

# 00\_Getting Started

- [Template](#)
- [Understanding BIG O Calculations](#)
- [Loops](#)
- [OOP for Python](#)
- [Data Types](#)

# Template

```
%% Commands for TeXCount
%TC:macro \cite [option:text,text]
%TC:macro \citep [option:text,text]
%TC:macro \citet [option:text,text]
%TC:envir table 0 1
%TC:envir table* 0 1
%TC:envir tabular [ignore] word
%TC:envir displaymath 0 word
%TC:envir math 0 word
%TC:envir comment 0 0

\documentclass[sigconf]{acmart}
\citestyle{acmauthoryear}
%%
%% \BibTeX command to typeset BibTeX logo in the docs
\AtBeginDocument{%
  \providecommand\BibTeX{{%
    Bib\TeX}}}

\setcopyright{rightsretained}
\copyrightyear{2025}
\acmYear{2025}
\acmConference{SIGGRAPH Appy Hour '25}{August 10-14, 2025}{Vancouver, BC, Canada}
\acmBooktitle{Special Interest Group on Computer Graphics and Interactive Techniques Conference Appy Hour
(SIGGRAPH Appy Hour '25), August 10-14, 2025}
\acmDOI{10.1145/3721260.3733980}
\acmISBN{979-8-4007-1552-5/2025/08}

\begin{document}
```

%%

%% The "title" command has an optional parameter,

%% allowing the author to define a "short title" to be used in page headers.

\title{ScavengeAR: From Licensing Fees to Free — Rebuilding Mobile AR with Unity-Native Tools}

\author{Victor Leung}

\email{thevictor2225@gmail.com}

\orcid{0009-0000-0600-668X}

%%\affiliation{%

%% \institution{Independent Developer}

%% \city{California}

%% \state{Mountain View}

%% \country{USA}

\begin{abstract}

ScavengeAR, an augmented reality creature-collecting mobile game, returns to SIGGRAPH in 2025 after a six-year hiatus, featuring a modernized tech stack and refined gameplay. The reboot preserves the core player experience while eliminating costly third-party dependencies.

\end{abstract}

\begin{teaserfigure}

\includegraphics[width=\textwidth]{scavengear\_teaserbanner.jpg}

\caption{Testing ScavengeAR's 2017 mobile build in Unity}

\Description{A person holds a smartphone displaying an augmented reality (AR) creature over a colorful marker pattern. Behind the phone, a computer screen shows the same marker being processed in Unity with a grid of image target icons. The AR creature is a teal, cartoon-style robot with yellow antlers and big eyes, floating above text describing SIGGRAPH's AR showcase.}

\label{fig:teaser}

\end{teaserfigure}

%%\received{20 February 2007}

%%\received[revised]{12 March 2009}

%%\received[accepted]{5 June 2009}

\maketitle

\section{Introduction}

ScavengeAR was SIGGRAPH's official AR mobile app from 2017 to 2019, offering attendees an engaging augmented reality experience and providing Luddy School of Informatics, Computing, and Engineering, Indiana

University Indianapolis students with hands-on opportunities in interactive media development.

In the game, SIGGRAPH attendees choose a role — Artist, Scientist, or Educator — and explore the conference venue to discover printed image targets that, when scanned through the app, spawn 3D AR creatures into their physical surroundings. Like a digital safari, players use the in-app camera to photograph each creature, capturing them into a personal library. New creatures are released each day of the conference, encouraging daily exploration and unlocking new layers of narrative and prize opportunities over time. In addition, the attendee has their own creature based on their role, which encourages real interactions with other attendees in order to catch all the creatures for the best prizes.

```
\begin{figure}[ht]
\centering
\includegraphics[width=\linewidth]{scavengear_threephoneview.PNG}
\caption{ScavengeAR 2019 Los Angeles Convention Center map screen, profile screen, and role share screen.}
\label{fig:teaser}
\end{figure}
\section{Motivation}
```

ScavengeAR ran from 2017-2019, with over a thousand daily active users during the conference. In 2020, the Covid Pandemic stopped in-person activity for a number of years, and effectively halted the app's development, leaving it in a deprecated state.

In 2025, a small volunteer team undertook a comprehensive refactoring of ScavengeAR to improve its maintainability and accessibility, in order to revive the spirit of the app to a modern audience.

