

Exercises

1. 4 points

Present a finite-state grammar, in graphic form, for each of the following languages. Make the grammars as simple as possible.

- a. That man laughed
That man and that man laughed
That man and that man and that man laughed
etc.
- b. Mary saw an old cat
Mary saw an old old cat
Mary saw an old old old cat
etc.

2. 4 points

- a. Discuss a phenomenon illustrating the infinitude of human languages.
- b. Discuss a phenomenon illustrating that sentences in human languages have structure.

3. 3 points

Given the following context-free PS grammar, give a derivation for each of the following sentences: abc , $aaabc$, $aabbbbbc$

$S \rightarrow ABC$ $A \rightarrow Aa$ $A \rightarrow a$ $B \rightarrow Bb$ $B \rightarrow b$ $C \rightarrow c$

4. 5 points

Given the following PS grammar, provide the information requested in A-C.

$S \rightarrow AB$ $A \rightarrow aA$ $B \rightarrow b$ $A \rightarrow a$

- A. Provide all of the equivalent derivations for the sentence aab .
- B. Give the (set theoretic) phrase marker for the sentence aab .
- C. Give the reduced phrase marker for the sentence aab (that is, the phrase marker consisting of the terminal string and the monostrings).

[Remember, to get from one line of a derivation to the next, exactly one rule applies once. Also, recall that two derivations are equivalent if they differ only in the order of application of rules.]

5. 6 points

Consider the following languages and provide the information requested in A and B.

- a. $a^n bfc^n$ ($abfc$, $aabfcc$, $aaabfccc$, etc.)
where n is greater than 0 ($n > 0$)
- b. $b^n a^{n-1}$ (bba , $bbbaa$, etc.)
 $n > 1$

- A. Write a context-free (Σ, F) grammar for each of these languages. Make the grammars as simple as possible. (**Be very careful to avoid 'overgeneration'.**)
- B. Give derivations for two sentences from each of the languages.