CL09: Variables & `while` loops

Announcements

Re: Assignments:

- **LS08: Variables** due tonight at 11:59pm
  - If you'd like, read this optional reading about variables!
- **LS09: while Loops** due tonight at 11:59pm
  - If you'd like, read this optional reading about while loops!
- **EX02: Wordle** – due Monday, September 22 at 11:59pm

Reminders:

- No class, office hours, or tutoring on Monday; we hope you enjoy your Wellbeing Day!
- **Quiz 01 on Friday, Sep 19**
  - **Hybrid review session at 6pm on Wednesday, Sep 17** in Sitterson Hall, room 014 and online
  - If you take your quizzes with ARS, please ensure you've scheduled it!
  - If you will have a university-approved absence for this day, tell me ASAP so we can arrange a time for you to make it up!

Warm-Up: Discuss these questions with a neighbor, then diagram how you believe this works:

```
1    def f(x: int) -> int:
2        y: int
3        y = x * 2
4        return y
5
6
7    print(f(3))
```

Questions to discuss with a neighbor:

What does line 2 remind you of?

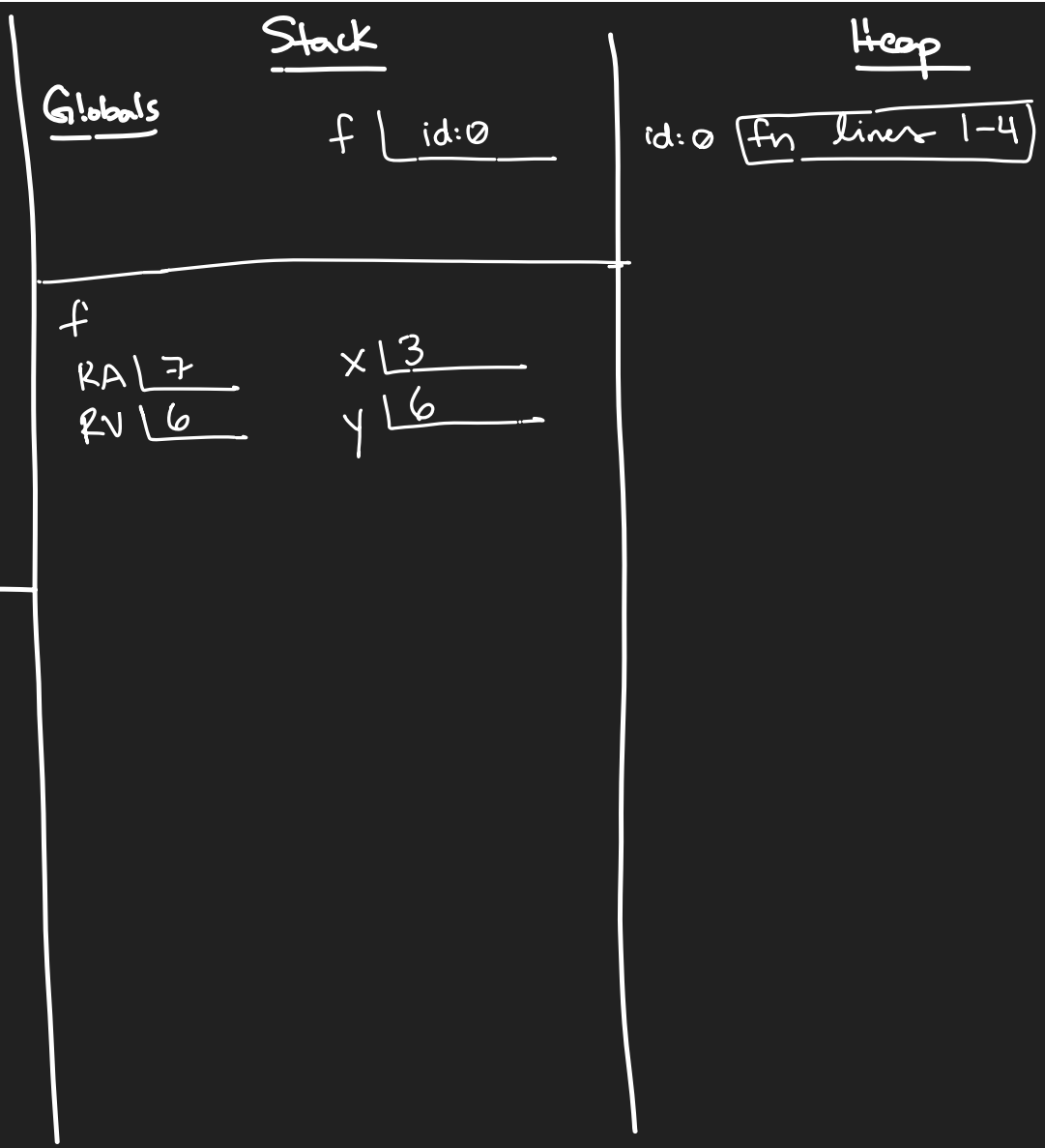
What does line 3 remind you of?

```python
def f(x: int) -> int:
    y: int
    y = x * 2
    return y


print(f(3))
```

