Welcome to the CoGrammar Multidimensional Lists

The session will start shortly...

Questions? Drop them in the chat. We'll have dedicated moderators answering questions.

Software Engineering Session Housekeeping

- The use of disrespectful language is prohibited in the questions, this is a supportive, learning environment for all - please engage accordingly. **(Fundamental British Values: Mutual Respect and Tolerance)**
- No question is daft or silly - **ask them!**
- There are **Q&A sessions** midway and at the end of the session, should you wish to ask any follow-up questions. Moderators are going to be answering questions as the session progresses as well.
- If you have any questions outside of this lecture, or that are not answered during this lecture, please do submit these for upcoming Academic Sessions. You can submit these questions here: **Questions**

Software Engineering Session Housekeeping cont.

- For all **non-academic questions**, please submit a query: **www.hyperiondev.com/support**
- Report a **safeguarding** incident: **www.hyperiondev.com/safeguardreporting**
- We would love your **feedback** on lectures: **Feedback on Lectures**

Skills Bootcamp
8-Week Progression Overview

Fulfil 4 Criteria to Graduation

✅ Criterion 1: Initial Requirements

- ***Timeframe:*** First 2 Weeks
- ***Guided Learning Hours (GLH):*** Minimum of 15 hours
- ***Task Completion:*** First four tasks

Due Date: 24 March 2024

✅ Criterion 2: Mid-Course Progress

- ***Guided Learning Hours (GLH):*** **60**
- ***Task Completion:*** 13 tasks

Due Date: 28 April 2024

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SKILLS FOR LIFE
SKILLS BOOTCAMPS
Department for Education
CoGrammar
Lists
April 2024

Learning Objectives and Outcomes

- Understand a bit of memory management with respect to lists
- Understand differences between an array and a list
- Define a python list and index
- Understand the different lists operations
- Define and implement 1D and higher dimensional lists

Problem Statement

Picture organizing your bookshelf with various genres of books. In Python, lists act like shelves, helping you group similar items together. For instance, you can create a list of "fiction" books or "non-fiction" books. This makes it easy to manage and access your collection efficiently. Let's dive into organizing with Python lists!

Agenda

- Lists Fundamentals
- 1D Lists
- ND Lists

Lists Fundamentals

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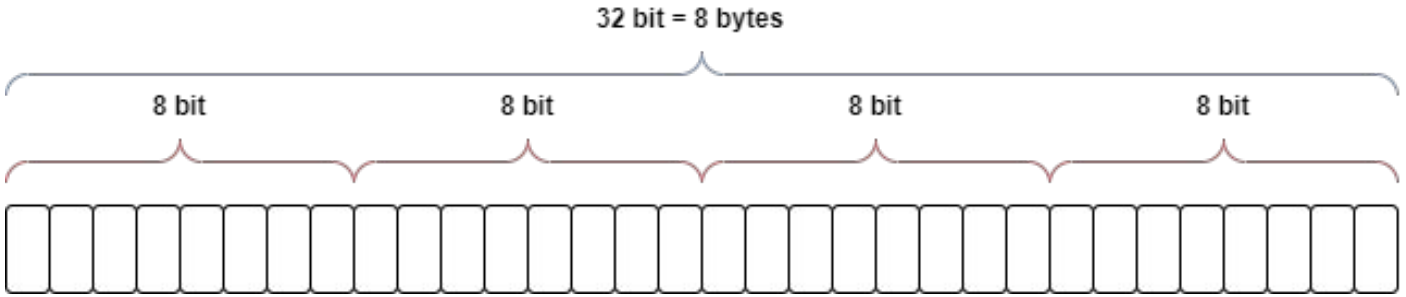
Data Types and Sizes

