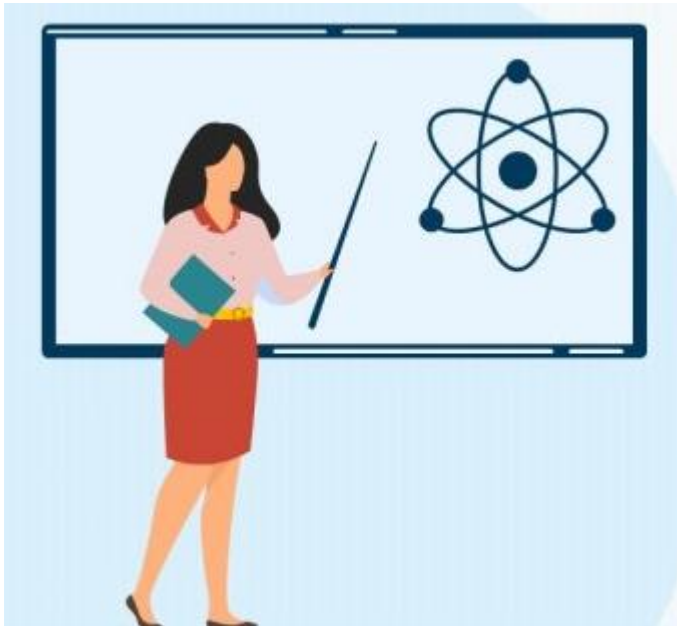


Introduction to Algorithm

EC2206



Welcome

2024.8

Suman Pandey



Conduct – Online

Email – suman17july@gmail.com, suman@postech.ac.kr

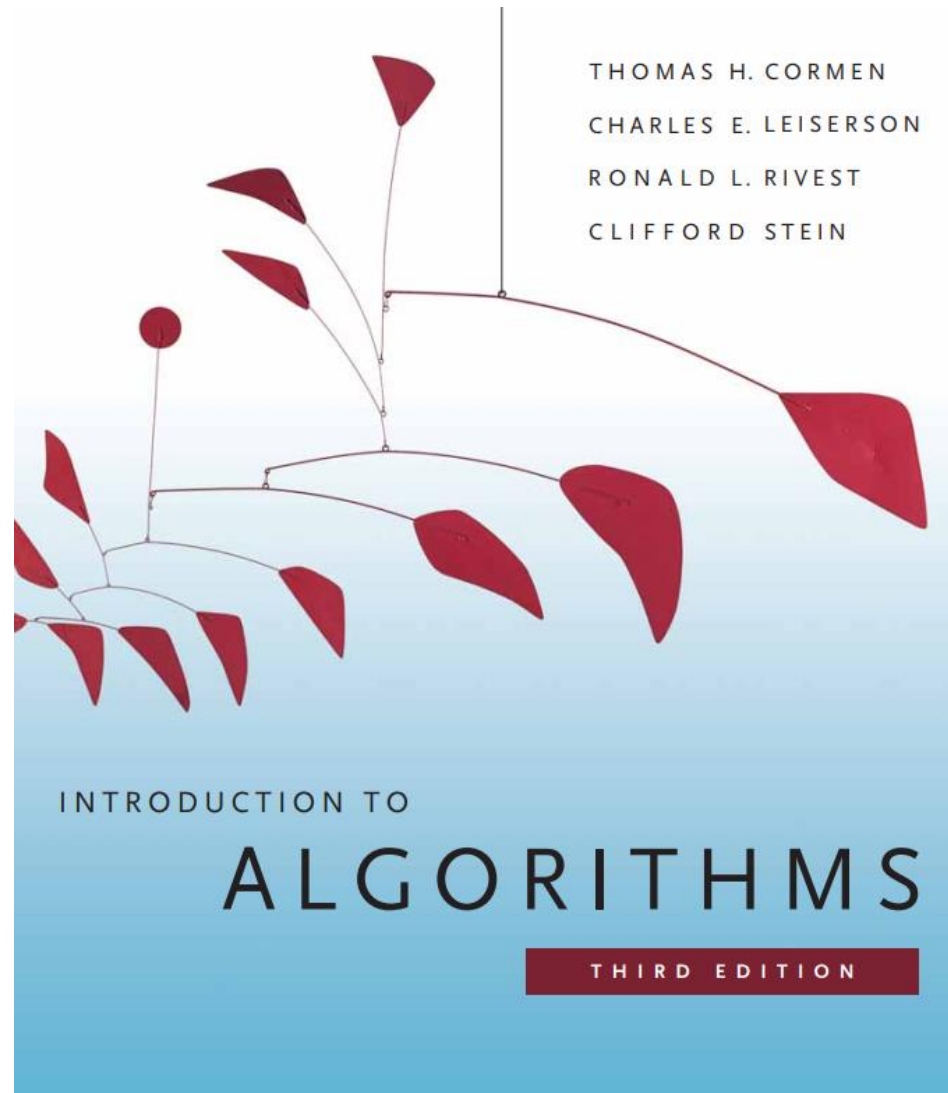
Office – EECS C3, C wing, 205 room

Phone – 010-3742-1791

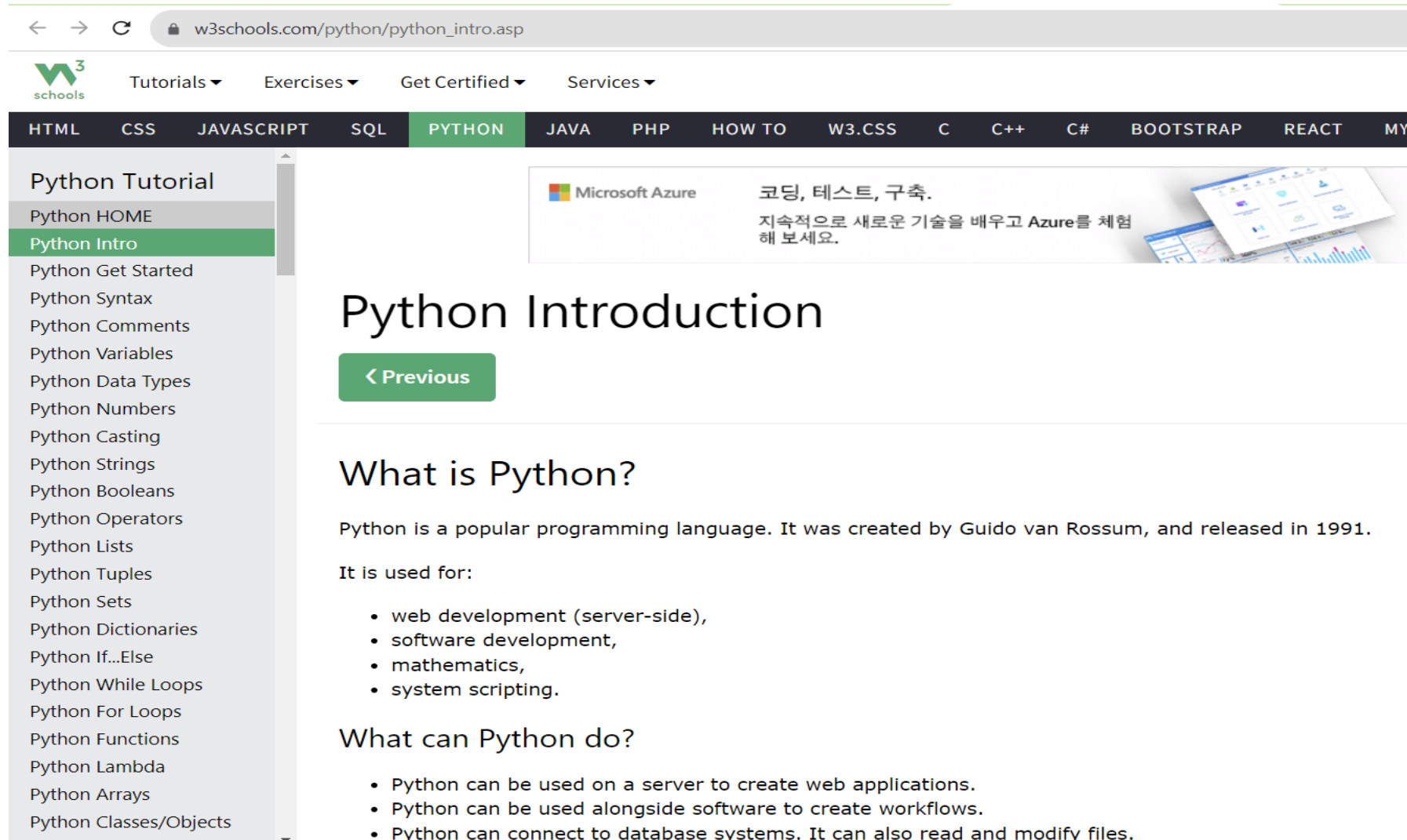
Technical Assistant

Fullname	Email address	Mobile phone
Seunghyuck Hyun	hyun_sh_ug@gm.gist.ac.kr	010-3156-5525
Lim, Chaehyun (임채현)	bkindtoevery1@gm.gist.ac.kr	010-4386-0909
Lee, Jae hee (이재희)	jhlee.ug@gm.gist.ac.kr	010-9177-0913
Altynbek kyzy, Sumaiia	sumaiiaaltyn@gm.gist.ac.kr	010-5083-8220

- **Assignments and Grading** – Technical Assistants will be responsible to clarify your doubts about Assignments and Grading



▶ https://www.w3schools.com/python/python_intro.asp



The screenshot shows the W3Schools website with the URL `w3schools.com/python/python_intro.asp` in the browser address bar. The navigation menu includes `HTML`, `CSS`, `JAVASCRIPT`, `SQL`, `PYTHON` (highlighted), `JAVA`, `PHP`, `HOW TO`, `W3.CSS`, `C`, `C++`, `C#`, `BOOTSTRAP`, `REACT`, and `MY`. The left sidebar lists the `Python Tutorial` topics, with `Python Intro` selected. The main content area features a Microsoft Azure advertisement with Korean text: "코딩, 테스트, 구축. 