Ling. 610 Fall 2022
Problem Set #1   22 points

Due Mon.. 9/12   1:00PM

1.   **4 points**
        Present a finite-state grammar, in graphic form, for each of the following languages. Try to make the grammar as simple as possible (*by some metric that you articulate*).

        a.   That man laughed
                That man and that man laughed
                That man and that man and that man laughed
                etc.

        b.   The syntax student is happy
                The syntax students are happy
                The syntax student really is happy
                The syntax students really are happy
                The syntax student really really is happy
                The syntax students really really are happy
                etc.

2.   **4 points**
        a. Give an argument, based on evidence you provide, that human languages are infinite.
        b. Give an argument, based on evidence you provide, that sentences in human languages have structure.(In particular, some phenomenon that is not explained without assuming structure, but is explained with structure. The latter is logically crucial.)

3.   **3 points**
        Given the following context-free PS grammar, give a derivation for each of the following sentences:
        abc, aaabc, aabbbbbc
        Σ: S
        F: S → ABC   A → Aa A → a B → Bb B → b C → c

4.   **5 points**
        Given the following PS grammar, provide the information requested in A-C.
        Σ: S
        F: S → AB A → aA B → b A → 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 subset of 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', i.e., generating sentences that are not in the language.)**

        B. Give derivations for 2 sentences from language a., and 2 from language b.