## ``` \section{Technical Approach} ```

The original version of ScavengeAR was built using Unity 2018 and Vuforia 8 - a robust and accessible image tracking solution that was among the most practical options for AR based 2D markers at the time. Vuforia's artist-friendly pipeline utilized a parent-child GameObject hierarchy within a single-scene architecture, allowing low-code AR development and rapid prototyping in a pre-ARKit/ARCore standardization era. However, Vuforia also required licensing fees for production deployment and cloud-hosted image target storage.

For the 2025 relaunch, ScavengeAR was refactored to using Unity 2022 and AR Foundation 5 — Unity's native, cross-platform AR framework built on top of ARKit and ARCore — to support lightweight, offline 2D image tracking and reduce long-term costs, build size, and technical dependencies.

Migrating to AR Foundation required a shift to its modular, multi-scene, prefab-driven architecture. While we

traded Vuforia's simplicity, the new system offered improved performance management and a clearer separation of concerns. AR Foundation also supports full in-editor XR simulation—replacing webcam-based workflows—which proved essential for rapidly iterating on the modernized photo capture experience.

Originally built using GameSparks for backend services and a licensed data binding plugin for UI management, we replaced GameSparks with Unity's built-in serialization for offline data handling, and transitioned to an open-source MVVM Toolkit. These changes not only further reduced external dependencies and licensing costs but also simplified the codebase, making it more approachable for new contributors.

While the core functionality remains consistent with previous iterations, this overhaul ensures that ScavengeAR can continue to be a sustainable and educational project. By leveraging Unity's modern XR capabilities and open-source tools, we've positioned the app for easier updates and potential future enhancements, aligning with our goal of providing valuable learning experiences for students and enjoyable interactions for conference attendees.

\section{Art and Design}

\begin{figure}[ht]

\centering

\includegraphics[width=\linewidth]{scavengear\_newcreatures.jpg}

\caption{New creatures for ScavengeAR}

\label{fig:teaser}

\end{figure}

Luddy School of Informatics, Computing, and Engineering, Indiana University Indianapolis students has historically contributed original 3D creature designs for each iteration of ScavengeAR, and they return once again with a new cast of characters. This year's creatures were developed using a traditional animation and visual effects pipeline, continuing the project's tradition of experimenting with new styles and creative direction in each version.

For the user experience, we retained the core interaction flow from ScavengeAR 2019, which has been iteratively tested and refined through multiple conference deployments. While earlier versions of the app featured playful mini-games like Triviatron and Sigglet Falls, these proved non-essential to the primary gameplay loop. Instead, our focus shifted to improving the AR photo-taking experience—updating the camera overlay to better suit modern tall-screen phones, adding a tactile shutter animation, and introducing a polaroid-style fadeout to reinforce the analog camera motif.

\section{Future Work}

\begin{figure}[ht]

\centering

\includegraphics[width=\linewidth]{scavengear-2018creature.png}

\caption{A 2018 ScavengeAR creature, originally featured at the SIGGRAPH Studio venue in the Vancouver Convention Centre, shown here without the mobile user interface.}

\label{fig:teaser}

\end{figure}

Mobile AR has historically offered a more accurate representation of augmented reality by leveraging the raw camera feed to detect physical markers in the environment. At the time, Mixed Reality headsets restricted access to raw passthrough video, limiting similar capabilities. That trend is now shifting, with newer headsets offering improved access to video passthrough.

As we look ahead, a key challenge will be unifying the user experience (UX), user interface (UI), and interaction patterns across both mobile and headset-based platforms. With our latest refactor, we're well-positioned to support both moving forward.

\begin{acks}

ScavengeAR could not have been created without the significant contributions of: Casey Kwock, Victor Leung, Thach Nguyen, Louie Whitesel, and Zeb Wood. Additionally, we appreciate the supporting contributions of Jose Garrido, Spencer Hayes, Alli Johnson, and Andy Wang.

We also thank the many volunteers who helped bring previous versions of the game to life, as well as the donors whose generosity helped cover software licensing costs throughout the project's development.

Finally, we extend our gratitude to the players across SIGGRAPH conferences whose enthusiasm and feedback have continually shaped the experience.

\end{acks}

%%

%% The next two lines define the bibliography style to be used, and

%% the bibliography file.

