CS 61A Summer 2017

Final Review

Discussion 14: August 8, 2017

1 Tree Recursion

1.1 Consider a special version of the count_stairways problem, where instead of taking 1 or 2 steps, we are able to take **up to and including** k steps at a time.

Write a function count_k that figures out the number of paths for this scenario.

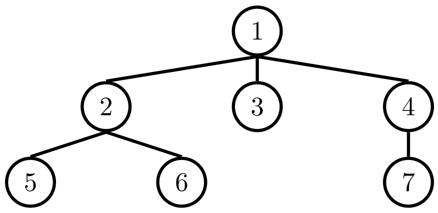
```
def count_k(n, k):
    """
    >>> count_k(3, 3) # 3, 2 + 1, 1 + 2, 1 + 1 + 1
    4
    >>> count_k(4, 4)
    8
    >>> count_k(10, 3)
    274
    >>> count_k(300, 1) # Only one step at a time
    1
    """
```

2 Mutable Linked Lists and Trees

2.1 Write a recursive function `flip_two` that takes as input a linked list `lnk` and mutates `lnk` so that every pair is flipped.

```
def flip_two(lnk):
    """
    >>> one_lnk = Link(1)
    >>> flip_two(one_lnk)
    >>> one_lnk
    Link(1)
    >>> lnk = Link(1, Link(2, Link(3, Link(4, Link(5)))))
    >>> flip_two(lnk)
    >>> lnk
    Link(2, Link(1, Link(4, Link(3, Link(5)))))
    """
```

2.2 Write a function `flatten` that given a Tree `t`, will return a linked list of the elements of `t`, ordered by level. Entries on the same level should be ordered from left to right. For example, the following tree will return the linked list `<1 2 3 4 5 6 7>`.



```
def flatten(t):
```

3 Streams

3.1 (Fall 2014) Implement `cycle` which returns a Stream repeating the digits 1, 3, 0, 2, and 4, forever. *Hint*: `(3+2) % 5 == 0`.

```
def cycle(start=1):
    """Return a stream repeating 1, 3, 0, 2, 4 forever.

    >>> stream_to_list(cycle(), n=12)
    [1, 3, 0, 2, 4, 1, 3, 0, 2, 4, 1, 3]
    """
```

3.2 Write a function `merge` that takes 2 sorted `Streams` `s1` and `s2`, and returns a new sorted `Stream` which contains all the elements from `s1` and `s2`.

4 Generators

4.1 Write a generator function that yields functions that are repeated applications of a one-argument function `f`. The first function yielded should apply `f` 0 times (the identity function), the second function yielded should apply `f` once, etc.

```
def repeated(f):
    """
    >>> [g(1) for _, g in
    ...  zip(range(5), repeated(double))]
    [1, 2, 4, 8, 16]
    """

    g = ________________________________________________________

    while True:

        ________________________________________________________________________

        ________________________________________________________________________
```

4.2 Ben Bitdiddle proposes the following alternate solution. Does it work?

```
def ben_repeated(f):
    g = lambda x: x
    while True:
        yield g
        g = lambda x: f(g(x))
```

4.3 Implement `accumulate`, which takes in an `iterble` and a function `f` and yields each accumulated value from applying `f` to the running total and the next element.

```
from operator import add, mul

def accumulate(iterable, f=add):
    """Return running totals

    >>> list(accumulate([1,2,3,4,5]))
    [1, 3, 6, 10, 15]
    >>> list(accumulate([1,2,3,4,5], mul))
    [1, 2, 6, 24, 120]
    """
    it = iter(iterable)
```