

# DATA 200

## Computational Programming for Analytics

Section 21  
Spring 2023  
Instructor: Ron Mak

### Assignment #2

Assigned: Wednesday, February 8  
Due: Wednesday, February 15 at 5:30 pm  
100 points max

### If statements and loops

The purpose of this assignment is to give you practice writing short Python code in notebooks and in standalone programs using `if` statements and loops.

### 1. Broken Richter Scale code

Here is a table of the Richter Scale for measuring the destructive effect of earthquakes:

Richter Scale	
Value	Effect
< 4.5	No destruction of buildings
4.5	Damage to poorly constructed buildings
6	Many buildings considerably damaged, some collapse
7	Many buildings destroyed
8	Most structures fall

The following Python code is supposed print the corresponding effect given a value for the variable `richter`, but it doesn't work correctly:

```
print(f'Richter value {richter:3.1f}: ', end='')

if richter < 4.5:
    print('No destruction of buildings')
elif richter >= 4.5:
    print('Damage to poorly constructed buildings')
elif richter >= 6:
    print('Many buildings considerably damaged, some collapse')
elif richter >= 7:
    print('Many buildings destroyed')
elif richter >= 8:
    print('Most structures fall')
```

Fix this code in a Jupyter notebook and test it with various values for variable `richter`.

## 2. Multiplication table

In a Jupyter notebook, write Python code to generate and print a 10 x 10 multiplication table. It should look like this:

1	2	3	4	5	6	7	8	9	10
2	4	6	8	10	12	14	16	18	20
3	6	9	12	15	18	21	24	27	30
4	8	12	16	20	24	28	32	36	40
5	10	15	20	25	30	35	40	45	50
6	12	18	24	30	36	42	48	54	60
7	14	21	28	35	42	49	56	63	70
8	16	24	32	40	48	56	64	72	80
9	18	27	36	45	54	63	72	81	90
10	20	30	40	50	60	70	80	90	100

Be sure to line up the columns of numbers nicely.

## 3. The Great Guess Bot 200

It's more accurate than any chat bot! First, you think of a number between 1 and 1000 inclusive. The Great Guess Bot will guess your number after at most 10 guesses. After each guess, it prompts you to enter the letter **L**, **H**, or **C** to tell it whether its guess was too low (L), too high (H), or correct (C).

Guess Bot's algorithm:

- Maintain four variables: `low`, `high`, `middle`, and `count`.
- Variables `low` and `high` will bracket the current search range: the value of `low` should be one below the bottom of the search range, and the value of `high` should be one above the top of the search range. Since the initial search range includes all the possible numbers, initially set `low = 0` and `high = 1001`.
- Each guess is the middle value of the current search range. Therefore, set `middle = (low + high)//2` and use that value as the guess.
- After making a guess, prompt the human (that's you) for the letter **L**, **H**, or **C** depending on whether the guess was too low, too high, or correct, respectively.
- If the guess was too low, Guess Bot needs to search the upper half of the current search range. Therefore, it must set `low = middle` and not change `high` to specify the new search range for the next guess.
- But if the guess was too high, Guess Bot needs to search the lower half of the current search range, Therefore, it must set `high = middle` and not change `low` to specify the new search range for the next guess.
- Increment variable `count` after each guess.

- If a guess was correct, the program should end, and Guess Bot is again triumphant!

Guess Bot should verify that the letter you enter after each guess is one of **L**, **H**, or **C**. If not, it should prompt you to enter a letter again.

The algorithm that Guess Bot uses is called a **binary search** because it halves the current search interval after each guess, and the next search interval is either the upper half or the lower half.

Write Guess Bot as a standalone Python program that you run in a terminal window. A run should look something like this (I thought of the number 281):

```
(base) ~/~/mak/DATA200/assignments/2: ipython GuessBot.py

My guess #1 is 500
L, H, or C? H

My guess #2 is 250
L, H, or C? L

My guess #3 is 375
L, H, or C? H

My guess #4 is 312
L, H, or C? H

My guess #5 is 281
L, H, or C? C
(base) ~/~/mak/DATA200/assignments/2:
```

## What to submit

1. Your Python notebooks(s) for the fixed and tested Richter Scale code and the multiplication table code. Include the output cells in your notebook(s).
2. Your Guess Bot program and a screenshot or a copy-and-paste text file from running the program in a terminal window. Show that it only accepts legitimate responses from you (letter **L**, **H**, or **C**).

## Rubric

Criteria	Max points
• Richter Scale code fixed and tested	• 30
• Multiplication table	• 30
• Guess Bot program	• 40