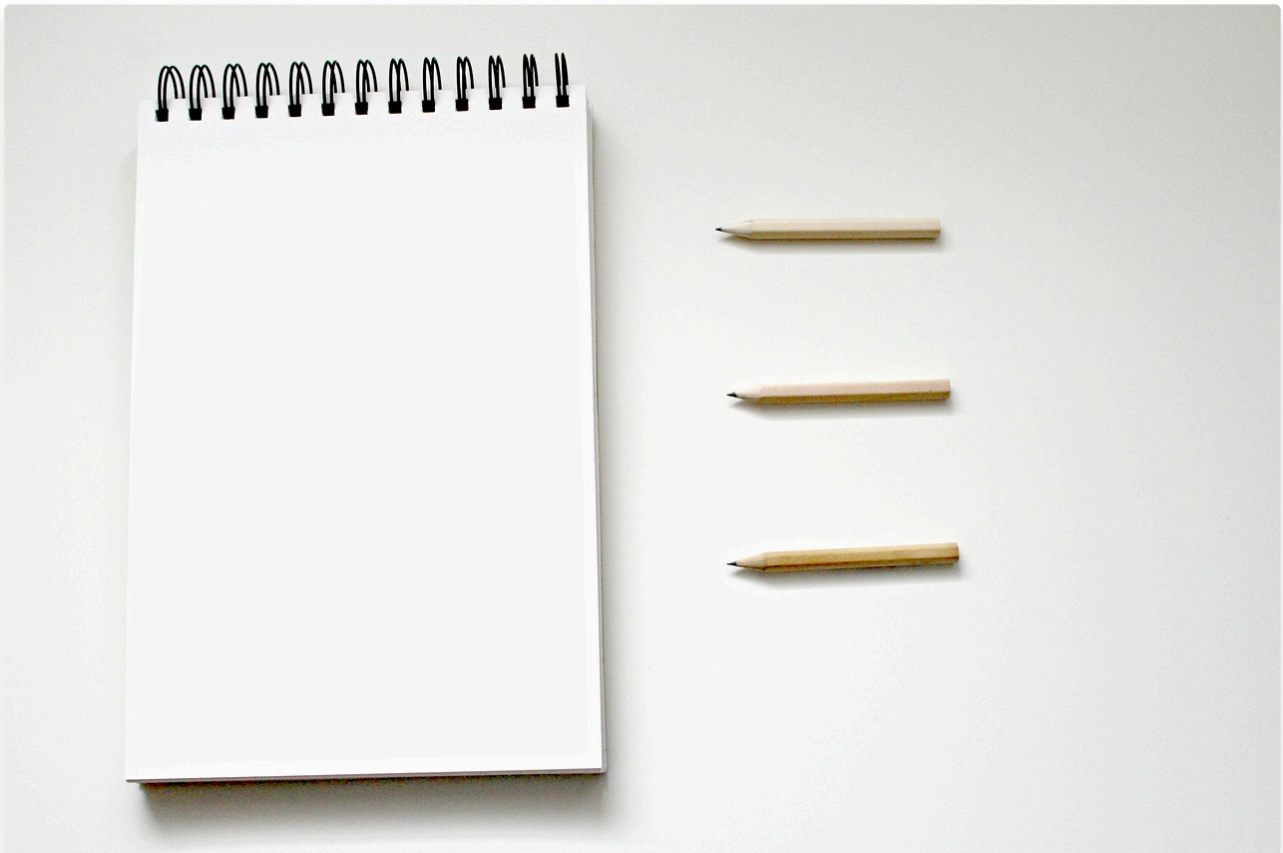


Iterating through 2D Lists

Textbook

Iterating Through 2D Lists



Another valuable skill is the ability to iterate through each element of a 2D list. This is best accomplished by the use of nested for loops. Let's explore how to iterate through every item in each list inside the list.

Here's an example of code that will multiply each element of a 2D list by 2:

```
1 my_list = [[0, 1, 2], [10, 15, 20], [100, 200, 300], [5, 6, 7]]
2 rows = 4
3 cols = 3
4
5 for i in range(rows):
6     for j in range(cols):
7         my_list[i][j] = my_list[i][j] * 2
8
9 print(my_list)
```

This will generate the following 2D list. Can you see how each item is multiplied by 2?

```
[[0, 2, 4], [20, 30, 40], [200, 400, 600], [10, 12, 14]]
```

Let's talk about what's going on in this code.

