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CS 1110 Regular Prelim 1 March 2020

This 90-minute exam has 6 questions worth a total of roughly 107 points (some point-total adjustment may occur during grading).
You may separate the pages while working on the exam; we have a stapler available.

It is a violation of the Academic Integrity Code to look at any exam other than your own, to look at any other reference material, or to otherwise give or receive unauthorized help.
We also ask that you not discuss this exam with students who are scheduled to take a later makeup.
Academic Integrity is expected of all students of Cornell University at all times, whether in the presence or absence of members of the faculty. Understanding this, I declare I shall not give, use or receive unauthorized aid in this examination.

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1. **Short Answer.** Write ERROR as shorthand for any error output.

(a) [4 points] What is printed out when the code below is executed?

```
alist = [20, 20]
count = 1
for a in alist:
    print(a)
    count = count * 2
print(count)
```

(b) [4 points] What is printed out when the code below is executed?

```
x = 1
y = 0
a = x >= 2 and (x/y) > 2
print("a is: " + str(a))
x = 16
b = x >= 2 and (x/y) > 2
print("b is:" + str(b))
```

(c) [4 points] What is printed out when the code below is executed?

```
def some_fun():
    print(i+6)
def more_fun(i):
    print(i-1)
i = 14
j = 10
some_fun()
more_fun(j)
```

(d) [4 points] Let `z` be a string containing at least one exclamation point. Write code that stores in variable `answer` the part of `z` that starts *just after* the first exclamation point in `z`.

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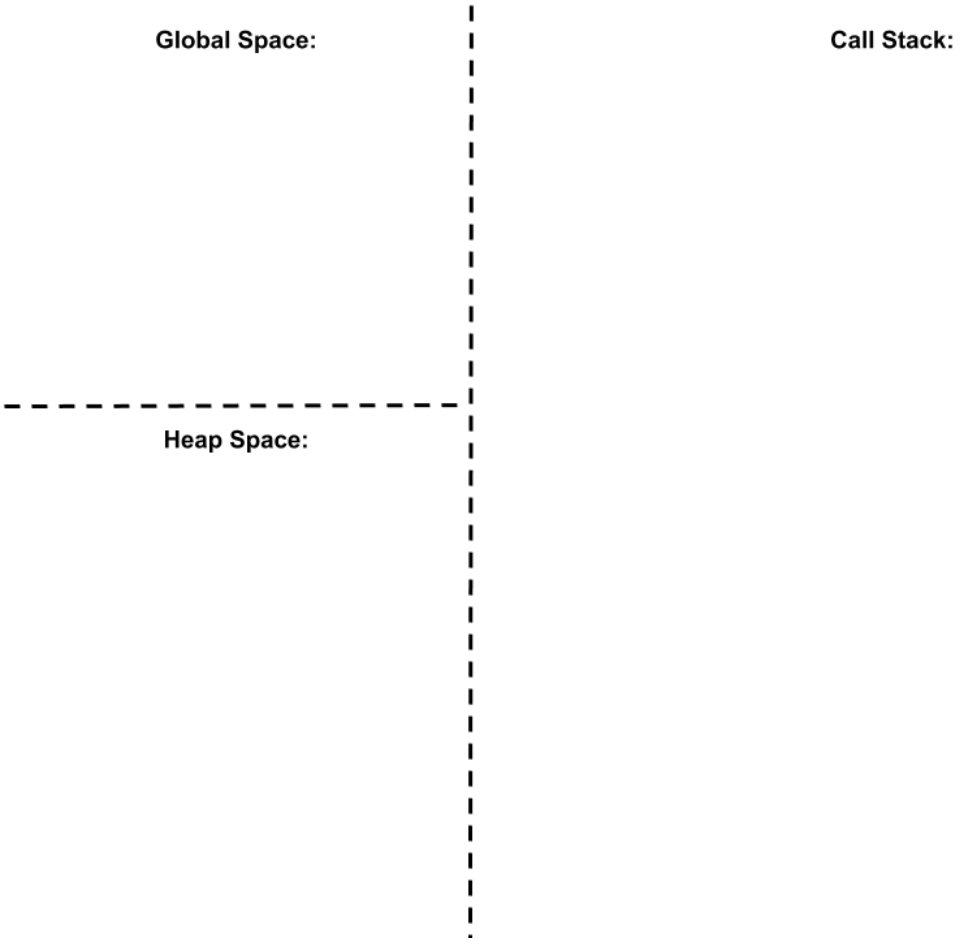
2. [26 points] `Circle` objects have three attributes: `x` [an `int`]: the x-coordinate of its center; `y` [an `int`]: the y-coordinate of its center; `color` [a non-empty `str`]: its color.

