CS 61A
Spring 2021

Final Review
Discussion 14: April 28, 2021

1 Recursion

1.1 (Adapted from Fall 2013) Fill in the blanks in the implementation of `paths`, which takes as input two positive integers `x` and `y`. It returns a list of paths, where each path is a list containing steps to reach `y` from `x` by repeated incrementing or doubling. For instance, we can reach 9 from 3 by incrementing to 4, doubling to 8, then incrementing again to 9, so one path is `[3, 4, 8, 9]`

```
def paths(x, y):
    """Return a list of ways to reach y from x by repeated
    incrementing or doubling.
    >>> paths(3, 5)
    [[3, 4, 5]]
    >>> sorted(paths(3, 6))
    [[3, 4, 5, 6], [3, 6]]
    >>> sorted(paths(3, 9))
    [[3, 4, 5, 6, 7, 8, 9], [3, 4, 8, 9], [3, 6, 7, 8, 9]]
    >>> paths(3, 3) # No calls is a valid path
    [[3]]
    """
    if _____:
        return _____

    elif _____:
        return _____

    else:
        a = _____
        b = _____
        return _____
```

5 Mutable Linked Lists and Trees

5.1 Write a function that takes a sorted linked list of integers and mutates it so that all duplicates are removed.

```
def remove_duplicates(lnk):
    """
    >>> lnk = Link(1, Link(1, Link(1, Link(1, Link(5)))))
    >>> remove_duplicates(lnk)
    >>> lnk
    Link(1, Link(5))
    """
```

```
if lnk is Link.empty or lnk.rest is Link.empty:
    return
else:
    if lnk.first == lnk.rest.first:
        lnk.rest = lnk.rest.rest
        remove_duplicates(lnk)
    else:
        remove_duplicates(lnk.rest)
```

```
while lnk is not Link.empty and lnk.rest is not Link.empty:
    if lnk.first == lnk.rest.first:
        lnk.rest = lnk.rest.rest
    else:
        lnk = lnk.rest
```

7 Scheme

7.1 Write a function that takes a procedure and applies to every element in a given nested list.

The result should be a nested list with the same structure as the input list, but with each element replaced by the result of applying the procedure to that element.

Use the built-in `list?` procedure to detect whether a value is a list.

```
(define (deep-map fn lst)
  (cond
    ((null? lst) lst)
    ((list? (car lst)) (cons (deep-map fn (car lst)) (deep-map fn (cdr lst))))
    (else (cons (fn (car lst)) (deep-map fn (cdr lst))))
  )
)
```

```
scm> (deep-map (lambda (x) (* x x)) '(1 2 3))
(1 4 9)
scm> (deep-map (lambda (x) (* x x)) '(1 ((4) 5) 9))
(1 ((16) 25) 81)
```