

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**

Last name	
First name	
Student ID number	
CalCentral email (_@berkeley.edu)	
Discussion Section	_____
<i>All the work on this exam is my own.</i> (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.

```
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(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.

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

    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

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