Output

6



Key Variable Terminology

Variable Declaration / Definition - Associates a name/identifier with a data type, and a space in the current frame

```
<name>: <type>
```

Examples:

```
students: int
```

```
message: str
```

Key Variable Terminology

Variable Declaration / Definition

```
<name>: <type>
```

- Associates a name/identifier with a data type, and a space in the current frame

Variable Assignment

```
students = 300
```

- Binds a new value to a variable name in memory

Key Variable Terminology

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```
<name>: <type>
```

Variable Assignment - Binds a new value to a variable name in memory

```
students = 300
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Variable Initialization - First time a variable is assigned

Key Variable Terminology

Variable Declaration / Definition

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Variable Assignment

```
students = 300
```

- Binds a new value to a variable name in memory

Variable Initialization

- First time a variable is assigned

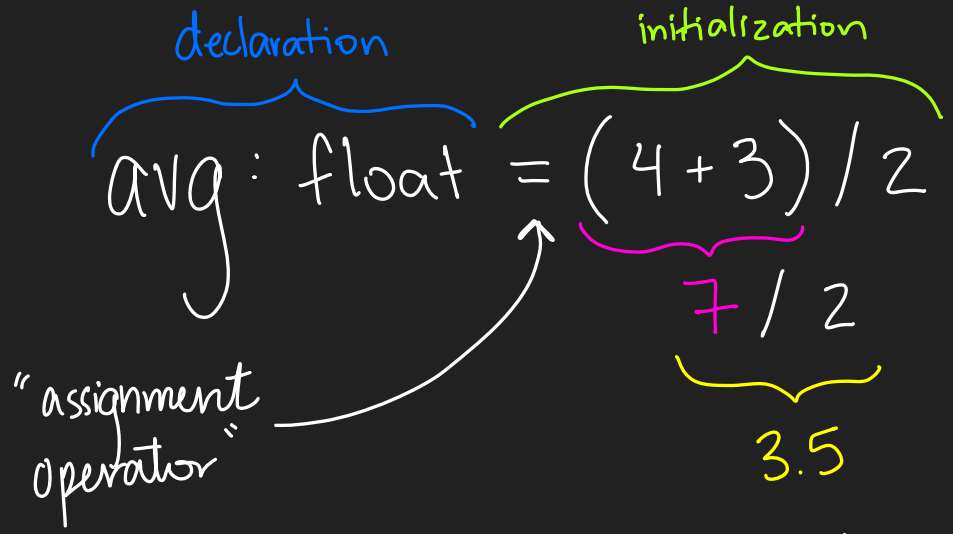
Variable Access

e.g., print(students)

- “Reading” or using a variable name in an expression

Left-hand vs. Right-hand Side of Assignment

Each side of the assignment operator (=) plays a distinct role in variable assignment!