First, we have a 2D list named `my_list`. Now we are trying to access each item in each list that's inside the overall list named `my_list`. We do this by using `range()`.

But first! We need to know how many rows and how many columns the list has, so we create variables for `rows` and `cols`.

Now we're ready to loop through `my_list`! We create a for loop that moves through the range of rows. For each item, we also loop through a range of columns. Then, we use the code `my_list[i][j]` to access each element in the list. Here, it's looking for the index of the outer list AND the index of the nested list. You can think of it this code as representing each item in the list. In this example, we multiply each element by 2 and update the value in the list.

Let's look at another example.

```
1 my_list= ["dog", "cat", "frog"], ["shark", "squid", "whale"], ["deer", "fox",
2 "badger"]]
3 rows = 3
4 cols = 3
5
6 for i in range(rows):
7     for j in range(cols):
8         my_list[i][j] = my_list[i][j] + " is awesome"
9
10 print(my_list)
11
```

Try it!

This will result in the following list:

```
[['dog is awesome', 'cat is awesome', 'frog is awesome'], ['shark is awesome', 'squid is
awesome', 'whale is awesome'], ['deer is awesome', 'fox is awesome', 'badger is awesome']]
```

Notice how the number of rows needed to be updated to match the number of rows in the list named `my_list`.

Project - Tic Tac Toe

Write a Tic Tac Toe game using 2D arrays

Create a Python program that allows one user to play Tic Tac Toe against the computer. You must use two-dimensional arrays to complete this project. You should print out the tic-tac-toe board in the terminal, and fill in the spaces with X and O characters as each player makes a move.

- The game must be able to determine when there is a winner, and congratulate the winning player
- The game must be able to determine when there is a tie, and no player is able to win

- Your computer should either play by picking a random open spot, or you could program it to make it a bit smarter. That's up to you! You could even create an easy, medium, or hard setting.

[Click here](#) for a helpful tutorial on 2D arrays.

Checkpoint

Iterating through 2D Lists

1. Practice iterating through a 2D list! Consider the following list.

```
my_list = [[40, 45, 50], [6, 7, 8], [100, 200, 300], [50, 60, 70], [9, 0, 1]]
```

2. Add `3` to every single item in this 2D list.
3. Print the updated 2D list.

Requirements:

- Create a variable named `rows` and assign it to the correct number.
- Create a variable named `cols` and assign it to the correct number.
- Create a for loop that iterates through the range of rows.
- Inside the for loop, create a for loop that iterates through the range of cols.
- Add 3 to each item in `my_list`
- Print the updated 2D list

Questions (5)

1. What does the following code represent?

MULTIPLE CHOICE

```
my_list[i][j]
```

Choose the correct answer:

- A. Every single item in the entire list in turn.
- B. The first item in every list inside of the list.
- C. The last item in every list inside of the list.
- D. The length of the entire overarching list.

2. In the following 2D list, how many rows are there?

MULTIPLE CHOICE

```
my_list = [ ["dog", "cat", "frog"], ["shark", "squid", "whale"], ["deer", "fox", "badger"], ["kangaroo", "koala", "wallaby"] ]
```

Choose the correct answer:

- A. 1
- B. 3
- C. 4
- D. 5

3. In the following 2D list, how many columns are there?

```
my_list = [{"dog", "cat", "frog"}, {"shark", "squid", "whale"}, {"deer", "fox", "badger"}, {"kangaroo", "koala", "wallaby"}]
```

Choose the correct answer:

- A. 1
- B. 3
- C. 4
- D. 5

4. Which type of loop is best suited for iterating through a 2D list?**Choose the correct answer:**

- A. while loop
- B. for loop
- C. do-while loop
- D. switch loop

5. True or False: You can only iterate through 1D lists.**Choose the correct answer:**

- A. True
- B. False

Challenges (2)

1. Multiply List Values

Consider the following list.

```
my_list = [[0, 1, 2], [10, 15, 20], [100, 200, 300], [5, 6, 7]]
```

Create a program that will multiply this list by whatever the user wants.

