1. (5 points) What is your favorite color?

2. (5 points) True/False: In developing a grammar, the primary motivation for the inclusion of a potential constituent (i.e., a non-terminal category) in the grammar is the meaning of the phrases covered by that category.

3. (5 points) Given the grammar on the attached sheet, provide a valid parse tree for the following example: Linda flew United to Chicago. Use the back of this page.

4. (5 points) True/False: The previous example is ambiguous given this grammar.

5. (5 points) True/False: Given a sentence $S$, the following equation adequately describes the computation performed by the probabilistic CKY algorithm given in the text.

\[
P(S) = \sum_{T \in \text{Yield}(T)} P(T)
\]

6. Probabilistic parsing with PCFGs can be improved via parent annotation.
   a) (5 points) Illustrate this technique on the tree you gave for question 3 (make a copy of it; don’t annotate the original).
   b) (5 points) Out of all the non-terminal categories in this grammar, which one has the potential to be most improved (helped) by this technique?

7. (15 points) Provide the missing semantic attachments for the relevant rules on the attached sheet such that the following FOL form could be produced as the representation for the given sentence given in question 3.

\[
\exists e \, \text{flying}(e) \land \text{flier}(e,\text{Linda}) \land \text{Carrier}(e,\text{United}) \land \text{Destination}(e,\text{Chicago})
\]

8. (5 points) Consider the problem of named-entity recognition where we’re looking for people, organizations, and locations. Provide an appropriate IOB-style annotation for the “United” example on the following page.
9. (10 points) Consider the problem of extracting relations between given named entities in this example. Describe three types of features that would be useful in classifying the relation between Rahsaan Johnson and the second United token in this example.

10. (10 points) A relation classification system would also have to consider possible relations between Rahsaan Johnson and Chicago. What problem does this pose and what kind of features might be helpful in avoiding it? Be specific.
A United jet lost electrical power forcing an emergency landing at the New Orleans airport, said Rahsaan Johnson, a spokesman for Chicago based United.