ALWAYS evaluate the right-hand side first!

Common Variable Errors

UnboundLocalError – Occurs when attempting to access a variable that is declared in a function but not yet initialized

NameError – Occurs when attempting to access a variable that has not been declared. Commonly from typos or renaming a variable and not updating all accesses

Example:

```
my_val : int
print(my_val)
```

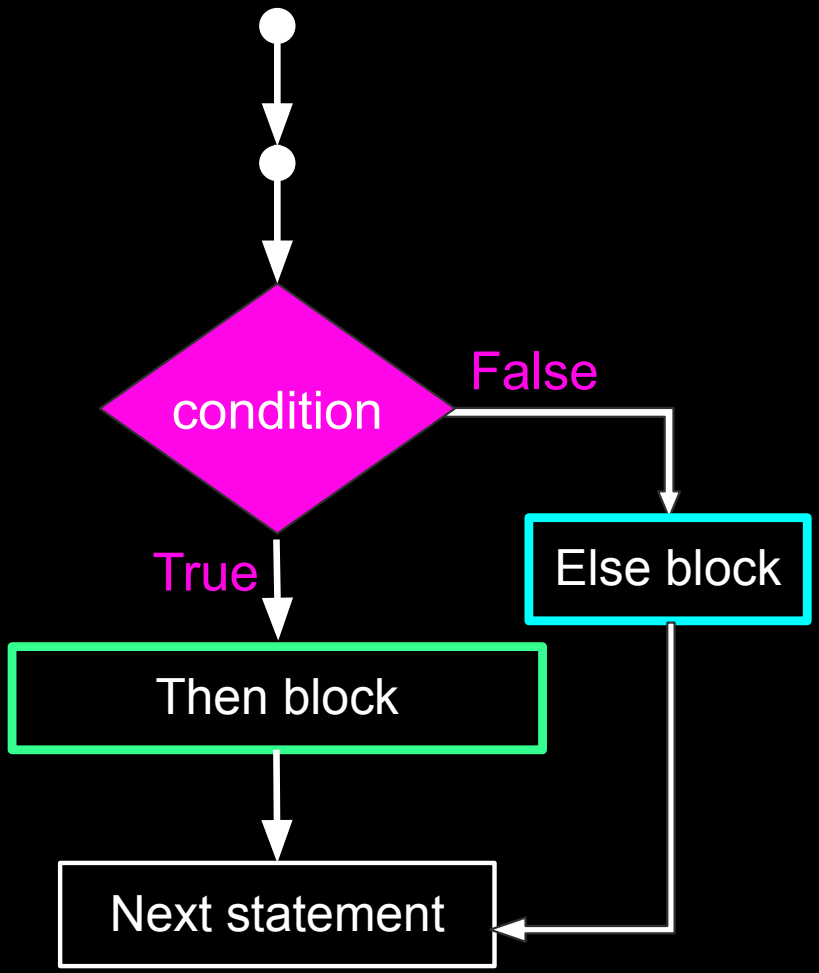
Variable was declared, but not initialized!