For example:

Input: 3

Output:

```
[[0, 3, 6], [30, 45, 60], [300, 600, 900], [15, 18, 21]]
```

Input: 100

Output:

```
[[0, 100, 200], [1000, 1500, 2000], [10000, 20000, 30000], [500, 600, 700]]
```

2. Find the Largest Value

1. Write a program that iterates through a 2D list. It will return the largest number in the entire list. But the list has some elements that the user puts in.
2. Take the following list for example.

```
my_list = [[0, 1, x], [10, 15, y], [100, 200, 300], [5, 6, z]]
```

3. Notice how this list has some variables in it?
4. Set each of the variables to a user input, so the first part of your program will look like this.

```
x = int(input("What is the first number?"))
```

```
y = int(input("What is the second number?"))
```

```
z = int(input("What is the third number?"))
```

```
my_list = [[0, 1, x], [10, 15, y], [100, 200, 300], [5, 6, z]]
```

5. Then you will iterate through the entire 2D array and return the largest number, depending on the user inputs.

For example:

Inputs: 1, 1, 1

Output: 300

Another example:

Inputs: 1, 4000, 100

Output: 4000

Answer Keys & Solutions

Checkpoint Solutions

Iterating through 2D Lists

```
1 my_list = [[40, 45, 50], [6, 7, 8], [100, 200, 300], [50, 60, 70], [9, 0, 1]]
2 rows = 5
3 cols = 3
4
5 for i in range(rows):
6     for j in range(cols):
7         my_list[i][j] = my_list[i][j] + 3
8
9 print(my_list)
```

Questions

1. What does the following code represent?

MULTIPLE CHOICE

Correct Answer:

- A. Every single item in the entire list in turn. ✓ Correct
- B. The first item in every list inside of the list. ✗ Incorrect
- C. The last item in every list inside of the list. ✗ Incorrect
- D. The length of the entire overarching list. ✗ Incorrect

Explanation:

You can use this code to do anything you normally would with a data point.

2. In the following 2D list, how many rows are there?

MULTIPLE CHOICE

Correct Answer:

- A. 1 ✗ Incorrect
- B. 3 ✗ Incorrect
- C. 4 ✓ Correct

D. 5

✗ Incorrect

Explanation:

Each list inside of the list counts as a row.

3. In the following 2D list, how many columns are there?

MULTIPLE CHOICE

Correct Answer:

A. 1

✗ Incorrect

B. 3

✓ Correct

C. 4

✗ Incorrect

D. 5

✗ Incorrect

Explanation:

The columns are how many items are in each list inside of the list.

4. Which type of loop is best suited for iterating through a 2D list?

MULTIPLE CHOICE

Correct Answer:

A. while loop

✗ Incorrect

B. for loop

✓ Correct

C. do-while loop

✗ Incorrect

D. switch loop

✗ Incorrect

Explanation:

For loops are best for iterating through lists

5. True or False: You can only iterate through 1D lists.

MULTIPLE CHOICE

Correct Answer:

A. True

✗ Incorrect

B. False

✓ Correct

Explanation:

This lesson shows how to iterate through a 2D list.

Challenges

1. Multiply List Values

Solution:

```
1 my_list = [[0, 1, 2], [10, 15, 20], [100, 200, 300], [5, 6, 7]]
2 rows = 4
3 cols = 3
4
5 answer = int(input("What do you want to multiply by?"))
6
7 for i in range(rows):
8     for j in range(cols):
9         my_list[i][j] = my_list[i][j] * answer
10
11 print(my_list)
```

2. Find the Largest Value

Solution:

```
1 x = int(input("What is the first number?"))
2 y = int(input("What is the second number?"))
3 z = int(input("What is the third number?"))
4
5
6 my_list = [[0, 1, x], [10, 15, y], [100, 200, 300], [5, 6, z]]
7 rows = 4
8 cols = 3
9
10 largest = 0
11
12 for i in range(rows):
13     for j in range(cols):
14         if my_list[i][j] > largest:
15             largest = my_list[i][j]
16
17
```



```
18 print(largest)
```