CS106A Midterm + Solutions

Instructions

- There are 6 problems to complete
- This is a closed note, closed computer exam
- The exam is 60 minutes and 100 points, graded on a curve
- We will not grade off for syntax errors, so long as we see the correct idea
- Good luck!

```
# CS106A Exam Reference Reminder
# [square brackets] denote functions listed here that we
have not used yet
# Exam questions will not depend on functions we have not
used yet
Bit:
  bit = Bit(filename)
  bit.front_clear() bit.left_clear() bit.right_clear()
  bit.move() bit.left() bit.right()
  bit.paint('red') [bit.erase()]

General functions:
  len() int() str() range() [list() sorted()]
String functions:
  isalpha() isdigit() isspace() isupper() islower()
  find() upper() lower() [strip()]
List functions:
  append() index() [extend() pop()  insert()]

SimpleImage:
  # read filename
  image = SimpleImage(filename)
  # create blank image
  image = SimpleImage.blank(width, height)

  # foreach loop
  for pixel in image:

  # range/y/x loop
  for y in range(image.height):
      for x in range(image.width):
          pixel = image.get_pixel(x, y)

Grid 2D:
  grid = Grid.build([['row', '0'], ['row', '1']])
  grid.width, grid.height - properties
  grid.in_bounds(x, y) - True if in bounds
  grid.get(x, y) - returns contents at that x,y, or None
if empty
  grid.set(x, y, value) - sets new value into grid at x,y


Read lines out of a text fie:
  with open(filename) as f:
      for line in f:
```

1. Short Answer (5 points)

Warmup Trace Problem

a. Write what value comes from the Python expression below.

```
>>> s = 'SpiderMan'
>>> s[3:]
??
```

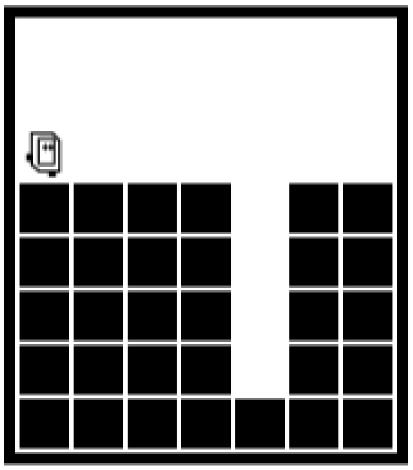
What 3 numbers print when the caller() function runs? This code runs without error.

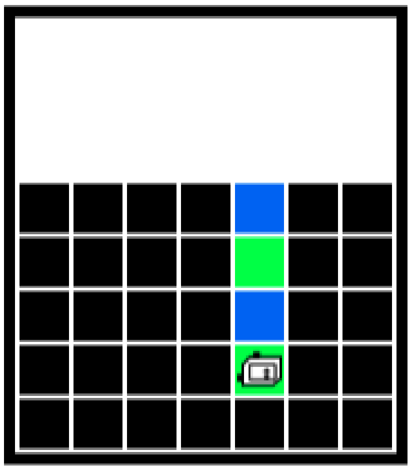
```
def foo(x, y)
    a = x + y
    return a


def caller():
    a = 1
    b = 5
    c = foo(b, a)
    print(a, b, c)

# Write 3 numbers here
```

2. Bit (10 points)

Bit is on the ground, facing the right side of the world. Move bit forward until a hole appears below. Move bit down the hole until blocked. Paint the topmost square inside the hole blue, the square below that green, the square below that blue, and so on. Leave bit at the bottom of the hole facing down.

