Instructions:

- Please write clearly. What I cannot read, I will not grade.
- Show all your work in detail. I give partial credit.
- This exam has 8 pages including the title page. Please check to make sure all pages are included.
- This exam is closed book, closed notes, no calculators.
- Don’t get bogged down on any one question. You will have 50 minutes to complete this exam.

I commit to uphold the ideals of honor and integrity by refusing to betray the trust bestowed upon me as a member of the Georgia Tech community.

Signature: ________________________________

<table>
<thead>
<tr>
<th>Question</th>
<th>Points</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Vocabulary</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>2. Fill in the Blanks</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>3. Python Expressions</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>4. Robot Drawing</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>5. Find the Error</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>6. Leaky Pipes</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>7. countUpBy</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>8. Average a List</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>9. Save Light Values</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Bonus Questions</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>91</strong></td>
<td></td>
</tr>
</tbody>
</table>
Vocabulary Questions

1. For each of the following vocabulary terms, write a concise 1-2 sentence definition. Be brief, and to the point.

   (a) (3 points) block
   - A block is a section of code that contains a set of instructions that are executed sequentially.

   (b) (3 points) dictionary
   - A dictionary is a collection of key-value pairs used to store data in a way that allows for quick lookup.

   (c) (3 points) flow of execution
   - The flow of execution refers to the sequence of operations that are performed to execute a program.

   (d) (3 points) function
   - A function is a block of code that performs a specific task and can be called by other parts of the program.

   (e) (3 points) recursion
   - Recursion is a method where a function calls itself repeatedly until a base case is reached.

   (f) (3 points) slice
   - A slice is a way of accessing a portion of a sequence, such as a list or a string.

   (g) (3 points) traverse
   - Traverse refers to the process of moving through the elements of a data structure in a systematic way.

2. (4 points) Fill in the blanks:
   Python has several compound data types that we have learned about. A ___________ can be used to store a sequence of characters, while a ___________ can store a sequence of any type of data (but is immutable). A ___________ can also store any type of data, and allows you to change elements within it. A ___________ associates keys to values.
Code Understanding Questions

3. Python Expressions - For this question, assume the following statements have already been entered and interpreted:

   a = [ 10, 32, 42, True, ["Ivy", "Oak", "Fern"], 3.14159, [ 10, 11, 12], 4]
   b = a
   c = a[0:4]
   d = a[4]
   d[2] = "Palm"

Act like the python interpreter and evaluate the following expressions, writing the value they evaluate to:

   (a) (2 points)  a[0]

   (b) (2 points)  3+2

   (c) (2 points)  len(a)

   (d) (2 points)  a[6][10]

   (e) (2 points)  d

   (f) (2 points)  c

   (g) (2 points)  a[4][2]

   (h) (2 points)  b[:2]

   (i) (2 points)  b[-2]

   (j) (2 points)  c[-2]

   (k) (2 points)  a[4] + [1,3,5]
4. (9 points) Robot Drawing - Assume `turn90degrees()` has been defined as below so the robot turns right 90° and `nudge(x)` has been defined to move the robot forward x units.

```python
def turn90degrees():
    turnRight(1, 1)

def nudge(x):
    forward(1, x)
```

The following code makes the robot drive the trajectory drawn in the box to the right.

```python
nudge(1)
turn90degrees()
nudge(1)
nudge(2)
```

Draw the robot’s trajectory when the following code is executed. Label the length of each move (nudge) using numbers as in the example above.

```python
def turn90degrees():
    turnRight(1, 1)

def nudge(x):
    forward(1, x)

turns = [2, 6]
for idx in [2, 2, 6, 2, 1]:
    if idx in turns:
        turn90degrees()
nudge(idx + 1)
```
5. (3 points) Find the Error: The following code contains a statement that will cause a runtime error. Circle the line and explain what’s wrong.

```python
e = "2.718"
pi = 3.14
pie = str(pi) + e
print int(e)
print int(pi)
print pie
```

6. (6 points) Leaky Pipes - What is printed by the following function if it is called with an input of 12?

```python
>>> leakyPipes( 12 )
def leakyPipes(n):
    if (n > 0):
        if (n % 4 == 0):
            print "drip %d" % n
            leakyPipes(n-3)
        if (n % 3 == 0):
            print "drop %d" % n
```
Code Writing Questions

7. (8 points) Write a function called `countUpBy` that accepts a single integer parameter and uses a while loop to print out a count from that number up to twenty (inclusive) by that number. You may assume that your input will be between one and 20 (inclusive).

```python
>>> countUpBy(5)
5
10
15
20

>>> countUpBy(7)
7
14
```

Examples:
8. (8 points) Average a List - Write a function called **average** that accepts a list of numbers (they may be ints or floats). It should **return** the average (mean) value of all the numbers in the list. If the list is empty, it must return **None**.

For example:

```python
>>> result = average( [10, 5, 5] )
>>> print result
6.666666666666667
```
9. (10 points) Write a function named `saveLightValues` that accepts the name of a file to open as a string parameter. The function should open the file for writing, and save ten light values from calling the `getLight("center")` function, one per line. Between calls to the `getLight()` function to get light samples, the robot should turn left a small amount (you choose the speed and duration).

10. (2 points (bonus)) Bonus Questions:
   
   (a) What did you name your robot?

   (b) What has been the most difficult topic or concept in this class for you to understand (what should we spend more time on)?