		Empty			
		C++	**Python**	**C++ Notes**	**Python Notes**
Variables	boolean	1 byte	24 bytes		But, **True (1)** has **28 bytes** and **False(0) has** 4 bytes less, **24 bytes**
	char	1 byte	2 bytes		**But**, a character in python is already a string, no difference. **49 bytes**
	int	4 bytes	24 bytes		
	float	4 bytes	24 bytes		
	double	8 byte	NA		double is not primitive to python
	string	32 bytes	49 bytes		+1 byte per additional character (49 + total length of characters)
	None (Null)	8 bytes	16 bytes		
Containers	list (array)	0 byte	40 bytes	If array empty, size is 0	+16 per additional item in a list (40 + 8*total length of items)
	tuple	0 byte	24 bytes	If array empty, size is 0	+8 per additional item in a list (24 + 8*total length of items), including another container
	set	0 byte	200 bytes	If array empty, size is 0	0-4 takes a size of 200. 5-18 size will be 712. 19th will take 2248 and so on...
	dict (map)	0 byte	48 bytes	If array empty, size is 1	Once filled is from 1 to 5 key-value pairs **216 bytes**, then, **344 bytes** (16 bytes more)

Unit of measure

The primary memory of a computer (**RAM)** is composed of bits of information, and those bits are typically grouped into larger units that depend upon the precise system architecture. Such a typical unit is a **byte**, which is equivalent to **8 bits**



Arrays (C++)

Linear data structure that collects elements of the **same data type** and stores them in **contiguous** and **adjacent memory locations.**

In RAM

0x7FFD90	0x7FFD91	0x7FFD93	0x7FFD94	0x7FFD95
‘A’	9			

Legend

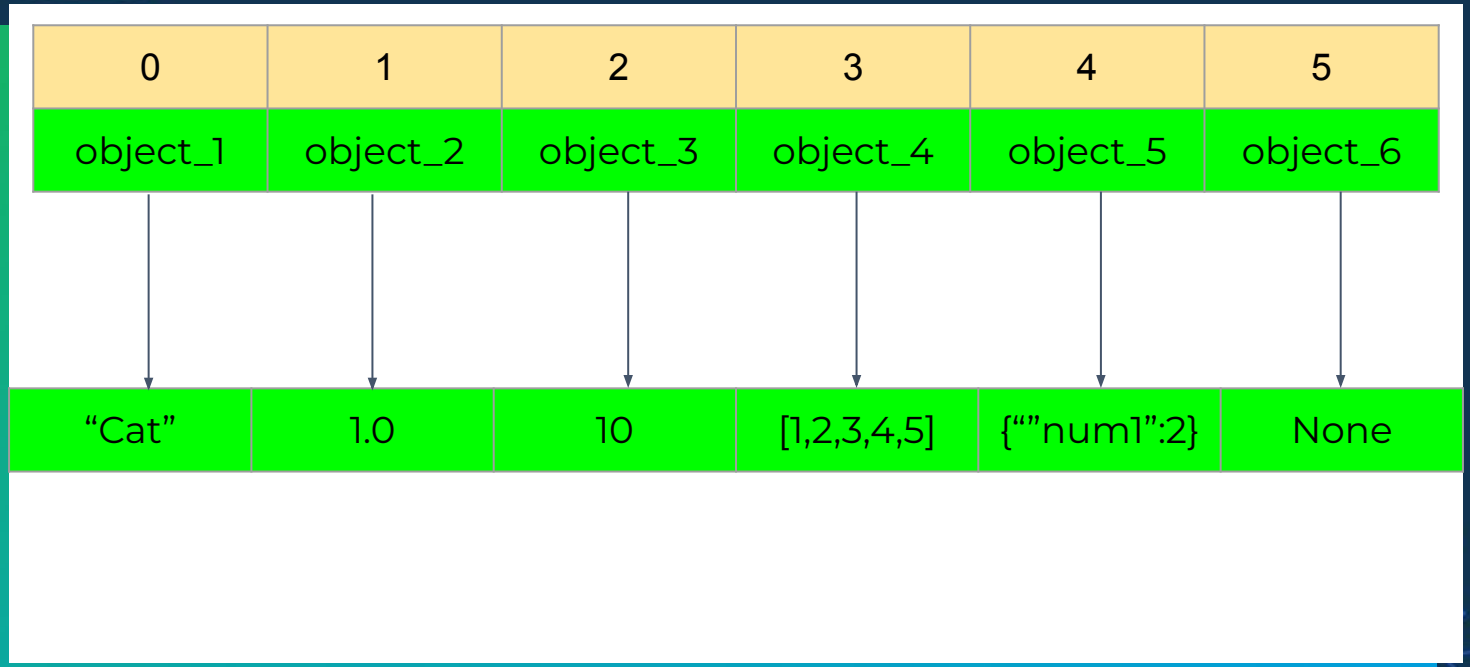
Memory Location	Character	integer

Referential Arrays

- As opposed to other programming languages like C++ or Java, **Python can receive any type of variable types in a list.**
- Each cell in a list, stores the reference of each number item inserted in it. Then it terms of inserting, retrieval and removal are done is quicktime, or constant time (for later)