Bit before and after:

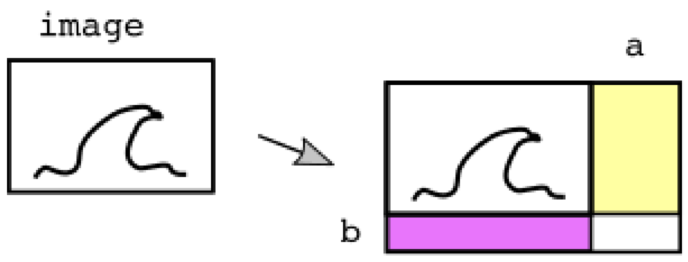




```
def cave_color(filename):
    bit = Bit(filename)
```

3. Image (20 points)

Given an image filename and ints **a** and **b** which are 1 or more. Create a new out image with a copy of the original image at the top left and with a vertical yellow stripe a-pixels-wide running down the right right side of the image. Also add a horizontal purple stripe b-pixels-high running along the bottom of the image. The yellow and purple stripes should not extend past the height and width of the image, respectively. The code for the copy of the image is provided - you write the code to create the output image and fill the two stripes. You may use a pair of loops for each stripe. The starter code includes an a-b-c outline, but any solution which gets the right output is fine. Reminder: create yellow by setting blue to 0 and purple by setting green to 0.



```
def two_stripes(filename, a, b):
    image = SimpleImage(filename)
    # a. Create out image
    out = SimpleImage.blank(   ??????   )

    # Write copy of original image (provided)
    for y in range(image.height):
        for x in range(image.width):
            pixel = image.get_pixel(x, y)
            pixel_out = out.get_pixel(x, y)
            pixel_out.red = pixel.red
            pixel_out.green = pixel.green
            pixel_out.blue = pixel.blue

    # b. yellow stripe a pixels wide
    pass

    # c. purple stripe b pixels high
    pass

    return out
```

4. String-List (20 points)

Write code for the two functions:

`digit_list(s)`: Given string s. Return a list of the int values of the digit chars in s, so `'ab31xx41'` returns `[3, 1, 4, 1]`

`atly(s)`: The string s will contain either zero or two or more `'@'` chars. If there are two or more `'@'`, return a string made of the chars after the second `'@'` followed by the chars before the first `'@'`. So `'aa@bbb@cccc'` returns `'ccccaa'`. If there are no `'@'` return `None`. Use str.find().

```
  'aa@bbb@cccc' -> 'ccccaa'
  'abc@donut@hello' -> 'helloabc'
  'abcxyz' -> None

def digit_list(s):
    pass



def atly(s):
    pass
```

5. Grid (23 points)

We have a Grid representing Yellowstone national park, and every square is either a bear `'b'`, rock `'r'`, or empty `None`.

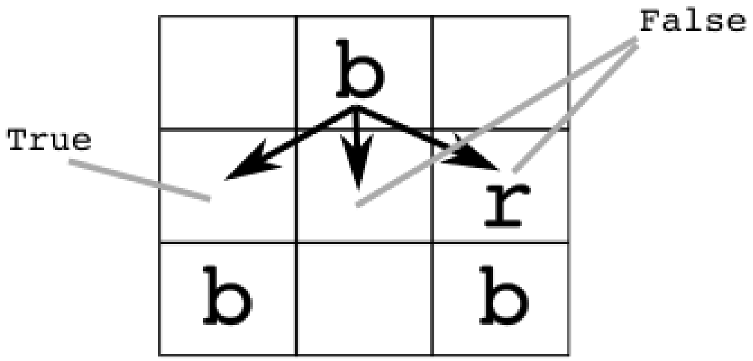
There are several different moves that can happen in this game, and for this problem you are writing the boolean function `bear_pile_ok(grid, x_to, y_to)` to check if a particular bear-pile move is ok. Here are the rules for a bear-pile move. Assume there is a bear at an in-bounds "from" square, and the function checks the "to" square with these rules:

1. The "to" square must be in-bounds

2. The to square must be empty

3. The square immediately below the to square must contain a bear.

If all three of those conditions are met, the bear-pile move is ok. The function is passed a prospective `x_to, y_to` to check - return `True` if the move is ok and `False` otherwise. Do not change the grid. Assume that that there is a bear at the "from" square. The "from" numbers are not needed for this computation, so they are not provided. The "to" square will always be one of 3 possible moves, as shown by the three arrows in the example below: down-left, straight-down, down-right.