%%\bibliographystyle{ACM-Reference-Format}

%%\bibliography{sample-base}

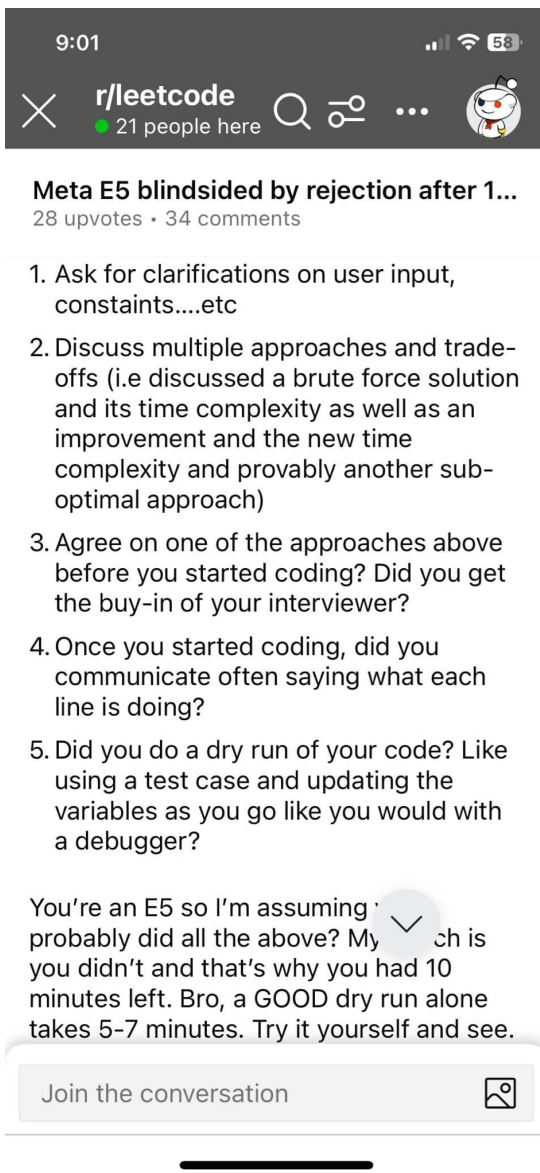
%%

%% If your work has an appendix, this is the place to put it.

\appendix

\end{document}

\endinput



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Sincerely,  
ACM Production

\*\*\*\*\*

Do not reply to this message as emails are not monitored at this account.

\*\*\*\*\*

<https://github.com/mdmzfzl/NeetCode-Solutions>

```
def solve_problem(inputs):  
    # Step 1: Understand the Problem  
    # - Parse inputs and outputs.  
    # - Clarify constraints (e.g., time, space).  
    # - Identify edge cases.  
  
    # Step 2: Plan and Design  
    # - Think about the brute-force approach.  
    # - Optimize: Can you use dynamic programming, divide & conquer, etc.?  
    # - Choose the appropriate data structures (e.g., arrays, hashmaps, heaps).  
  
    # Step 3: Implement the Solution  
    # - Use helper functions for modularity.  
    # - Write clear, well-commented code.  
  
def helper_function(args):  
    # Optional: For recursion, BFS, DFS, etc.  
    pass
```



```
# Main logic
result = None # Initialize result or output variable.

# Example logic
# for num in inputs:
#     result += num # Or other computations.

return result

# Driver code (for testing locally)
if __name__ == "__main__":
    inputs = [] # Replace with example test cases.
    print(solve_problem(inputs))
```

# Understanding BIG O Calculations

Big O notation is a way to describe how the algorithm grow as the input size increases. Two things it considers:

- Runtime
- Space

## 1. Basic Idea

- **What It Measures:**

Big O notation focuses on the **worst-case scenario** of an algorithm's performance. It tells you how the running time (or space) increases as the size of the input grows.

- Guarantee of Performance:

Worst-case analysis provides a guarantee that the algorithm won't perform worse than a certain bound, regardless of the input.

- Adversarial Inputs:

In interviews, interviewers often assume inputs that force the algorithm to perform at its worst, so understanding the worst-case behavior is crucial.