지속적으로 새로운 기술을 배우고 Azure를 체험해 보세요." Below the ad is the title `Python Introduction` and a `< Previous` button. The section `What is Python?` contains the text: "Python is a popular programming language. It was created by Guido van Rossum, and released in 1991." and "It is used for:" followed by a bulleted list: "web development (server-side), software development, mathematics, system scripting." The section `What can Python do?` contains a bulleted list: "Python can be used on a server to create web applications. Python can be used alongside software to create workflows. Python can connect to database systems. It can also read and modify files."

Python Tutorial

- Python HOME
- Python Intro
- Python Get Started
- Python Syntax
- Python Comments
- Python Variables
- Python Data Types
- Python Numbers
- Python Casting
- Python Strings
- Python Booleans
- Python Operators
- Python Lists
- Python Tuples
- Python Sets
- Python Dictionaries
- Python If...Else
- Python While Loops
- Python For Loops
- Python Functions
- Python Lambda
- Python Arrays
- Python Classes/Objects

Microsoft Azure 코딩, 테스트, 구축. 지속적으로 새로운 기술을 배우고 Azure를 체험해 보세요.

Python Introduction

[< Previous](#)

What is Python?

Python is a popular programming language. It was created by Guido van Rossum, and released in 1991.

It is used for:

- web development (server-side),
- software development,
- mathematics,
- system scripting.

What can Python do?

- Python can be used on a server to create web applications.
- Python can be used alongside software to create workflows.
- Python can connect to database systems. It can also read and modify files.

Why use Python for Algorithm



- ▶ Once you learn AL, you can proceed with AI easily using python

► Install Anaconda

- <https://docs.anaconda.com/anaconda/user-guide/getting-started/#nav-hello>
- Use Jupiter notebook to write your code

Agenda

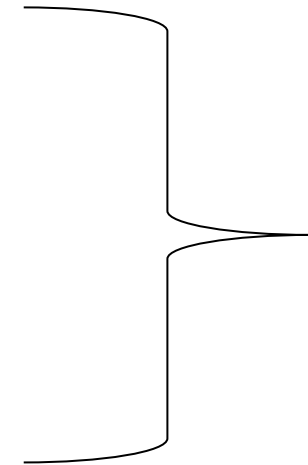
- ▶ Role of Algorithms
- ▶ Big O
- ▶ Recursion, Divide and Conquer
- ▶ Sorting Algorithms
- ▶ Dynamic Programming
- ▶ Matrix-Chain multiplication
- ▶ Greedy Algorithm
- ▶ **Mid Term**
- ▶ Binary Trees / Heap
- ▶ Graph
- ▶ Minimum Spanning Tree
- ▶ Shortest Path / Topological Sort
- ▶ **Final Term**

- ▶ **If we have time**
- ▶ Integer Linear Programming
- ▶ NP-Completeness

How Much Coding you will do ?

