# Introductions

First, introduce yourself to your interviewing partner. The “icebreaker” for this interview, is what are your plans for May?

# Question 1: Linked Lists

At lecture, we saw how to develop a BNF grammar for a stack. We are already familiar with singly linked lists over number like the following image:

Can you describe for me how to develop a BNF grammar for linked lists? Provide at least one example of a concrete sentence allowed by your grammar.

We have provided the rest of this blank paper and writing utensils to assist in this exercise.

## Question 1: Logistics:

Give the interviewee the question page for this question. Ask them the question as stated on the question page. As needed, provide hints and assistants. If they cannot arrive at a sufficient answer, then you might consider reviewing the solution with them. You can always prod further to understand their total understanding of the topic.

## Question 1 HINTS:

* What are the required meta-symbols for this BNF grammar?
  + ::=
  + |
* What is the smallest linked list we could create?
* If you understand your smallest list, how could we define an even bigger list? How could we make it nearly infinite in size?

## Question 1 SOLUTIONS:

There are many ways to write a BNF grammar for a linked list. This particular structure suggests that the linked list will always contain at least one element. In it’s easiest form we might write something like LinkedList ::= Leaf( n ) | Node( n, LinkedList ) such that n is in the set of natural numbers. Alternatively, we may choose to assume that the list can be empty and write something like: LinkedList ::= EmptyList | Node( n, LinkedList ). We could also represent this graphically like so:

LinkedList ::= | LinkedList such that n is a natural number

Regardless the interviewee should state their assumptions clearly.

The choice of ‘non-terminal’ name “LinkedList”, ‘terminals’ like “Leaf”, “EmptyList”, or “Node” or ‘meta-variable’ ‘n’ for a number is not too important, but semantic variable names are encouraged.

# Question 2: What is this structure?

Consider the following structure defined with BNF grammars:

Foo ::= Bar

| Baz( Foo, **z**, Foo )

z is a natural number

What popular data structure does this describe?

Can you give one example sentence that is valid in the language defined by the provided grammar involving at least 3 numbers?

We have provided the rest of this blank paper and writing utensils to assist in this exercise.

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## Question 2: HINTS:

* We’ve seen a linked list data structure, what is different between the grammars that we’ve seen so far and this grammar?
* What is the smallest sentence that we can produce in the language defined by this grammar?
  + What is the next smallest sentence that we can produce?
    - And the next smallest one?
      * What pattern arises?
* Is this a sorted data structure?

## Question 2: SOLUTIONS:

This grammar represents a Binary Tree.

Some valid sentences:

* Baz( Bar, 1, Baz( Bar, 5, Baz( Bar, -10, Bar ) ) ) [ a degrative tree]
* Baz( Baz( Bar, 1, Bar ), 5, Baz( Bar, -10, Bar ) ) [ a balanced tree ]
* Baz( Baz( Bar, 1, Baz( Bar, 5, Bar ), -10, Bar ) ) [ an imbalanced tree]
* NOTE: the specific numbers do not matter
* NOTE: there are many other valid options
* NOTE: if they redefine the grammar with better names as suggested below, then they may and should represent the sentence using their provided grammar

The grammar uses poor semantic variable names for the non-terminal and terminals of the grammar. A better representation might be BinaryTree ::= EmptyTree | Node( BinaryTree, n, BinaryTree ). Or graphically as:

BinaryTree ::= X |

BinaryTree BinaryTree

n is a natural number

It is important to note, that the provided definition does not impose any constraints on the data maintaining a relative order, so this is not a Binary Search Tree.

# GRADING:

* Instructions: Now that you have completed the interview, grade each other on your performance as interviewee. Review the following grading criteria. State what you believe your own grade on the interview question should be. State what you perceive your partner’s grade on answering the question should be. Please be respectful when completing this section of the interview process. Please understand that due to the condensed time of this lecture and interview, it would not be reasonable to assume people achieve a high grade on the interview. We are only seeking an honest assessment of the experience. If the grades do not align, discuss the difference in perspectives of the grade in the time permitted for this interview.
* Grading criteria:
  + **Advanced Understanding**: clearly and concisely articulates their understanding of the topic, states their assumptions, and uses strong vocabulary correctly in their explanation without excessive need for follow up questions.
  + **Proficient**: articulates their understanding of the topic with or without some need for follow-up questions from the interviewer. Demonstrates that they understand the topic well enough as pre-requisite knowledge for the next module of the course.
  + **Approaching**: articulates their understanding in a way that demonstrates that they understand some of the underlying information required as pre-requisite knowledge for the next module of the course, but needs to spend some additional time reviewing and learning the topic when possible.
  + **Novice**: Fails to demonstrate any sufficient mastery of the material. The explanations are vague or unclear. They need excessive follow up questions from the interviewer. They need to spend significant time reviewing and learning the topic when possible.

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