Example:

```
phrase = phrase + "!"
```

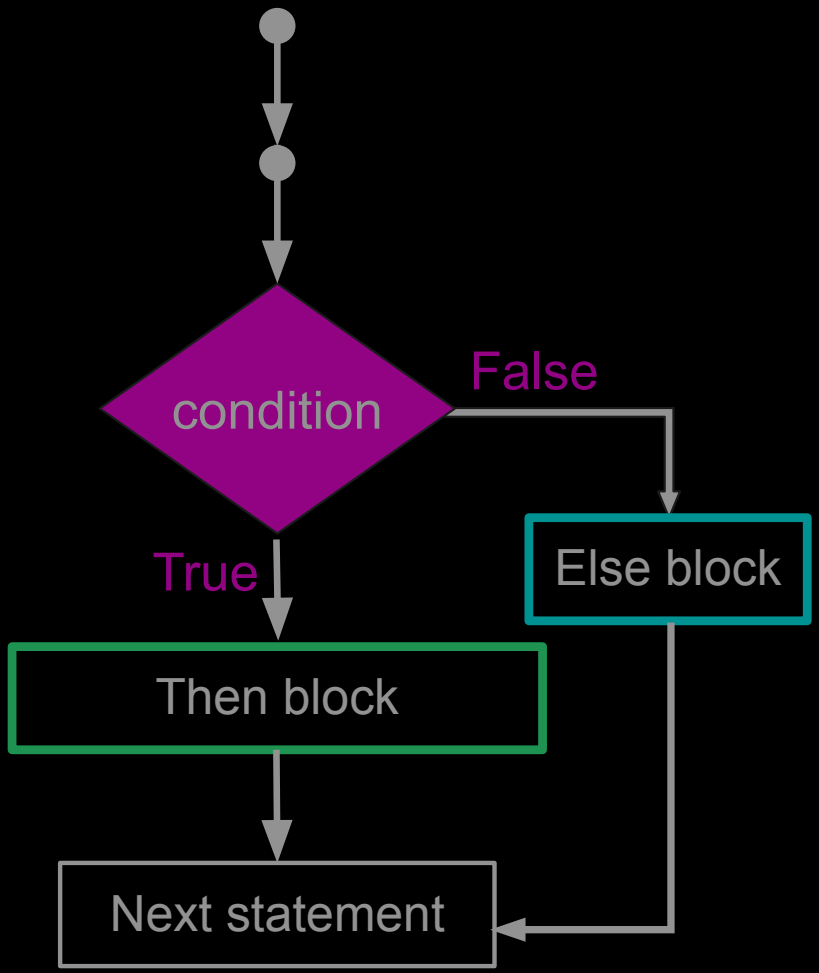
The variable, phrase, has not been declared yet!

Recall: if-then-else / *Conditional* Statements

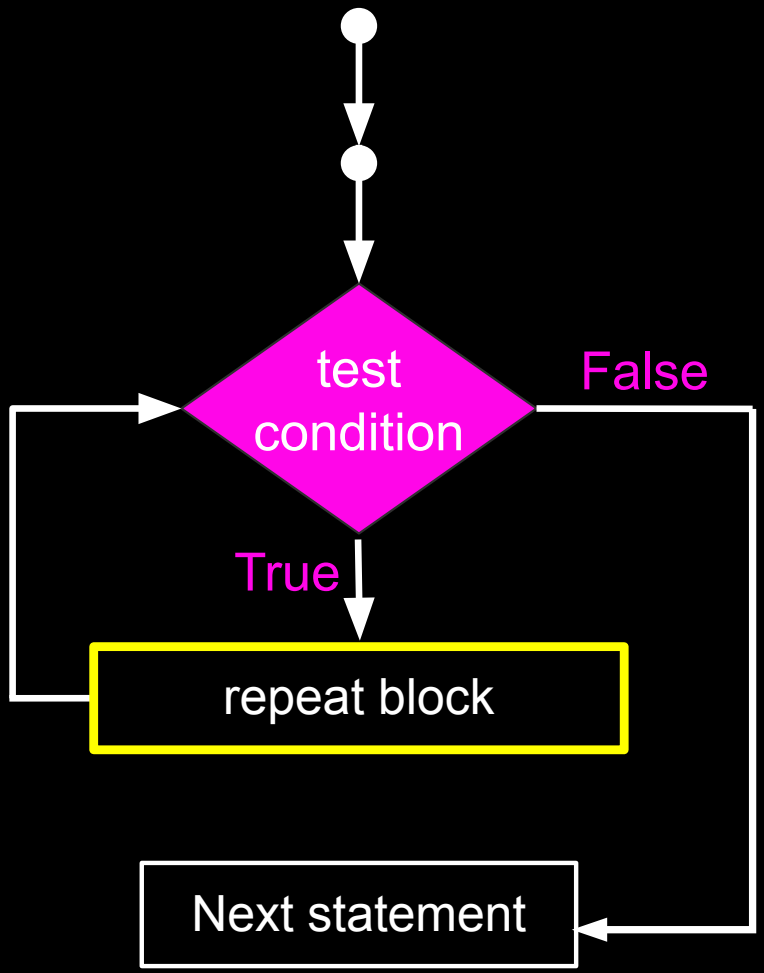



```
if <condition>:
    <then, execute these statements>
else:
    <execute these statements>
<rest of program>
```

