



LE/EECS 1015
(Section D)
Week 11: Collections III

Shogo Toyonaga
York University
Lassonde School of Engineering

This Week...

1. A Review of the Collection Memory Model

- **Shallow Copy**
- **Deep Copy**

2. Nested Collections

- **Iteration**
- **Aliasing**

Goals of Lab 9

1. **Writing and debugging scripts that use nested collections.**
2. **Writing concise, clean code (accounting for time complexity)**

Lab 9 – What You Do....

Task	Points
Follow the Steps (Separate Numbers)	30
Debugging (Debug Correlation)	30
Implementation (Tic-Tac-Toe Game)	20

Lab 9 – Useful Resources

- [Nested loops in Python are easy ୧୧ \(Bro Code\)](#)
- [Nested Loops: Visually Explained \(Visually Explained\)](#)

(Recap) Collection Memory Model

- Shallow Copy

- “Constructs a new compound object and then (to the extent possible) inserts references into it to the objects found in the original.”

- Deep Copy

- “Constructs a new compound object and then, recursively, inserts copies into it of the objects found in the original.”

Collection Memory Model

Assume that we have the following 2D List (called, “square”):

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25

```
from copy import copy, deepcopy  
square_shallow = copy(square)  
square_deep = deepcopy(square)
```

How will updating `square[0][0] = “A”` change `square_shallow` and/or `square_deep`? Explain your answer.

Nested Data Types

- A nested datatype is a collection whose elements consist of other collections themselves.
 - You will be working with references; it is important to understand the **Collection Memory Model**!
 - Things can get messy if you do not handle your pointers properly.
- You will need to provide **n indexes** to access and/or update an element that is nested **n times**.

Nested Loops

- Using nested loops allows us to traverse and/or iterate through nested collections easily.
- For each iteration of the outer loop, the inner loop will run from beginning to end.
- You can write **nested summations** by leveraging nested loops!

Nested Loops

Write a nested for loop which calculates the following sum:

$$\sum_{i=1}^{10} \sum_{j=1}^{10} i \times j = 3025$$

Nested Loops (ft. Time Complexity)

“If you need more than 3 levels of indentation, you’re screwed anyway, and should fix your program.”

- Linus Torvalds

Thank You!

Shogo Toyonaga
Lassonde School of
Engineering