   A constructor expression like `Circle(5, 4, "blue")` creates a new `Circle` object with `x` attribute having value `5`, `y` attribute having value `4`, and `color` attribute having value `"blue"`.

```
1  def move_helper(a,b):
2      value = a+b
3      if value < 0:
4          return 0
5      return value
6
7  def moveCircle(circle, move, coordinate):
8      if coordinate == 'x':
9          x_move = move_helper(circle.x, move)
10         circle.x = x_move
11     else: # if executed, include line no. in frame
12         y_move = move_helper(circle.y, move)
13         circle.y = y_move
14
15 c = Circle(5,7,"red")
16 moveCircle(c,-6,'x')
17 moveCircle(c,2,'y')
18 a = c.color
```

Diagram the execution of lines 1-18 in the areas below.



3. **String Slicing**

(a) [8 points] A parenthetical phone number has parentheses around the first three digits (the area code), three more numbers, a hyphen, and then the last four numbers. So '(123)456-7890' is a valid parenthetical phone number.

Here is the specification for a function that judges whether a string is a valid parenthetical phone number.

```
def paren_phone_num(s):
    """Returns True if s is a valid parenthetical phone-number string,
    False otherwise.
    Precondition: s is a string.

    Example inputs and outputs:
    '(123)456-7890'     --> True
    '(123) 456-7890'    --> False
    '(123)456-7890-1'   --> False
    """
```

The above docstring gives some test cases, as inputs and expected outputs (omitting rationales). Write **four more distinct test cases**, as input and expected outputs (no need for `assert_equals` statements), plus rationale. Each test case needs to be conceptually distinct, for example, testing a different condition for a `False` rather than `True` return value.

(b) [16 points] Now, implement the function.

You may not use for-loops in this function, only string operations and methods. You should *instead* use the string method `isdigit()`: for a string `x`, `x.isdigit()` returns `True` if all the characters in `x` are digits, `False` otherwise.

```
def paren_phone_num(s):
    """Returns True if s is a valid parenthetical phone-number string,
    False otherwise.
    Precondition: s is a string.

    Example inputs and outputs:
    '(123)456-7890'     --> True
    '(123) 456-7890'    --> False
    '(123)456-7890-1'   --> False
    """
    # Helpful position-numbering guide:
    # 0 1 2 3 4 5 6 7 8 9 10 11 12  <- possible indices
    # ( x x x ) x x x - x x  x  x   <- sample input template
```

4. **Objects and Functions**

Consider a `Person` class with the attributes

- `name`: a string representing the name of this person
- `friends`: a (possibly empty) list of Person objects representing this person's friends

(a) [10 points] Implement the following function according to the specifications. Your implementation **must make effective use of `range()` in a for-loop.**

Hint: Recall the Python keyword `in`, which returns `True` if a value is in a sequence, and `False` otherwise. For example, `2 in [2, 3, 4]` evaluates to `True`, but `5 in [2, 3, 4]` evaluates to `False`.

```
def common(f1, f2):
    """Returns: a string list containing the names of the people that are in
    both Person list f1 and Person list f2.

    Example: Let p1, p2, ..., p6 be Person objects.  If f1 is the list
    [p2, p3, p5] and f2 is the list [p3, p4, p6, p5], then common(f1, f2)
    returns a list containing the names of p3 and p5 (not p3 and p5 themselves).

    Precondition: f1 and f2 are each a nonempty list of Person objects.
    """
```

(b) [5 points] Implement function `mutual_friends` according to the specifications below. Your implementation must use function `common` from part (a) in a meaningful way. Assume `common` has been correctly implemented. Pay attention to the specifications of both `mutual_friends` and `common`.

```
def mutual_friends(p1, p2):
    """Returns: a string list containing the names of the mutual friends of
    Persons p1 and p2.  If p1 and p2 have no mutual friends, return an empty
    list.

    Precondition: p1 and p2 are each a Person object.
    """
```

(c) [9 points] Implement the following function according to the specifications below. Your implementation **must use a "for-each" loop meaningfully, i.e., you cannot use `range()` in your loop**.

```
def nickname_friends(p):
    """Returns: the number of names modified.  This function modifies
    Person p's friends list such that the names longer than 5 characters will
    will be truncated to the first 5 characters and a "u" is appended.  Names 5
    characters in length or shorter remain unchanged.

    Example: If p has 3 friends named "Jonathan", "Benji", and "Tristan", then
    their names will become "Jonatu", "Benji" (unchanged), and "Tristu",
    respectively, and the function returns 2.

    Precondition: p is a Person object with a nonempty friends list.
    """
```

