CSCI-UA-0002

Intro to Computer Programming (No Prior Experience)

Module 5: For Loops, Nested Loops

Professor Emily Zhao

Section 008
T/R 12:30-1:45PM

Section 012
T/R 4:55-6:10PM

Agenda

- Review Assignment problem
- Review Ed Questions
- Module 5 Review
- Practice Problems

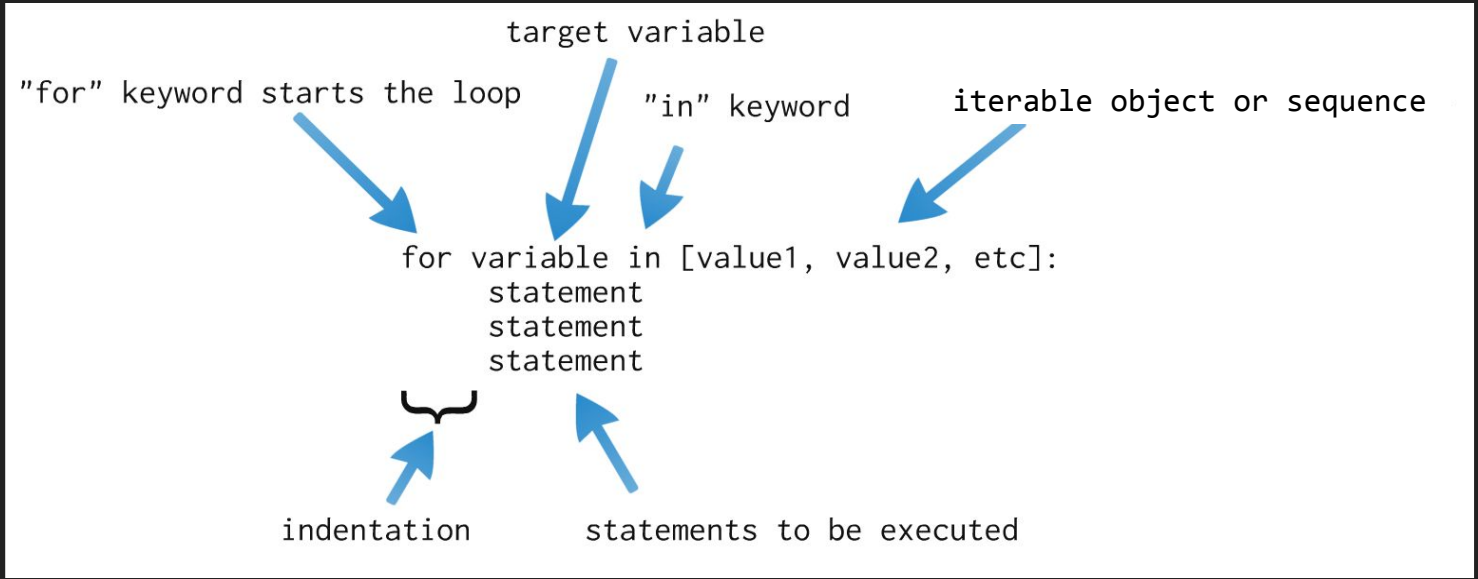
Module 5

- For Loops
- Nested Loops
- Simple Data Validation
- Controlling Speed in Turtle Graphics

Your Questions

→ I want an example of a...
  – nested loop
  – a while loop in a for loop
  – a for loop in a while loop
→ What does it mean to “iterate”?
→ Quiz questions

The “for” loop



True or False: You can name the target variable anything you want.

True

Iterable Objects

any object capable of returning its elements one at a time, allowing you to iterate (loop) through those elements

Lists
An ordered collection of elements, which can be of different data types

Strings
You can think of them as a "list" of characters

Sequence
The `range()` function returns a sequence of numbers (aka a range object)

Lists

```
for name in ['Craig', 'John', 'Chris']:
    print ("The current user is:", name)
```

```
> The current user is: Craig
> The current user is: John
> The current user is: Chris
```

Strings

```
for letter in "Emily":
    print(letter)
```

```
>   E
>   M
>   I
>   L
>   Y
```

`range()`

`range()`

`range(stop)`

`range(start, stop, step)`

- Returns a sequence of numbers, starting from 0 by default, and increments by 1 by default, and stops before a specified number.
- In its simplest form, it takes a single integer, the number at which it stops before.
- The range() function returns an “iterable”, which is a Python data type