`if-then-else` Statements

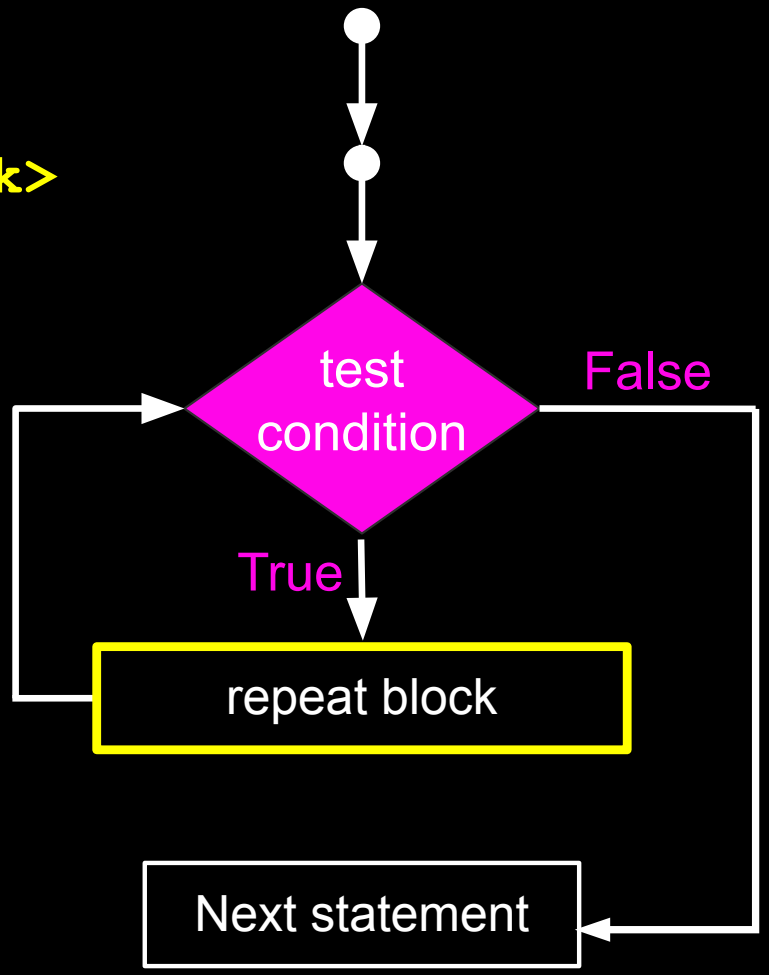


`while` Loop Statements



`while` Loop Statements

```
while <condition>:
    <execute indented repeat block>
<rest of program>
```



