Exam Prep Section - CS61A Spring 2018

Worksheet 1: Higher Order Functions, Order of Evaluation, Environment Diagrams

1. You Complete Me (Sp15 Midterm 1 3a)

(a) **(4 pt)** Implement the `longest_increasing_suffix` function, which returns the longest suffix (end) of a positive integer that consists of strictly increasing digits.

```
def longest_increasing_suffix(n):
    """Return the longest increasing suffix of a positive integer n.

    >>> longest_increasing_suffix(63134)
    134
    >>> longest_increasing_suffix(233)
    3
    >>> longest_increasing_suffix(5689)
    5689
    >>> longest_increasing_suffix(568901) # 01 is the suffix, displayed as 1
    1
    """

    m, suffix, k = 10, 0, 1

    while n:

        n, last = n // 10, n % 10


        if last < m:


            m, suffix, k = last, suffix + k * last, 10 * k

        else:

            return suffix

    return suffix
```

2. A Highly Intelligent Animal (Su15 Midterm 1 Q4c)

A number `n` contains a *sandwich* if a digit in `n` is surrounded by two identical digits. For example, the number `242` contains a sandwich because `4` is surrounded by `2` on both sides. `1242` also contains a sandwich, while `12532` does not contain a sandwich.

Implement the `sandwich(n)` function, which takes in a nonnegative integer `n`. It returns `True` if `n` contains a sandwich and `False` otherwise. If `n` has fewer than three digits, it cannot contain a sandwich.

```
def sandwich(n):
    """Returns True if n contains a sandwich and False
       otherwise

    >>> sandwich(416263)    # 626
    True
    >>> sandwich(5050)      # 505 or 050
    True
    >>> sandwich(4441)      # 444
    True
    >>> sandwich(1231)
    False
    >>> sandwich(55)
    False
    >>> sandwich(4456)
    False
    """
    tens, ones = (n // 10) % 10, n % 10

    n = n // 100

    while n > 0:

        if n % 10 == ones:

            return True

        else:

            tens, ones = n % 10, tens

            n = n // 10

    return False
```

3. Digit Fidget (Fa15 Midterm 1 Q3c)

(3 pt) Implement `luhn_sum`. The *Luhn sum* of a non-negative integer n adds the sum of each digit in an *even* position to the sum of doubling each digit in an *odd* position. If doubling an odd digit results in a two-digit number, those two digits are summed to form a single digit. *You may not use recursive calls or call* ***find_digit*** *in your solution.*

```
def luhn_sum(n):
    """Return the Luhn sum of n.

    >>> luhn_sum(135)     # 1 + 6 + 5
    12
    >>> luhn_sum(185)     # 1 + (1+6) + 5
    13
    >>> luhn_sum(138743)  # From lecture: 2 + 3 + (1+6) + 7 + 8 + 3
    30
    """
    def luhn_digit(digit):


        x = digit * multiplier


        return (x // 10) + x % 10


    total, multiplier = 0, 1


    while n:


        n, last = n // 10, n % 10


        total = total + luhn_digit(last)


        multiplier = 3 - multiplier


    return total
```

4. Dog Goes Woof (Fa13 Midterm 1 Q1)

1. (12 points) Dog Goes Woof

For each of the following call expressions, write the value to which it evaluates *and* what would be output by the interactive Python interpreter. The first two rows have been provided as examples.

Assume that you have started Python 3 and executed the following statements:

```
from operator import add, mul
def square(x):
    return mul(x, x)

def dog(bird):
    def cow(tweet, moo):
        woof = bird(tweet)
        print(moo)
        return woof
    return cow

cat = dog(square)
```

Expression	Evaluates to	Interactive Output
`square(5)`	25	25
`1/0`	ERROR	ERROR
`add(square(2), mul(3, 4))`	16	16
`print(print(print(2)))`	None	2 None None
`cat(3, 4)`	9	4 9
`square(cat(5))`	Error	Error
`cat(square(2), print(5))`	16	5 None 16
`cat(print(square(3)), 8)`	Error	9 Error