What's the output?

```
range(5)
```
→ [0, 1, 2, 3, 4]

```
range(1, 5)
```
→ [1, 2, 3, 4]

```
range(5, 10)
```
→ [5, 6, 7, 8, 9]

```
range(0, 10, 2)
```
→ [0, 2, 4, 6, 8]

```
range(1, 10, 2)
```
→ [1, 3, 5, 7, 9]

```
range(10, 0, -3)
```

```
range(0, 10, -3)
```

Count Controlled vs Condition Controlled

A **count** controlled loop is a repetition structure that iterates a specific number of times

```
for num in [1, 2, 3, 4, 5]:
    print("This will print 5 times")
```

In contrast, a **condition** controlled loop iterates a variable number of times – we control the # of iterations through our Boolean condition

```
counter = 0
while counter < 5:
    print ("This will print 5 times")
    counter += 1
```

Review
Assignment #3, Problem #2: Guess the Number

Programming Challenge: FizzBuzz

A classic interview question for computer programming jobs

- Write a program that prints the numbers from 1 to 100
  - For the multiples of 3, print “Fizz” instead of the number
  - For the multiples of 5, print “Buzz” instead of the number
  - For numbers which are multiples of both 3 and 5, print “FizzBuzz”

```
>  1, 2, Fizz, 4, Buzz, Fizz, 7, 8, Fizz,
   10, 11, Fizz, 13, 14, FizzBuzz...
```

FizzBuzz (thought process)

- How do I print the numbers 1 through 100?
- How do I check a number's divisibility by 3, 5, or both?
  - What operator do I have to use?
- Once I've found a way to check, which condition should I check first?
- How do I go about structuring my code?

Logic:
Print corresponding string depending on divisibility
Otherwise, just print the number

FizzBuzz [SOLUTION]

```
for i in range(1, 101):
    if i % 3 == 0 and i % 5 == 0:
        print("Fizzbuzz")
    elif i % 3 == 0:
        print("Fizz")
    elif i % 5 == 0:
        print("Buzz")
    else:
        print(i)
```

Nested Loops

Nested Loops

- A nested loop can be described as a “loop inside of a loop”
- It’s the same idea as nested selection statements (“if” statements inside other “if” statements)

Nested Loops

- The innermost loop will iterate through all its iterations for every single iteration of an outer loop
- Inner loops complete their iterations faster than outer loops
- To get the total number of iterations of a nested loop, multiply the number of iterations of all the loops

While loop in for loop

Validate user data with a while loop inside of a for loop that runs our program 3 times

```
import random

print("I'm thinking of a number between 1 and 10!")

# generate random number
#num = random.randint(1, 10)
num = 5

# create boolean variable
guessed = False

for i in range(1,4):
    # VALIDATE DATA
    while True:
        guess = int(input("Guess #" + str(i)+": "))
        if 1 <= guess <= 10:
            break
        else:
            print("Please enter a number between 1 and 10")

    if guess == num:
        print("You got it!")
        print("The secret number was", num)
        print("It took you", i, "times to guess.")
        guessed = True
        break

    elif guess > num:
        print("Too high")
    else:
        print("Too low")
```

For loop in while loop

Do a finite number of tasks within a larger repeating program

```
# boolean variable
compute = "yes"


while compute == "yes":
    for i in range(0,4):
        print("Option" + str(i))

        # Option #1
        # Option #2
        # Option #3

    compute = input("Do you want to keep going? yes or no")

    if compute == "no":
        break
```

Programming Challenge: Clock Simulator

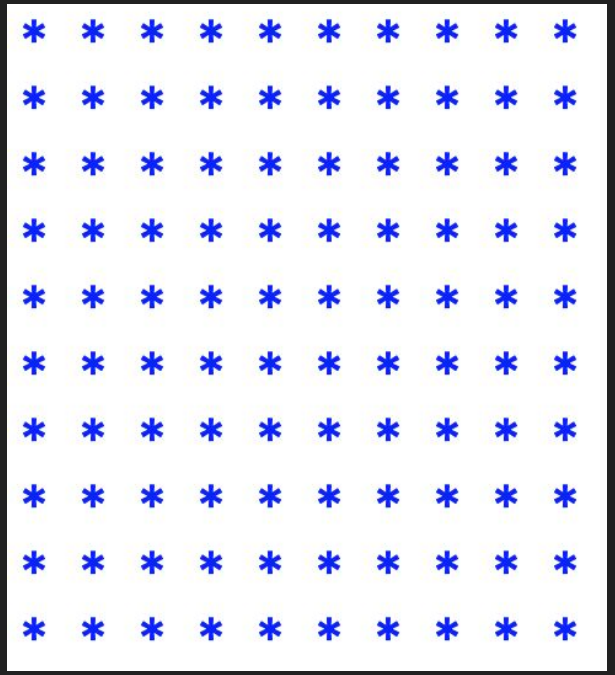
Write a program that prints out every possible time value for a single day

