INSTRUCTIONS

- You have 10 minutes to complete this quiz.
- The exam is closed book, closed notes, closed computer, closed calculator.
- Mark your answers on the exam itself. We will not grade answers written on scratch paper.
- For multiple choice questions, fill in each option or choice completely.
  - □ means mark all options that apply
  - ○ means mark a single choice

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All the work on this exam is my own. (please sign)

0. Your thoughts? Draw your favorite Halloween costume idea!
1. **Bubba Gump**

Write the output displayed by the interactive Python interpreter when each expression below is evaluated.

```python
class Tree:
    def __init__(self, label, branches=[]):
        self.label = label
        self.branches = list(branches)

    def is_leaf(self):
        return not self.branches

    def __repr__(self):
        if self.is_leaf():
            return 'Tree(' + repr(self.label) + ')
        return 'Tree(' + repr(self.label) + ') + repr(self.branches) + ')

forrest = Tree(1)
gump = Tree(1, [forrest, forrest])
forrest.label = 2
forrest = Tree(forrest)

>>> run = Tree(forrest, gump.branches)
>>> run
Tree(Tree(2)), [Tree(2), Tree(2)])

>>> forrest.label = 1
>>> run
Tree(Tree(1), [Tree(2), Tree(2)])
```

2. **Seeing the Forest for the Trees**

Implement `all_paths` which takes a `Tree` and returns a list of linked list paths from the root to each leaf.

```python
class Link:
    empty = ()
    def __init__(self, first, rest=empty):
        self.first = first
        self.rest = rest

def all_paths(t):
    ***
    if t.is_leaf():
        return [Link(t.label)]

    paths = []
    for b in t.branches:
        paths += [Link(t.label, path) for path in all_paths(b)]
    return paths

def __init__(self, first, rest=empty):
    self.first = first
    self.rest = rest

>>> t = Tree(1, [Tree(2), Tree(3)])
>>> all_paths(t)
[Link(1, Link(2)), Link(1, Link(3))]
```