► **Assignment** - There will be several coding assignments during this course

- Basic Python Skills – 5 question (easy)
- Sorting – 2 questions (easy)
- Recursion – 2 question (medium)
- Dynamic Programming – 3 questions (easy , medium, hard)
- Greedy – 2 question (easy, medium)
- Graph – 2 question (medium, hard)



30% of your grades

► **Complexity of Assignment** -

- Easy
- Medium
- Hard

► **Queries related to coding should be directed to Technical Assistants**

► **I will show you sample code for algorithms as we go through each of them.**

Method for Assignment Submission

- ▶ Auto graded challenges – Through out the course 10 different challenges
- ▶ Tool used – Coderbyte.com
- ▶ The tool will auto grade your submission
- ▶ However, TAs, will make sure if the submitted assignment has best time complexity

Assignment Format

- ▶ You will receive an email for each assignment.
- ▶ Open this assignment, when you have enough time and energy to solve the challenge. Going back and forth with these assignment is not possible.

☆ Assessment from Gwangju Institute of Science and Technology

From: **Coderbyte** <do-not-reply@coderbyte.com> Add Block

To : ● <suman17@gist.ac.kr> Add

Sent time: 2023,08,25 15:40:35

🔒 Secure level ?

1 | 2 | 3 | 4 |
5

▶ Compose a mail to the appropriate body



_Hi there,

You have been invited to take an assessment on Coderbyte. Click the button below to get started,

Open Assessment

Learn how Coderbyte works before you begin the assessment with this [guide](#).

Please Enter Student ID here

- ▶ Enter Student ID, Do not change the default email address.

← → ↻ coderbyte.com/sl-candidate?inviteKey=Foy1zIA1Zb

Student ID

**Do not change
this email**



Gwangju Institute of Science and Technology
Assessment

Suman

suman17@gist.ac.kr

☐ I understand that once I begin this assessment I cannot leave and return to this assessment at a later time.

Begin Assessment

Time limit: Unlimited time

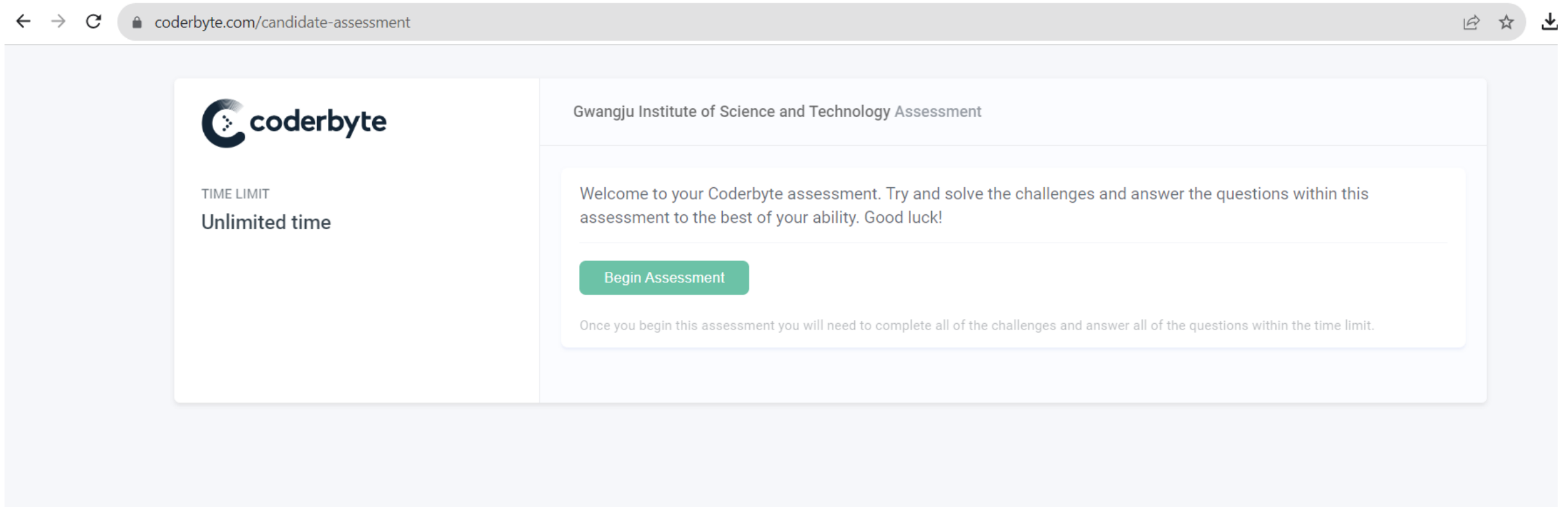
This organization has agreed to the [terms](#) with Coderbyte. Learn more about how your data is stored in our [privacy policy](#).



