Problem 2. Assume the same grammar and lexicon, but with lexicalized probabilities. The probability of a rule r is conditioned on its head h, so, for example, we will have separate probabilities for the following rules:

$$\text{NP} \rightarrow \text{N}|\text{N} = \text{United}$$
$$\text{NP} \rightarrow \text{N}|\text{N} = \text{Houston}$$

The probability of a head h is conditioned on the head of its parent constituent m, so we also collect probabilities such as $P(\text{head} = \text{United}|\text{parent} = \text{Houston})$. For a non-lexical constituent C, given a rule r of the form $C \rightarrow C_1 \ldots C_n$, where h is the head of C and m is head of the parent constituent of C, we calculate the probability of C as follows.

$$P(C) = P(r|h)P(h|m)\prod_{i=1}^{n} P(C_i)$$

a. (8 points) List all the lexicalized probabilities that are relevant for choosing which of the two structures from Problem 1 is more probable. Do not list any other probabilities.

b. (8 points) Are there lexical dependencies that are relevant for choosing attachment of PPs that are not captured by the lexicalized model? Support your answer with examples.