- Print out the hours and minutes
  - 0:0
  - 0:1
  - ...
  - 23:59

Extension:

- Can you get your output to have leading 0s?
- Print out the seconds, too.
- Example: 01:03:22

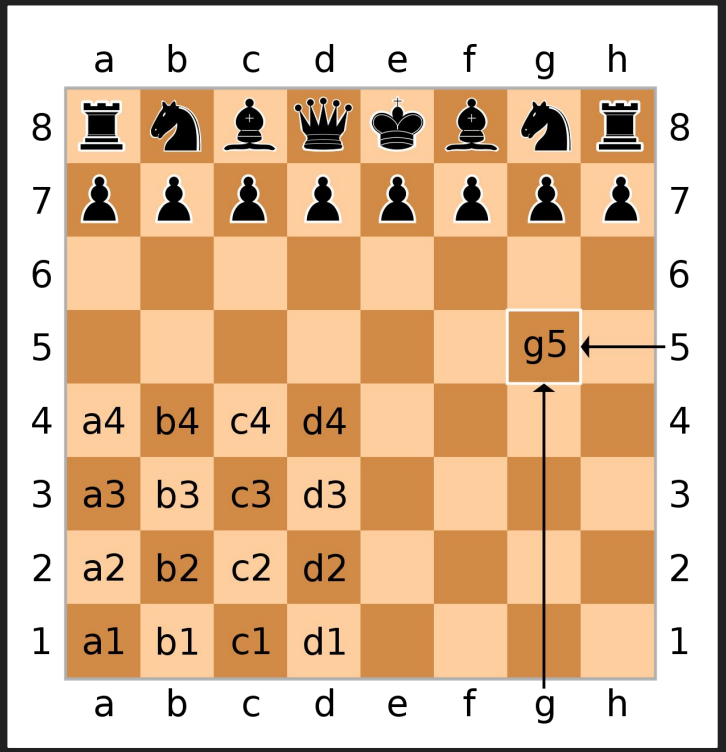
Grid of Asterisks



1. Generate a 10x10 grid of asterisks
   a. Try without loops
   b. Try using a while loop
   c. Try (1) for loop
   d. Try (2) for loops

2. Change your code so that it can generate an any number by any number grid

Chessboard



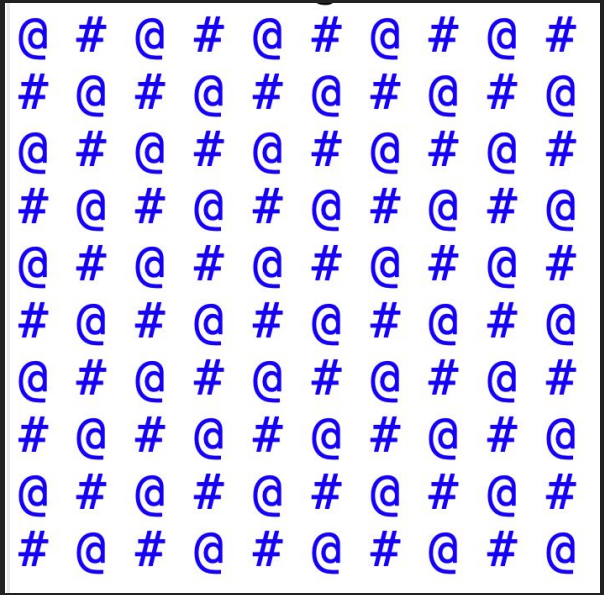
Generate a table of chess coordinates.

How many for loops do you need?

Expected Output:

```
A8 B8 C8 D8 E8 F8 G8 H8
A7 B7 C7 D7 E7 F7 G7 H7
A6 B6 C6 D6 E6 F6 G6 H6
A5 B5 C5 D5 E5 F5 G5 H5
A4 B4 C4 D4 E4 F4 G4 H4
A3 B3 C3 D3 E3 F3 G3 H3
A2 B2 C2 D2 E2 F2 G2 H2
A1 B1 C1 D1 E1 F1 G1 H1
```

Checkerboard – Challenge



Make a 10x10 checkerboard grid with alternating symbols.

Careful: Does your code work if you want to make an odd# x odd# grid?

Hint: Is there a relationship between the row and column numbers and what symbol is drawn?

Homework

- Assignment #3 (due Thurs @ 11:59PM)
- Self-Paced Learning Module #5 (due next Tues)
- Quiz #5 (due next Tues)