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5. **Testing and Debugging** The function `can_get_along` uses the birth years of two people to determine if they are compatible according to the logic of the Chinese zodiac. There are multiple bugs in the code below, potentially spread out across multiple functions. Read the specifications of each function carefully. On the next page, you will be asked to identify and fix the existing bugs.

```
1  def can_get_along(year1, name1, year2, name2):
2      """Prints out compatibility.
3      Years are ints, which convert to signs.
4      """
5      a1 = chinese_zodiac(year1)
6      print(name1 + " is " + \
7          proper_grammar(a1[0]) + a1 + '.')
8      a2 = chinese_zodiac(year2)
9      print(name2 + " is " + \
10         proper_grammar(a2[0]) + a2 + '.')
11     if compatible(a1,a2):
12         print('They are a good match!')
13     print('They are not a good match.')
14
15 def chinese_zodiac(year):
16     """Returns: sign (as str) of year (int)
17     """
18
19     zodiac = ['Rat', 'Ox', 'Tiger',
20               'Rabbit', 'Dragon', 'Snake',
21               'Horse', 'Sheep', 'Monkey',
22               'Chicken', 'Dog', 'Pig']
23
24     y = year - 4.0
25     en = zodiac[y % len(zodiac)]
26     return en
27
28 def compatible(z1,z2):
29     """Returns: True if z1 and z2 compatible,
30     False otherwise.
31     'Rat', 'Dragon', and 'Monkey' are compatible;
32     as are 'Ox', 'Snake', 'Rooster';
33     as are 'Tiger', 'Horse', 'Dog';
34     as are 'Rabbit', 'Goat', 'Pig'.
35     """
36     match = [['Rat', 'Dragon', 'Monkey'],
37     ['Ox', 'Snake', 'Rooster'],
38     ['Tiger','Horse','Dog'],
39     ['Rabbit', 'Goat','Pig']]
40
41     for i in range(len(match)):
42         if z1 in match[i] or z2 in match[i]:
43             return True
44     return False
45
```

```
46 def proper_grammar(first_letter):
47     """Returns: 'a ' or 'an ', depending on
48     first_letter, a string consisting of a
49     single capital letter.
50     """
51     if is_vowel(first_letter):
52         return "an "
53     return "a "
54
55 def is_vowel(x):
56     """Returns: True if 'x' is a vowel,
57     False otherwise.
58
59     Preconditions:
60         `x` [str]: a string with length 1.
61     """
62     vowels = 'AEIOU'
63     if vowels.find(x) < len(vowels):
64         return True
65     return False
```

(a) [4 points] **First Bug**: Consider the following call to `can_get_along` and the Python error it triggers.

```
>>> can_get_along(1996,'Suzie', 1997,'Ahmad')
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
  File "zodiac_friends.py", line 5, in can_get_along
    a1 = chinese_zodiac(year1)
  File "zodiac_friends.py", line 25, in chinese_zodiac
    en = zodiac[y % len(zodiac)]
TypeError: list indices must be integers or slices, not float
```

Below, explain where (line number) and why this error is triggered. And, fix the problem by writing below how the code should be rewritten.

(b) [4 points] **Second Bug**: After the first bug (above) is fixed, the call

```
>>> can_get_along(1996,'Suzie', 1997,'Ahmad')
```

should print out the following lines:

```
Suzie is a Rat.
Ahmad is an Ox.
[some other output]
```

Instead, it does the following.

```
>>> can_get_along(1996,'Suzie', 1997,'Ahmad')
Suzie is an Rat.
Ahmad is an Ox.
[some other output]
```

Below, explain where (line number) and why this error is triggered. And, fix the problem by writing below how the code should be rewritten.

(c) [8 points] **Third and Fourth Bugs**: Consider the following call to `can_get_along`

```
>>> can_get_along(1989,'Ji-woo', 1995,'Liam')
Ji-woo is a Snake.
Liam is a Pig.
They are a good match!
They are not a good match.
```

We guarantee that Ji-woo and Liam are years of the Snake and the Pig, respectively. Below, explain where (line numbers) and why the two problems are triggered. And, fix the problems by writing below how the code should be rewritten.

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6. [1 point] **Fill in your last name, first name, and Cornell NetID at the top of each page.**