

CS527: HW4 Solutions

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Question 2.6(b) 20 points

Question 2.13(a) 10 points

Question I (5 points each)

In each case below, say what language (a subset of $\{a, b\}^*$) is generated by the context-free grammar with the indicated productions. In all cases, S is the start variable.

1. $S \rightarrow aS \mid bS \mid \epsilon$
2. $S \rightarrow SS \mid bS \mid a$
3. $S \rightarrow SaS \mid b$
4. $S \rightarrow SaS \mid b \mid \epsilon$

Question II (5 points)

In each case below, find a CFG generating the giving language.

1. The set of odd-length strings in $\{a, b\}^*$ with middle symbol a
2. The set of even-length strings in $\{a, b\}^*$ with the two middle symbols equal
3. The set of odd-length strings in $\{a, b\}^*$ whose first, middle, and last symbols are all the same

Question III (20 points)

Show using mathematical induction that every string produced by the context-free grammar with production rules:

$$S \rightarrow a \mid aS \mid bSS \mid SSb \mid SbS$$

has more a 's than b 's.