✓ Learn how Coderbyte works before you begin the assessment



Begin Submitting Assignment


- ▶ Begin the assignment, Mostly you will get entire weekend to solve your assignment. Unless I take a mock test, where I can limit the time.



Click on Begin Challenge

- ▶ Click on Begin Challenge.

← → ↻ coderbyte.com/candidate-assessment  



TIME LEFT
Unlimited time

Gwangju Institute of Science and Technology

Welcome to your Coderbyte assessment.

Submit Assessment

CHALLENGES INCOMPLETE

Assessment

CODING CHALLENGES

First Factorial	Begin Challenge
Array Addition I	Begin Challenge
sum of two numbers	Begin Challenge

Click on Begin Challenge

← → ↻ coderbyte.com/information/First%20Factorial



[View Assessment](#)

Challenge Information

Difficulty: Easy


Maximum Score: 10

Description: For this challenge you will be determining the factorial for a given number.

[BEGIN CHALLENGE →](#)

We run a script that is only activated on the editor page which will save your mouse movements and key presses. This allows your organization to see how you modify your code over time. The tracking is only performed on the next web page, so it will not occur on any other web page or website once you leave Coderbyte. For more information on how this works email us at support@coderbyte.com

Write your code, test your code and submit

 coderbyte

← Back to assessment | View instructions

easyTime left: Unlimited time

First Factorial

Have the function `FirstFactorial(num)` take the `num` parameter being passed and return the factorial of it. For example: if `num = 4`, then your program should return $(4 * 3 * 2 * 1) = 24$. For the test cases, the range will be between 1 and 18 and the input will always be an integer.

Examples

Input: 4
Output: 24

Input: 8
Output: 40320

Browse Resources

powered by Google

Search for any help or documentation you might need for this problem. For example: array indexing, Ruby hash tables, etc.

Python3

VimEmacsLightReset

```
1 def FirstFactorial(num):
2
3     # code goes here
4     return num
5
6 # keep this function call here
7 print(FirstFactorial(input()))
```

▶ Run CodeRun Test CasesSubmit

8

Auto-clearClear log

Python version: 3.9.17

Packages installed

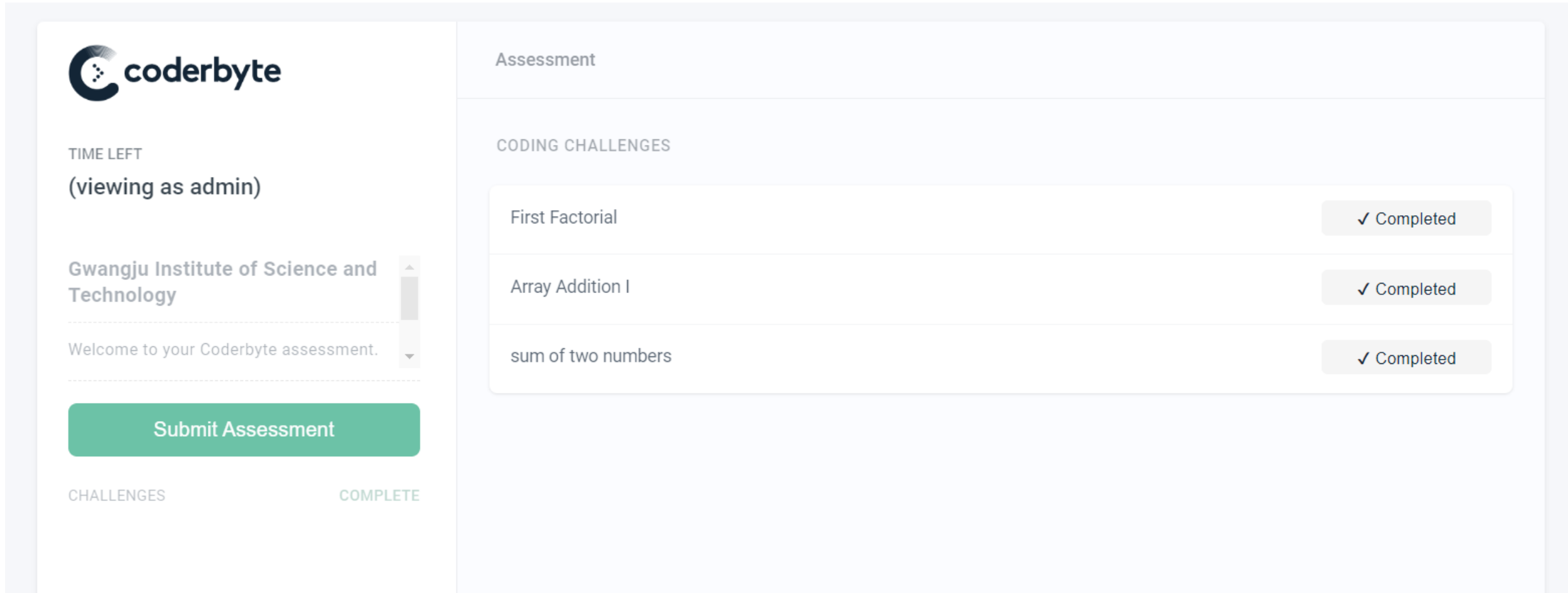
approvaltests
boto3
mysql
numpy
pandas
pyspark
pytest
requests
scikit-learn
scipy
tensorflow
torch
unittest