In the example above, the down-left move is ok. The straight-down move is not ok, because there is no bear below. The down-right move is not ok because there is a rock in the way.

```
def bear_pile_ok(grid, x_to, y_to):
    pass
```

6. Upper/Lower Encryption (22 points)

Suppose we have an encryption function similar to the homework but with two slug lists - one for lowercase inputs and one for uppercase inputs.

```
def encrypt(source, slug_lower, slug_upper, ch):
```

The `source` parameter is a list of chars that can be encrypted, all in lowercase form. The `slug_lower` and `slug_upper` lists hold encrypted chars, the same length as the source list, like this:

```
    source = ['a', 'b', 'c', 'd']
slug_lower = ['t', 'Q', 'p', 'Z']
slug_upper = ['r', 'i', 'Y', 'M']
```

To encrypt the parameter `ch`, if its lowercase form is found in the source list, its encrypted form is at the same index in one of the two slug lists. If the original char is lowercase, its encrypted form is in `slug_lower`. Otherwise, its encrypted form is in `slug_upper`. If the char is not found in the source list, e.g. `'$'`, then it is returned unchanged.

```
# Examples using above source/slugs
Encrypt of 'a' is 't'
Encrypt of 'A' is 'r'
Encrypt of 'b' is 'Q'
Encrypt of 'B' is 'i'
Encrypt of '$' is '$'
```

On the homework project, lowercase chars were always encrypted as lowercase, and uppercase chars encrypted as uppercase. On this problem, the encrypted chars are a mixture of lowercase and uppercase. Each input char that has a match in the source list will be either lowercase or uppercase, e.g. `'a'` or `'A'`.

```
def encrypt(source, slug_lower, slug_upper, ch):
    pass
```

Solutions

```
#
# 1. Short Answer

derMan

print: 1 5 6


#
# 2. Bit

def cave_color(filename):
    bit = Bit(filename)
    # Find the hole to our right
    while not bit.right_clear():
        bit.move()
    # Move down the hole
    bit.right()
    while bit.front_clear():
        bit.move()
        bit.paint('blue')
        if bit.front_clear():
            bit.move()
            bit.paint('green')

#
# 3. Image

def two_stripes(filename, a, b):
    image = SimpleImage(filename)
    # a. Create out image
    out = SimpleImage.blank(image.width + a, image.height
+ b)

    # Write copy of original image (provided)
    for y in range(image.height):
        for x in range(image.width):
            pixel = image.get_pixel(x, y)
            pixel_out = out.get_pixel(x, y)
            pixel_out.red = pixel.red
            pixel_out.green = pixel.green
            pixel_out.blue = pixel.blue

    # b. yellow stripe a pixels wide
    for y in range(image.height):
        for x in range(a):
            pixel_out = out.get_pixel(image.width + x, y)
            pixel_out.blue = 0

    # c. purple stripe b pixels high
    for x in range(image.width):
        for y in range(b):
            pixel_out = out.get_pixel(x, image.height + y)
            pixel_out.green = 0

    return out



#
# 4. String-List

def digit_list(s):
    result = []
    for ch in s:
        if ch.isdigit():
            result.append(int(ch))
    return result



def atly(s):
    at1 = s.find('@')
    if at1 == -1:
        return None
    at2 = s.find('@', at1 + 1)  # need the +1!
    return s[at2 + 1:] + s[:at1]


#
# 5. Grid

def bear_pile_ok(grid, x_from, y_from, x_to, y_to):
    # bear from - given as assumption
    # if grid.get(x_from, y_from) != 'b':
    #    return False

    if not grid.in_bounds(x_to, y_to):   # in bounds
        return False

    if grid.get(x_to, y_to) != None:    # empty
        return False

    if grid.in_bounds(x_to, y_to + 1) and grid.get(x_to,
y_to + 1) == None:
        return True   # the one true in this approach

    # need to check y + 1 OOB before looking

    return False

    # Alternately...
    # if not grid.in_bounds(x_to, y_to + 1) or
grid.get(x_to, y_to + 1) != 'b': return False
    # return True last


#
# 6. Encryption
```

```
def encrypt(source, slug_lower, slug_upper, ch):
    low = ch.lower()
    if low in source:
        idx = source.index(low)
        if ch.islower():
            return slug_lower[idx]
        return slug_upper[idx]
        # could use "else" or "isupper",
        # but works fine just like this
    return ch
```