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"I pledge my honor that I have abided by the Stevens Honor System"

### Problem 7

CFG generating the language: one complement of  $\{a^n b^n \mid n \geq 0\}$  complement of  $\{a^n b^n \mid n \geq 0\}$  may be of two types

- (i) no. of a's and b's are not equal but in the order no. of a's followed by no. of b's
- (ii) not in the form no. of a's followed by no. of b's

CFG generating the language  $L_1 = \{a^p b^q \mid p > q\}$

will be  $as, b/as, a$

$S_1 \rightarrow \text{~~as, b/as, a~~}$  [no. of a's greater than no. of b's]

CFG generating the language  $L_2 = \{a^p b^q \mid p < q\}$

will be

$S_2 \rightarrow aS_2b/S_2b/b$  [no. of a's lesser than no. of b's]

CFG generating strings not in for  $a^p b^q$

$S_3 \rightarrow TbTaT$

$T \rightarrow aT/bT/\epsilon$

Finally, CFG generating the complement of  $\{a^n b^n \mid n \geq 0\}$  will be...

$S \rightarrow S_1/S_2/S_3$

$S_1 \rightarrow as, b/as, a$

$S_2 \rightarrow aS_2b/S_2b/b$

$S_3 \rightarrow TbTaT$

$T \rightarrow aT/bT/\epsilon$