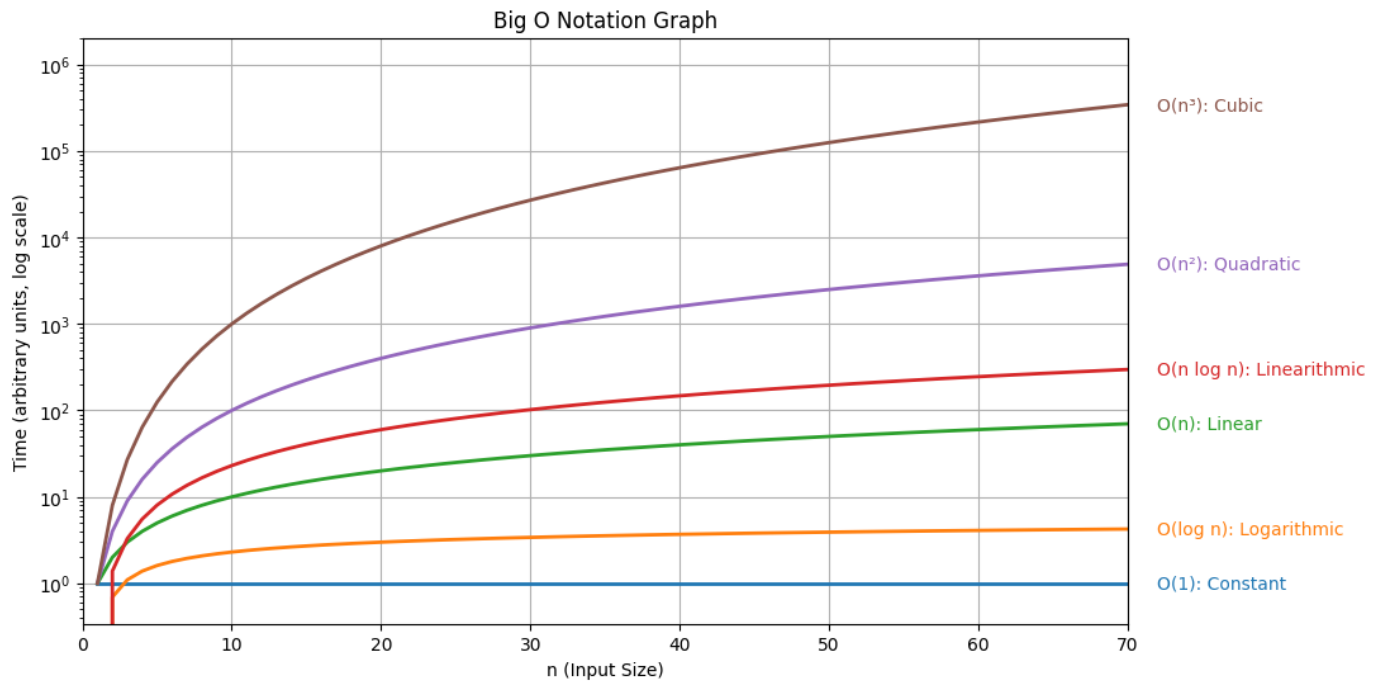
- Comparing Algorithms:

Worst-case complexity gives a clear basis for comparing different algorithms, ensuring that you choose one that performs reliably under all conditions.

- **Ignoring Constants:**

It abstracts away constants and less significant terms. For instance, if an algorithm takes  $3n + 5$  steps, it's considered  $O(n)$  because, for large  $n$ , the constant 5 and multiplier 3 become negligible compared to  $n$ .

## 2. Common Time Complexities



In order of least dominating term  $O(1)$  to most dominating term (the one that grows the fastest)

- **$O(1)$  - Constant Time:**

The runtime does not change with the size of the input.

- *Example:* Accessing an element in a list by its index.

- **$O(\log n)$  - Logarithmic Time:**

The runtime increases slowly as the input size increases.

- *Example:* Binary search in a sorted list.

- **$O(n)$  - Linear Time:**

The runtime increases linearly with the input size.

- *Example:* Iterating through all elements of an array to find a specific value.

- **$O(n \log n)$ :**

Often seen in efficient sorting algorithms like mergesort or heapsort.

- *Example:* Sort the list in  $O(n)$ , then use a Binary search in a sorted list  $O(\log n)$ .

- **$O(n^2)$  - Quadratic Time:**

The runtime increases quadratically as the input size increases.

- *Example:* Using two nested loops to compare all pairs in an array.

## 3. Understanding Through Examples

### Constant Time - $O(1)$

```
def get_first_element(lst):  
    return lst[0]
```

Regardless of list size, only one operation is performed.

## Linear Time - $O(n)$

```
def find_max(lst):  
    max_val = lst[0]  
    for num in lst:  
        if num > max_val:  
            max_val = num  
    return max_val
```

In the `find_max` function, every element is inspected once, so the time grows linearly with the list size.

## Quadratic Time - $O(n^2)$

```
def print_all_pairs(lst):  
    for i in range(len(lst)):  
        for j in range(len(lst)):  
            print(lst[i], lst[j])
```

Here, for each element, you're iterating over the entire list, leading to a quadratic number of comparisons.