output logs will appear here

- ▶ Read and solve your challenge.
- ▶ You can run code, and provide input in the text box
- ▶ You can run all the test cases, at once, it will indicate if any test case is failing
- ▶ Fix your code and run it as many times as you like before clicking submit button

After completing all the challenge Submit Assignment

- ▶ After finishing all the assignment, you can click on Sumit Assignment



The screenshot displays the Coderbyte assessment interface. On the left sidebar, the Coderbyte logo is at the top, followed by 'TIME LEFT (viewing as admin)'. Below this is the institution name 'Gwangju Institute of Science and Technology' and a welcome message 'Welcome to your Coderbyte assessment.' A green 'Submit Assessment' button is positioned below the welcome message. At the bottom of the sidebar, there are two tabs: 'CHALLENGES' and 'COMPLETE'. The main content area is titled 'Assessment' and contains a section for 'CODING CHALLENGES'. This section lists three challenges, each with a '✓ Completed' status:

Challenge Name	Status
First Factorial	✓ Completed
Array Addition I	✓ Completed
sum of two numbers	✓ Completed

Professors Dashboard looks like this

Python Assessment

Created by pawantiwari@bitmesra.ac.in on Jul 05 2023

[Preview](#) ☒ [Edit](#)

Invite candidates (4/300 max) ?

john@email.com, sarah@email.com, ... (up to 50 email addresses)

Send private invite link

 OR

Copy public invite link

Assessment details

3

Challenges

0

Open-ended

0

Multiple choice

Candidate details

25%

Qualifying

4 invited

3 assessed

1 qualified

All candidates ▼

JSON Export

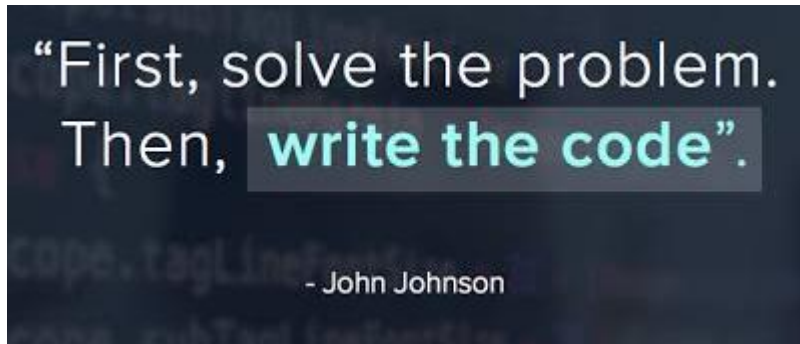
CSV Export

Search for candidates...