`while` Loop Statements

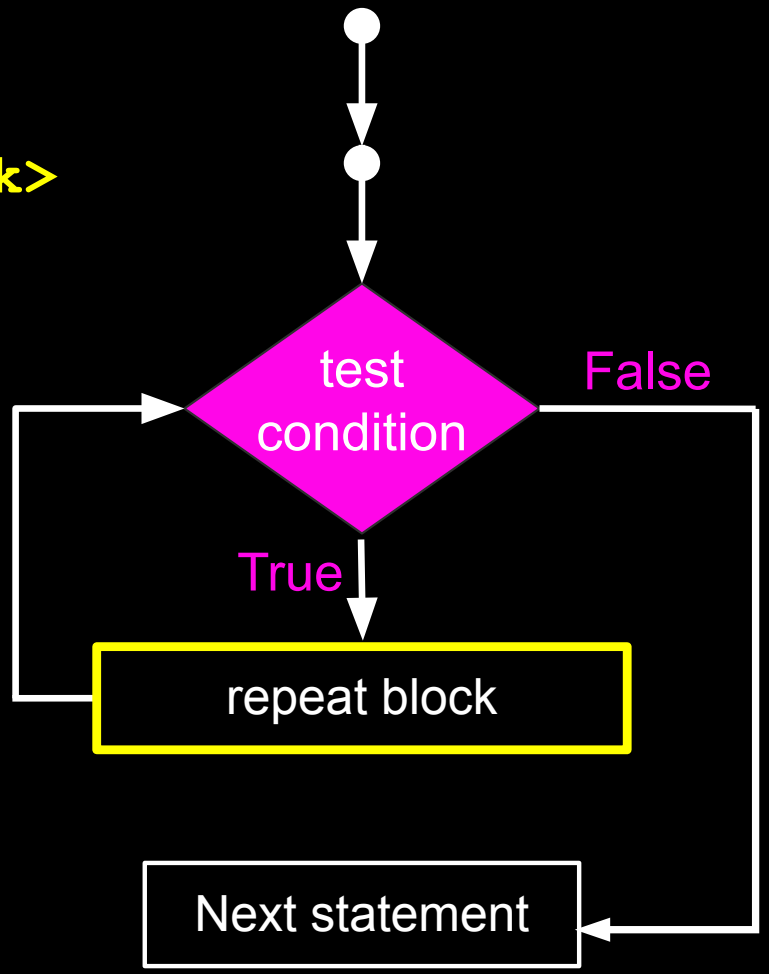
```
while <condition>:

    <execute indented repeat block>

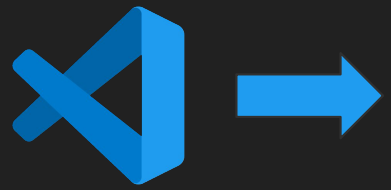
<rest of program>
```

When we reach a while loop statement in code…

- While the **condition** evaluates to **True**:
  - Execute the **repeat block**
  - Jump back up to the test if the **condition** is still True. This process will repeat (“iterate”) until the condition is False. In which case…
- When the **condition** evaluates to **False**:
  - *Skip past* the **repeat block** and continue on to the next line of code at the same level of indentation as the `while` keyword



Let's try writing a function, `count_to_n`, that will print values from 0 to n using a `while` loop!



Requirements:

Name: `count_to_n`
Parameter: `n`, an int
Return type: `None`

We'll need:

- Local variable (to keep track of the count)
- `while` loop (to iterate through each value of count, from 0 to `n`)

Output:

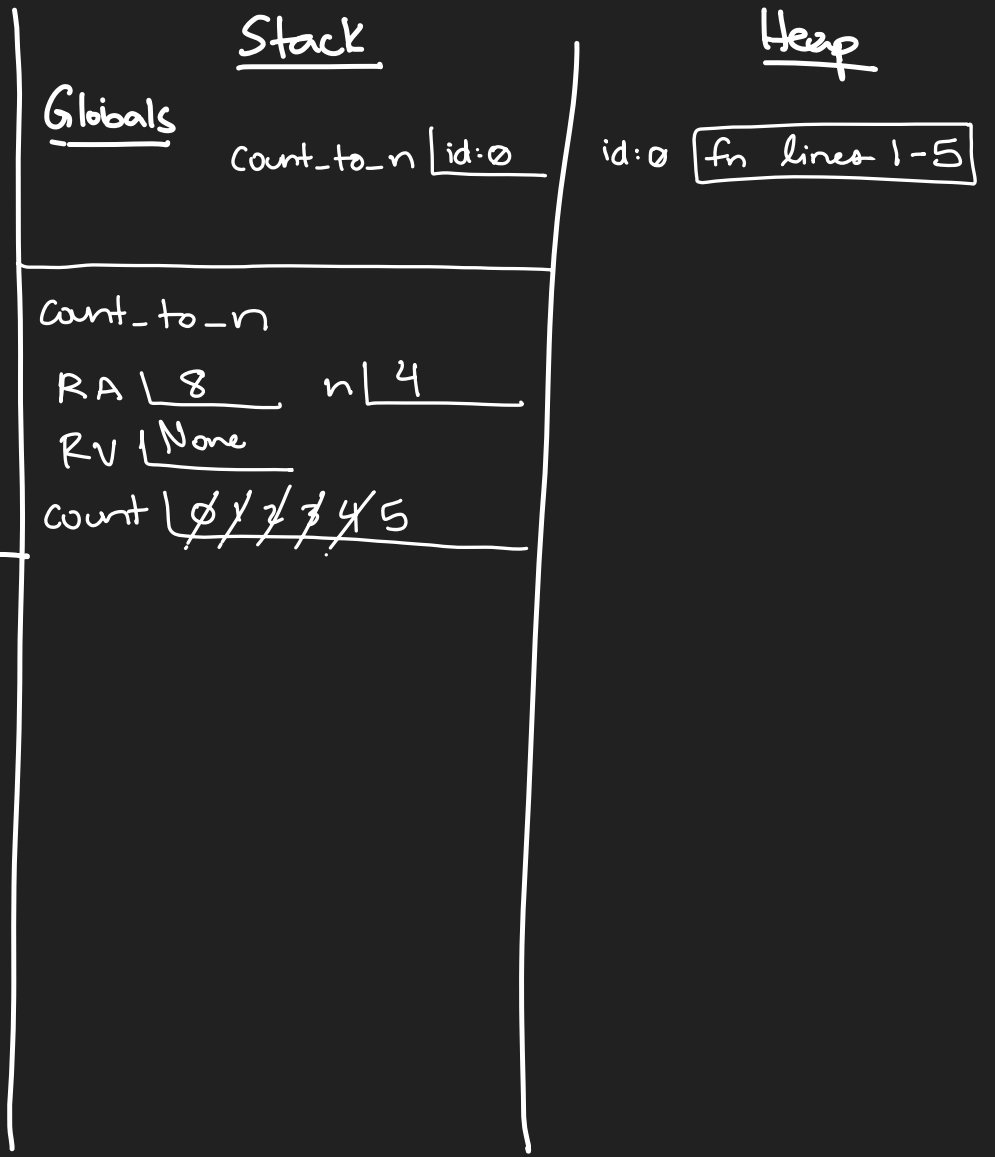
```
Count is: 0
Count is: 1
Count is: 2
Count is: 3
Count is: 4
```

```python
def count_to_n(n: int) -> None:
    count: int = 0
    while count <= n:
        print(f"Count is: {count}")
        count = count + 1
    # Loop while the condition is true!

count_to_n(n=4)
```

Output

Count is: 0
Count is: 1
Count is: 2
Count is: 3
Count is: 4



A common problem: the dreaded *infinite loop*

If a condition in a **`while`** loop never becomes False, the loop will continue indefinitely.

To prevent this:

- Ensure that your loop's condition will eventually evaluate to False!

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1  def count_to_n(n: int) -> None:
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3      while count <= n:
4          print(f"Count is: {count}")
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7
8  count_to_n(n=4)
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```

Which line of code in the code listing prevents an *infinite loop* from occurring? What would happen without it?

Common use cases of `while` loops

- **User input validation:** Prompt the user for a valid input until they give one to you!
  - *Think:* our word-guessing game example, or Wordle!
- **Game loops:** Keep a game running until some condition is met
  - Common examples: You run out of lives or attempts
- Iterating through values
  - Examples:
    - Counting from 0 to n ✅
    - Looping through every character in a string (via subscription notation)

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```python
def reverse(a_str: str) -> str:
    """Reverse a string"""
    idx: int = 0
    result: str = ""
    while idx < len(a_str):
        result = a_str[idx] + result
        idx = idx + 1

    return result


print(reverse(a_str="abc"))
```