# 4. Why Big O Matters

- **Performance Insight:**

Understanding Big O helps you predict how your solution will scale.

- $O(n)$  solution will generally perform better than an  $O(n^2)$  solution as the input size increases.

- **Algorithm Choice:**

It allows you to compare different algorithms and select the most efficient one for your needs.

- Discussing Big O can show your understanding of algorithm efficiency.

# 5. Space Complexity

- Just as you can analyze time complexity, Big O also helps you understand how much memory an algorithm requires relative to the input size.

## 6. Visualizing Growth Rates

Imagine a graph where the x-axis is the input size and the y-axis is the time taken:

- **$O(1)$**  is a flat line.
- **$O(n)$**  is a straight, upward-sloping line.
- **$O(n^2)$**  starts off similar for small inputs but grows much faster as  $n$  increases.

## 7. Combining big-o

When you have different parts of an algorithm with their own complexities, combining them depends on whether they run sequentially or are nested within each other.

### 1. Sequential Operations

If you perform one operation after the other, you add their complexities. For example, if one part of your code is  $O(n)$  and another is  $O(n^2)$ , then the total time is:

- **$O(n) + O(n^2) = O(n^2)$**

This is because, as  $n$  grows, the  $O(n^2)$  term dominates and the lower-order  $O(n)$  becomes negligible.

```
def sequential_example(nums):  
    # First part:  $O(n)$   
    for num in nums:  
        print(num)  
  
    # Second part:  $O(n^2)$   
    for i in range(len(nums)):  
        for j in range(len(nums)):  
            print(nums[i], nums[j])
```

Here, the overall time complexity is  $O(n) + O(n^2)$ , which simplifies to  $O(n^2)$ .

### 2. Nested Operations

If one operation is inside another (nested loops), you multiply their complexities. For example, if you have an outer loop that runs  $O(n)$  times and an inner loop that runs  $O(n)$  times for each

iteration, then the total time is:

```
def nested_example(nums):  
    for i in range(len(nums)):      # O(n)  
        for j in range(len(nums)):  # O(n) for each i  
            print(nums[i], nums[j])
```

This nested structure gives you  $O(n^2)$  overall.

### 3. Combining Different Parts

In real problems, your code might have a mix of sequential and nested parts.

The key idea is:

1. Add the complexities for sequential parts.
2. Multiply the complexities for nested parts.
3. Drop the lower-order terms and constant factors.

When adding complexities, the dominating term (the one that grows the fastest) is the one that determines the overall Big O notation.

Examples:

```
def combined_example(arr):  
    # Sequential part: Loop that processes each element.  
    # This loop runs O(n) times.  
    for x in arr:  
        print(x) # O(1) operation per element.  
  
    # Nested part: For each element in arr, loop over arr again.  
    # The inner loop is nested within the outer loop, giving O(n) * O(n) = O(n^2) operations.  
    for x in arr:  
        for y in arr:  
            print(x, y) # O(1) operation per inner loop iteration.  
  
    # If we call combined_example, the overall complexity is:  
    # O(n) [from the first loop] + O(n^2) [from the nested loops].  
    # For large n, O(n^2) dominates O(n), so we drop the lower-order term and constant factors,  
    # and the overall time complexity is O(n^2).  
  
if __name__ == "__main__":
```

```
sample_list = [1, 2, 3, 4, 5]
combined_example(sample_list)
```

```
# Binary search on a sorted list
def binary_search(arr, target):
    low, high = 0, len(arr) - 1
    while low <= high:
        mid = (low + high) // 2
        if arr[mid] == target:
            return mid
        elif arr[mid] < target:
            low = mid + 1
        else:
            high = mid - 1
    return -1

# Outer loop processes each query, each using binary search
def search_all(sorted_arr, queries):
    results = []
    for query in queries:      # O(n) if queries contains n items
        index = binary_search(sorted_arr, query) # O(log n)
        results.append(index)
    return results

if __name__ == '__main__':
    # Assume this list is already sorted
    sorted_arr = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]
    # List of queries (if its size is roughly n, overall complexity is O(n log n))
    queries = [3, 7, 10]
    print("Search results:", search_all(sorted_arr, queries))
```

- **Binary Search Function:**

This function performs a search on a sorted list in  $O(\log n)$  time.

- **Sequential Outer Loop:**

The `search_all` function iterates through each query. For each query, it calls binary search.