0	1	2	3	4	5
“Cat”	1.0	10	[1,2,3,4,5]	{“”num1”:2 }	None

Referential Arrays



Definitions

- **A container** is a construct used to group related values together and contains references to other objects instead of data.
- **A list** is a container created by surrounding a dynamically typed array sequence of variables or literals with brackets [ ] or list().
- **An element** or a call is a list item
- **Index:** in a list refers to the position of an element within the list. Usually starts from 0
- **Mutability**: ability of modify a data structure at runtime. A list is mutable data structure in Python

1D Lists

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1D Lists: Definition

A list is a container created by surrounding a dynamically typed array sequence of variables or literals with brackets [ ] or list().

```
>>> myList = [“cat”, 1.0, 10, [1,2,3,4,5], {“”num1”:2}, None]
>>> myList[2]
[1,2,3,4,5]
>>> my_list = [ ]        #or   my_list = list()   creates an empty list
```

10 is a position 2

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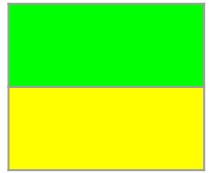
1D Lists: Operations

Adding an element in a list: **append()**

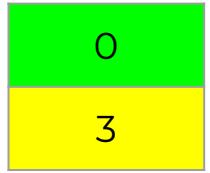
my_list = list()



Empty list

To add **3** to the list, then **5**

my_list**.append(3)**



3 added to list

my_list**.append(5)**

5 added to list

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1D Lists: Operations

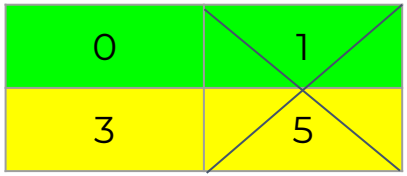
Removing an element in a list: **pop()**

my_list = list()

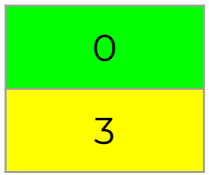
To add **3** to the list, then **5**

my_list**.append(3)**

my_list**.append(5)**



my_list.pop() # => returns **5**



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1D Lists: Operations

Updating a cell in a list: **update**

my_list = list()

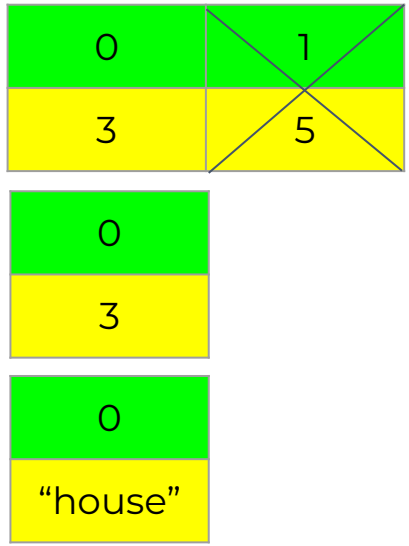
To add **3** to the list, then **5**

my_list**.append(3)**

my_list**.append(5)**

my_list.pop() # => returns **5**

My_list[0] = “house”



1D Lists: Operations

Extending the list: **extend()**

my_list[0] = “house”

your_list = [“Monday”, True]

0
“house”

Beware!

extend() is an **inplace** function

my_list.extend(your_list)

0	1	2
“house”	“Monday”	True

1D Lists: Operations

Extending the list: **+ (extend)**

my_list[0] = “house”

your_list = [“Monday”, True]

0
“house”

Beware!

