|y| > 0$

3) $i \geq 0 : x(y)^i z \in L$

$x = a^{P \cdot 3}$, $y = a$, $z = b^P$

1) $|xy| = (P-3) + 1 = P \cdot 2 \leq P$

2) $|y| = 1 > 0$

3) $P = 2$, $x(y)^2 z = a^{P-3} aab^v = a^{P-1} b^P$

$a^{P-1} b^P L$

3 is not satisfied

6) $L1 = \{a^n b^n : n \geq 0\}$ which is context free

$L2 = \{a^n b^n$ n is a multiple of 5$\}$ lang.

$S \to AA\ AA\ AA$

$A \to aaaaa$

$B \Rightarrow bbbbb$

Since, context free lang. are closed under complement

and insection with regular langs.

We can use these properties to say

L is context free.

7) $S \to aSS \mid b$

$\{a^n b^{2n} \mid n \geq 1\}$

For evey one a, two b's must generate

IF not regular because we want to count the number we need a's, we need external memory. DFA has no memory.