- The outer loop contributes  $O(n)$  (assuming there are  $n$  queries).
- The binary search inside the loop contributes  $O(\log n)$  per query.

- **Combined Complexity:**

Multiplying the two together gives  $O(n \cdot \log n)$ .

When combined with the rule of dropping lower-order terms and constants, the overall time complexity is  $O(n \log n)$ .

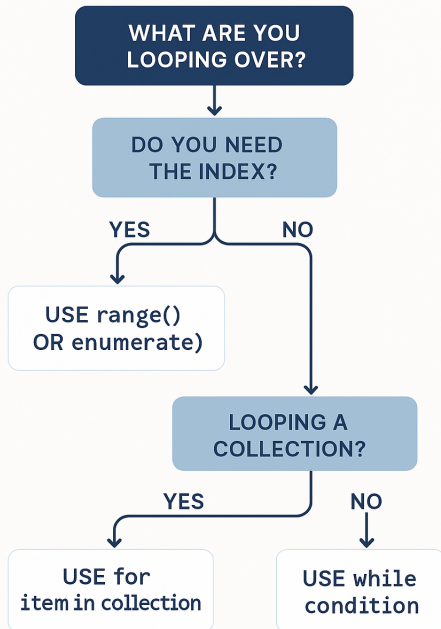
This example demonstrates how nested operations (a loop with an inner binary search) yield an  $O(n \log n)$  algorithm.

**Special Note:** If using python sort method, it uses TimSort which worse case is  $O(n \log n)$



# Loops

## THOUGHT PROCESS: WHICH LOOP TO USE?



## for Standard

Use when you want to **loop directly over the items** (values only).

Input	Example	Output
<code>["apple", "banana"]</code>	<code>for fruit in ["apple", "banana"]: print(fruit)</code>	<code>apple banana</code>
<code>"hi"</code>	<code>for char in "hi": print(char)</code>	<code>h i</code>
<code>{"a": 1, "b": 2}</code>	<code>for key in {"a": 1, "b": 2}: print(key)</code>	<code>a b</code>
<code>dict.items()</code>	<code>for k, v in {"a": 1}.items(): print(k, v)</code>	<code>a 1</code>

## for RANGE LOOPS

Use when you need to **count**, **index**, or **control the steps** of iteration.

Input	Example	Output
<code>range(3)</code>	<code>for i in range(3): print(i)</code>	<code>0 1 2</code>
<code>range(2, 5)</code>	<code>for i in range(2, 5): print(i)</code>	<code>2 3 4</code>
<code>range(0, 6, 2)</code>	<code>for i in range(0, 6, 2): print(i)</code>	<code>0 2 4</code>
<code>range(3, 0, -1)</code>	<code>for i in range(3, 0, -1): print(i)</code>	<code>3 2 1</code>
<code>range(len(list))</code>	<code>for i in range(len(fruits)): print(fruits[i])</code>	values in <code>fruits</code>

# ☐☐ ENUMERATE LOOPS

Use when you want **both index and value** from a list or iterable.

Input	Example	Output
<code>["x", "y"]</code>	<code>for i, v in enumerate(["x", "y"]): print(i, v)</code>	<code>0 x 1 y</code>
<code>["a", "b", "c"]</code>	<code>for i, letter in enumerate(["a", "b", "c"]): ...</code>	<code>0 a 1 b 2 c</code>

# ☐☐ NESTED LOOPS

Loop Type	Input	Example	Output
☐☐ Range	<code>range(2), range(2)</code>	<code>for i in range(2): for j in range(2): print(i, j)</code>	<code>0 0, 0 1, 1 0, 1 1</code>
☐☐ Range	2D array ( <code>matrix</code> ) by index	<code>for i in range(len(matrix)): for j in range(len(matrix[0])):</code>	Access each <code>matrix[i][j]</code>
☐☐ Range	All pairs in list	<code>for i in range(len(nums)): for j in range(i+1, len(nums)):</code>	Pairs <code>(i, j)</code>
☐☐ Enumerate	List of lists (2D grid)	<code>for i, row in enumerate(grid): for j, val in enumerate(row):</code>	<code>(i, j, val)</code> per cell
☐☐ Normal	List of lists (values only)	<code>for row in matrix: for val in row: print(val)</code>	Each cell value
☐☐ Normal	Two arrays (cross product)	<code>for a in ["a", "b"]: for n in ["1", "2"]: print(a, n)</code>	<code>a 1, a 2, b 1, b 2</code>

