Name:_____   **Partner:**   _____
Python Activity 21: Scope
Variables have limited visibility inside and outside of functions.

Learning Objectives
Students will be able to:
Content:
- Define **scope** in python.
- Identify the scope of **local** and **global** variables.
- Predict how scope will impact variable assignment.
*Process:*
- Write code that properly assigns values to local and global variables.
Prior Knowledge
- Python concepts: assignment, functions, expressions

Concept Model:
Observe the following diagram, depicting two dorms and an academic building. In the dorms, "Mark Hopkins" is thought to refer to Mark Hopkins '1824, President of Williams College 1836-1872. The third building, TCL, is full of Computer Science students who think "Mark Hopkins" refers to Professor Mark Hopkins who started working at Williams Computer Science in 2022:
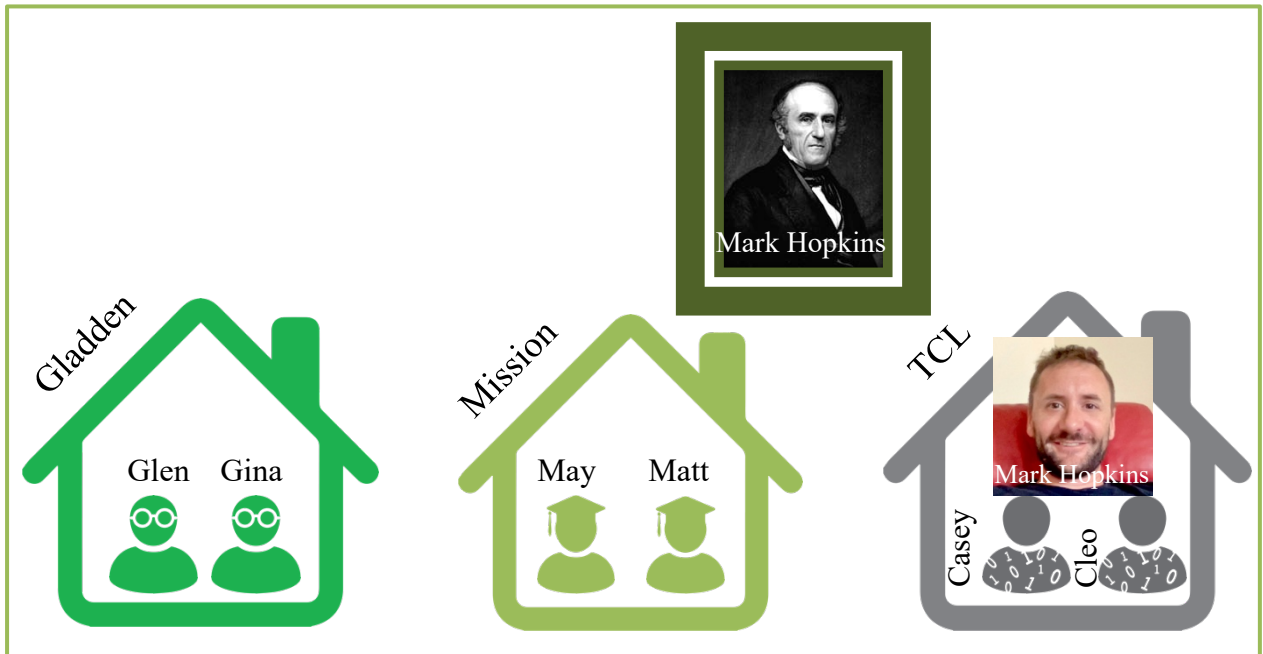
CM1. You overhear a conversation between 2 students, Glen and Cleo. Ann says, "Mark Hopkins was born in 1802." Cleo replies, "Mark Hopkins is a time traveler then!" Briefly explain why Cleo thinks this:

_____

_____

Examine the following python snippet that emulates the diagram above:

Code Example

```python
mar_hop = 111119 # Mark Hopkins '1824 student ID number

def gladden():
    glen = 223456 # Glen's student ID number
    gina = 287654 # Gina's student ID number
    print(glen, gina, mar_hop)

def mission():
    may = 277777 # May's student ID number
    matt = 288888 # Matt's student ID number
    print(may, matt, mar_hop)

def tcl():
    mar_hop = 998877 # Mark Hopkins '2022 student ID number
    casey = 212233 # Casey's student ID number
    cleo = 233444 # Cleo's student ID number
    print(casey, cleo, mar_hop)
```

CM2. If we were to call the function affiliated with Glen's dorm, `gladden()`, what do you expect would be printed?

_____

If we were to call the function affiliated with Cleo's building, `tcl()`, what do you expect would be printed?

_____

How might the printed values for the variable `mar_hop` differ (do they?)? Why/not?

_____

_____

CM3. If we were to add the print statement `print(glen)` to the bottom of the `mission()` and `tcl()` functions, what do you predict will happen when we call these two functions?

_____

_____

> **FYI:** The mapping of variable/function/object names to objects is limited in **scope**. Functions and classes all generate independent **frames** where these mappings are stored. This creates objects that can be seen in one frame, but not another.

Critical Thinking Questions:

1. Examine the following code below:

<table>
<tr><td colspan="2" align="center">Code Example</td></tr>
<tr><td>

```
# Question 1a
0 def triple(num):
1     multiplier = 3
2     return multiplier * num
3 answer = triple(5)
4 print(answer)
```

</td><td>

```
# Question 1b
0 multiplier = 3
1 def triple(num):
2     return multiplier * num
3 answer = triple(5)
4 print(answer)
```

</td></tr>
</table>

   a.   Where does the assignment for the `multiplier` variable appear in the above code for Question 1a?

   (i) **before** the function header   (iii) **after** function body, <u>before</u> function call

   (ii) **in** the function body   (iv) **after** function body, <u>after</u> function call

   What might the above code for Question 1a print to terminal?   _____

   b.   Where does the assignment for the `multiplier` variable appear in the above code for Question 1b?

   (i) **before** the function header   (iii) **after** function body, <u>before</u> function call

   (ii) **in** the function body   (iv) **after** function body, <u>after</u> function call

   What might the above code for Question 1b print to terminal?   _____

<table>
<tr><td colspan="2" align="center">Code Example</td></tr>
<tr><td>

```
# Question 1c
0 def triple(num):
1     return multiplier * num
2 multiplier = 3
3 answer = triple(5)
4 print(answer)
```

</td><td>

```
# Question 1d
0 def triple(num):
1     return multiplier * num
2 answer = triple(5)
3 multiplier = 3
4 print(answer)
```

</td></tr>
</table>

   c.   Where does the assignment for the `multiplier` variable appear in the above code for Question 1c?

   (i) **before** the function header   (iii) **after** function body, <u>before</u> function call

   (ii) **in** the function body   (iv) **after** function body, <u>after</u> function call

   What might the above code for Question 1c print to terminal?   _____

   d.   Where does the assignment for the `multiplier` variable appear in the above code for Question 1d?

   (i) **before** the function header   (iii) **after** function body, <u>before</u> function call

   (ii) **in** the function body   (iv) **after** function body, <u>after</u> function call

   What might the above code for Question 1d print to terminal?   _____

e. **Only one** of the above code examples results in a "`NameError: name 'multiplier' is not defined`" error. Which example *might* that be, and why?

_____

_____