+ not is an **inplace** operation

new_list = my_list **+** your_list

0	1	2
“house”	“Monday”	True

1D Lists: Operations

* (Repeat) and List Comprehension

Repeat

```
let new_list = [None]

let counter = 10

# To have 10 slots in new_list with None

>>> new_list * counter
[None, None, None, None, None, None, None, None, None, None]
```

1D Lists: Operations

* (Repeat) and List Comprehension

List Comprehension (Compressed **for loop**)

```
>>> counter = 10

>>>let new_list = [x for x in range(counter)]
```

result

iterator

```
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
```

1D Lists: Operations

Slicing

```
>>> new_list  = [start:end:step]

>>> new_list = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]

>>> new_list[0:5:2]

[0, 2, 4]

>>> new_list[::-1] # reversing the list
[9, 8, 7, 6, 5, 4, 3, 2, 1, 0]
```

2D Lists

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2D Lists: Definitions

Definitions

- 2D Lists extension of 1 D List
- Each cell is an object referring to another Python list
- Two-dimensional lists, often referred to as 2D lists or matrices
- Nested Lists

2D Lists: Operations

Access

>>> new_list = [[1.0,”cat”,3], [4,”fish”,6], 7,”hen”,9.0]

- As in a 1D list, we have indices
- 1 index for the row
- 1 index for the column

To access “fish”
>>>new_list[1][1]
“fish”

	0	1	2
0	1.0	“cat”	3
1	4	“fish”	6
2	7	“hen”	9.0

3D Lists

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3D Lists: Definitions

Definitions

- 3D Lists extension of 2D List
- Each cell is an object referring to another Python list, which also refers to another list
- Three-dimensional lists, often referred to as 3D lists or **matrices**
- Nested Lists

3D Lists: Operations

Access

```
>>> new_list  = [[['#', '#', '#'], ['#', '#', '#'], ['#', '#', '#']],
 [['#', '#', '#'], ['#', '#', '#'], ['#', '#', '#']],
 [['#', '#', '#'], ['#', '#', '#'], ['#', '#', '#']]]
```

- As in a 2D list, we have indices
- 1 index for the row
- 1 index for the column
- 1 index for the third axis

matrix_item = [row_index][column_index][last_index]

3D Lists: Operations

Access

```
>>> new_list  = [[['#', '#', '#'], ['#', '#', '#'], ['#', '#', '#']],
                 [['#', '#', '#'], ['#', '#', '#'], ['#', '#', '#']],
                 [['#', '#', '#'], ['#', '#', '#'], ['#', '#', '#']]]
```

- As in a 2D list, we have indices
- 1 index for the row
- 1 index for the column
- 1 index for the third axis

matrix_item = [row_index][column_index][last_index]

Summary

- **A list** is a container created by surrounding a dynamically typed array sequence of variables or literals with brackets [ ] or list().
- **Lists** operations include:
  - pop()
  - append()
  - extend()
  - The rest can be Data Structures
- Dimensionality can be 1D, 2D or 3D

Homework

Problem Statement: High Scores Tracker

You're tasked with creating a high scores tracker for a video game. The tracker should store the top 5 scores achieved by players. Players can submit their scores, and the tracker should update accordingly, ensuring only the highest scores are kept.
Write a Python program that implements this high scores tracker using lists. Your program should include the following functionalities:

- Initialize an empty list to store the top 5 scores.
- Implement a function **submit_score(score)** that takes a player's score as input and updates the list of top scores if the score is among the top 5.
- Implement a function **display_scores()** that displays the current top 5 scores in descending order.

Ensure your program handles edge cases such as ties in scores and maintains the order of submission for players with the same score.

Homework

```
# Initialize high scores tracker
initialize_high_scores()

# Submit scores
submit_score(800)
submit_score(600)
submit_score(1000)
submit_score(700)
submit_score(900)

# Display current top 5 scores
display_scores()
```

Homework

```
# Initialize high scores tracker
initialize_high_scores()

# Submit scores
submit_score(800)
submit_score(600)
submit_score(1000)
submit_score(700)
submit_score(900)

# Display current top 5 scores
display_scores()
```

Output:
Top 5 Scores:
1. 1000
2. 900
3. 800
4. 700
5. 600

Thank you for attending

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