5. Supernatural (Sp15 Midterm 1 Q2a)

2. (14 points) Supernatural

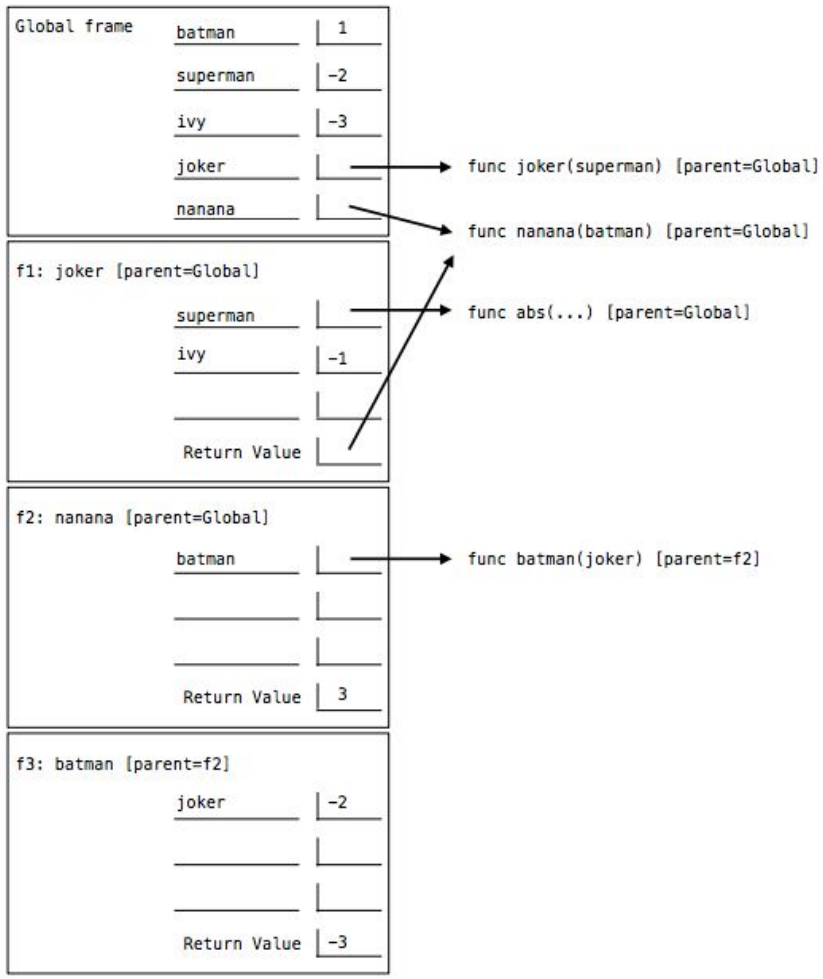
(a) (6 pt) Fill in the environment diagram that results from executing the code below until the entire program is finished, an error occurs, or all frames are filled. *You may not need to use all of the spaces or frames.*

A complete answer will:

- Add all missing names and parent annotations to all local frames.
- Add all missing values created or referenced during execution.
- Show the return value for each local frame.

Remember: Do not add a new frame when calling a built-in function (such as `abs`).

```
1  batman, superman, ivy = 1, -2, -3
2
3  def nanana(batman):
4      while batman(superman) > ivy:
5          def batman(joker):
6              return ivy
7      return -ivy
8
9  def joker(superman):
10     if superman(batman):
11         ivy = -batman
12     return nanana
13
14 joker(abs)(abs)
```



6. Envy, Iron, Mint (Fa14 Midterm 1 Q2a)

2. (14 points) Envy, Iron, Mint

(a) (6 pt) Fill in the environment diagram that results from executing the code below until the entire program is finished, an error occurs, or all frames are filled. *You may not need to use all of the spaces or frames.*

A complete answer will:

- Add all missing names, labels, and parent annotations to all local frames.
- Add all missing values created during execution.
- Show the return value for each local frame.

```
1  def peace(today):
2      harmony = love+2
3      return harmony + today(love+1)
4
5  def joy(peace):
6      peace, love = peace+2, peace+1
7      return love // harmony
8
9  love, harmony = 3, 2
10 peace(joy)
```