---

## 1. `for` loop

Use when you want to iterate over items in a list, set, or string.

```
colors = ['red', 'green', 'blue']  
for color in colors:  
    print(color)
```

---

## 2. `enumerate()` loop

Use when you need both the index and the value.

```
for i, color in enumerate(colors):  
    print(i, color)
```

---

## 3. `range()` loop

Use when you want to:

- Loop a specific number of times
- Access list items by index
- Do nested loops

---

## 4. `while` loop

Use when:

- You don't know how many times you'll loop
- You're waiting for a condition to change

```
x = 0
while x < 5:
    print(x)
    x += 1
```

⚠ Warning: Always make sure the condition will eventually become `False` or you'll get an infinite loop!

# ⚠ When to Use Which?

Loop Type	When to Use
<code>for item in list</code>	Clean, readable, item-based loops
<code>enumerate()</code>	Index + value
<code>range()</code>	Loop by number or index, brute-force logic
<code>while</code>	Loop while a condition is true (uncertain end)

# Optional Daily Practice Prompts

Want to write one of each daily?

- `for item in list`: print all characters in "hello"
- `enumerate()`: print index and item of a fruit list
- `range()`: print numbers 1 to 10
- `while`: count down from 5 to 0

Want me to add this to your **daily fundamentals checklist** or export it as a mini Anki flashcard set or markdown file you can keep open?

# OOP for Python

Absolutely! Here's a practical set of **Python OOP code examples** for each item in your **Object-Oriented Programming (OOP)** checklist — perfect for review or muscle-memory practice.

---

## Object-Oriented Programming (OOP) in Python — With Code Examples

---

### 1. Create a class with `__init__()`

```
class Dog:
    def __init__(self, name):
        self.name = name

d = Dog("Fido")
print(d.name) # Fido
```

### 2. Add a method to the class

```
class Dog:
    def __init__(self, name):
        self.name = name

    def bark(self):
        return f"{self.name} says woof!"

d = Dog("Rex")
```

```
print(d.bark()) # Rex says woof!
```

## 3. Use `@property` for a read-only attribute

```
class Circle:
    def __init__(self, radius):
        self._radius = radius

    @property
    def area(self):
        return 3.14 * self._radius ** 2

c = Circle(3)
print(c.area) # 28.26
# c.area = 50 # Error: can't set attribute
```

## 4. Inherit from another class

```
class Animal:
    def speak(self):
        return "Some sound"

class Dog(Animal):
    def speak(self):
        return "Bark"

d = Dog()
print(d.speak()) # Bark
```

## 5. Override a method

```
class Animal:
    def speak(self):
        return "Some sound"

class Cat(Animal):
    def speak(self):
        return "Meow"

c = Cat()
print(c.speak()) # Meow
```

## 6. Use `super()` to call base class method

```
class Animal:
    def speak(self):
        return "Some sound"

class Dog(Animal):
    def speak(self):
        base = super().speak()
        return base + " + Bark"

d = Dog()
print(d.speak()) # Some sound + Bark
```

## 7. Use `__repr__()` or `__str__()`

```
class Dog:
    def __init__(self, name):
        self.name = name

    def __repr__(self):
        return f"Dog('{self.name}')
```

```
def __str__(self):
    return f"My dog's name is {self.name}"

d = Dog("Buddy")
print(repr(d)) # Dog('Buddy')
print(str(d)) # My dog's name is Buddy
```

Absolutely! Here's the full **ChatGPT response on polymorphism**, polished and formatted so you can save it, review it, or turn it into a markdown or flashcard:

# ❏ What is Polymorphism in Python?

## ❏ Definition:

“**Polymorphism** means "**many forms**" — the same function or method behaves differently depending on the object it's acting on.

## ❏ Real-World Analogy:

- You call `draw()` on a `Circle`, `Square`, or `Triangle` and each one handles it differently.
- You don't care *how* it draws — you just know the object will handle it correctly.

# ❏ Python Polymorphism Example 1

## Method Overriding

This is classic *runtime polymorphism* through inheritance:

```
class Animal:
    def speak(self):
        return "Some sound"
```



```
class Dog(Animal):
    def speak(self):
        return "Bark"

class Cat(Animal):
    def speak(self):
        return "Meow"

animals = [Dog(), Cat()]

for animal in animals:
    print(animal.speak()) # Bark, Meow
```

□ You call the same method `speak()` , but each class handles it differently.

## □ Python Polymorphism Example 2

# Duck Typing

Python doesn't require a shared parent class — it just cares if the object has the right method.

```
class Bird:
    def fly(self):
        print("Flapping wings")

class Plane:
    def fly(self):
        print("Engines on")

def lift_off(flier):
    flier.fly()

lift_off(Bird()) # Flapping wings
lift_off(Plane()) # Engines on
```

□ As long as the object has a `fly()` method, it can be passed in — **“if it quacks like a duck...”**

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# TL;DR:

Concept	Meaning
Polymorphism	Same method name, different behavior
Method override	Subclasses implement their own version
Duck typing	Type doesn't matter, behavior does
Benefit	Cleaner, extensible, decoupled code

---

Would you like me to export this explanation as a `.md`, `.txt`, or add it to a reference doc for your interview prep?

# Data Types

Absolutely — knowing your **core data types** inside and out is essential for **LeetCode** and **coding interviews**. These are the types you'll **see constantly** and will use to build efficient solutions.

Here's a curated list of the **must-know data types** for LeetCode — including how to use them, when to choose them, and a one-liner to remember what they're best at.

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## ☐☐ LeetCode Data Types You Should Know (Python)

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### ☐1. `int` – Whole numbers

Used for counting, math, binary, etc.

```
n = 42
```

☐☐ Use cases:

- Loops, math, binary search, bit manipulation
- 

### ☐2. `float` – Decimal numbers

Used rarely, but important for precision-sensitive problems.

```
pi = 3.14
```

☐☐ Watch out for rounding errors.

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### ☐3. `str` – Strings

## High-frequency on LeetCode

```
s = "leetcode"
```

Know:

- `s[::-1]` – reverse
  - `s.split()` – split by whitespace
  - `s.isalnum()` – alphanumeric check
  - `ord(c)`, `chr(n)` – ASCII value
- 

## 4. list – Ordered, mutable collection

Most used structure in LeetCode

```
arr = [1, 2, 3]
```

Know:

- `arr.append(x)`
  - `arr.pop()`, `arr.pop(0)`
  - `arr[::-1]`
  - `arr.sort()` VS `sorted(arr)`
  - Slicing, binary search, sliding window
- 

## 5. tuple – Ordered, immutable collection

Used for keys in sets/dicts or returning multiple values.

```
t = (1, 2)
```

Know:

- `x, y = t`
  - Useful as hashable keys: `visited[(x, y)] = True`
- 

## 6. set – Unordered, unique items

Great for fast lookup and duplicates

```
s = set([1, 2, 3])
```

☐ Know:

- `x in s` →  $O(1)$
  - `set(list)` removes duplicates
  - Set operations: `union`, `intersection`, `difference`
- 

## ☐7. `dict` – Key-value pairs

☐ Critical for hash maps / fast lookups

```
d = {"a": 1, "b": 2}
```

☐ Know:

- `d.get(k, default)`
  - `defaultdict(list)`
  - Frequency count: `Counter(s)`
  - Keys/values/items iteration
- 

## ☐8. `collections.deque` – Double-ended queue

✂ Fast `append` and `popleft()` → great for BFS

```
from collections import deque
q = deque([1, 2])
q.append(3)
q.popleft()
```

---

## ☐9. `heapq` / Min Heap (via list)

☐ Use for priority queue, top K elements

```
import heapq
h = [5, 3, 8]
heapq.heapify(h)
heapq.heappop(h)
```

☐ Python only has min-heaps — invert values for max-heap.

---

## ☐ 10. `collections.Counter` – Fast frequency counting

```
from collections import Counter
c = Counter("aabbcc")
```

☐ Useful for:

- Anagram check
  - Majority element
  - Multiset behavior
- 

## ☐ TL;DR: Memorize These for LeetCode

Type	What it's good for
<code>int</code>	Counting, math
<code>float</code>	Precision, rarely needed
<code>str</code>	Manipulation, parsing, search
<code>list</code>	Arrays, stacks, sliding window
<code>tuple</code>	Hashable keys, return multiple items
<code>set</code>	Uniqueness, fast lookup
<code>dict</code>	Key-value, counting, hash maps
<code>deque</code>	BFS, queue (O(1) pops)
<code>heapq</code>	Priority queue, top K problems

Type	What it's good for
Counter	Fast frequency counting

Would you like:

- Anki cards for this?
- Daily drills where you implement key operations from memory?
- A printable reference sheet or PDF?