Name ↕	Email ↕	Status ↕	Joined ↕	Time Taken ↕	Final score ↕	Cheating ↕	Actions
20210234	suman17@gist.ac.kr ⚠	In progress	Aug 25	N/A	0%	Not detected	👍 👎 📄 View report ⋮
suman	suman17july@gmail.com	Submitted	Jul 06	N/A	83%	Not detected	👍 👎 📄 View report ⋮
-	pawantiwari@bitmesra.ac.in	Submitted	Jul 05	N/A	67%	Detected	👍 👎 📄 View report ⋮
-	suman17@gist.ac.kr	Invited (Aug 25)	-	N/A	N/A	N/A	⋮

Grading

- ▶ **Assignment – 30%**
- ▶ **Mid Term – 30%**
- ▶ **Final Term – 30%**
- ▶ **Class presence – 10%**



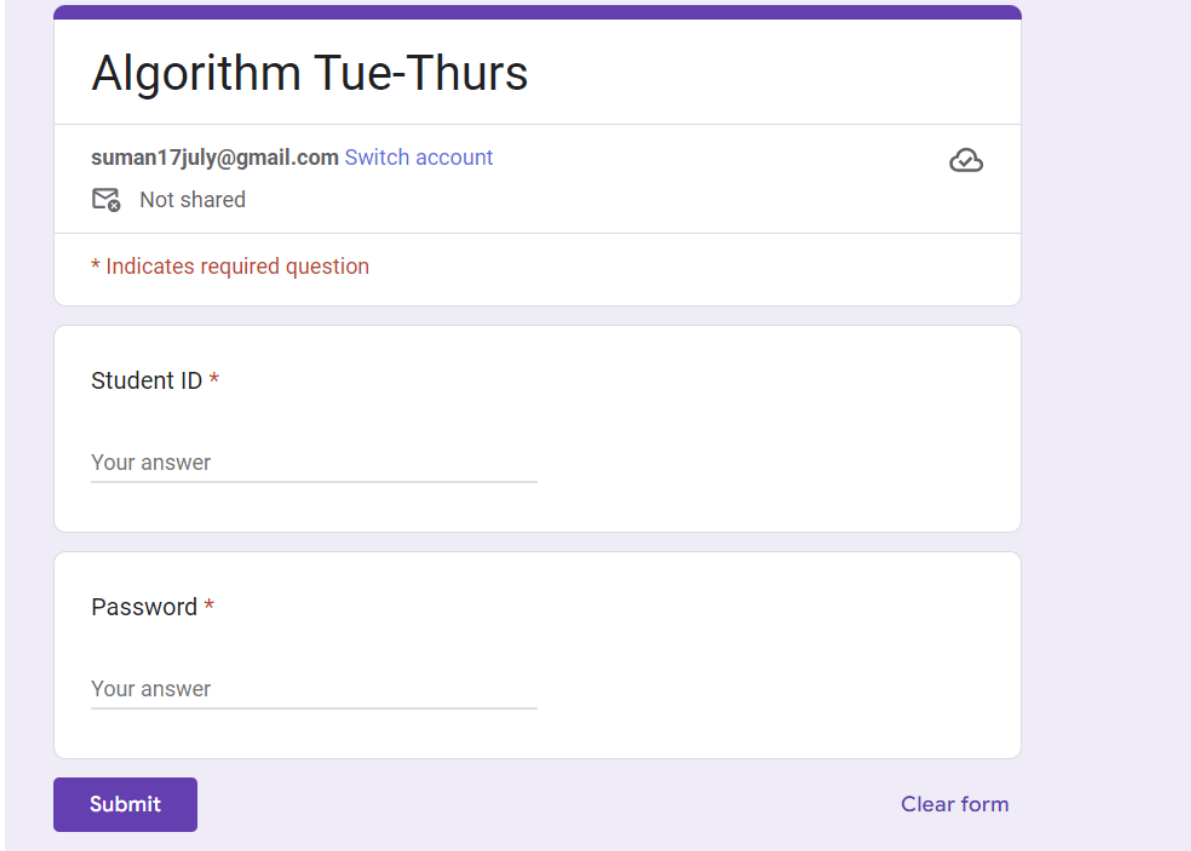
- ▶ I will first explain the algorithm, and then show you code
- ▶ There are two approach to this class
 - Mathematical
 - Coding
- ▶ Mathematical approach is great for writing paper and research articles
- ▶ Coding approach is better for preparing you for interview with big companies
- ▶ We will discuss both the approaches

Attendance

Attendance will be taken in Google form. Please fill your Student ID carefully. Password for the attendance will be announced in the class.

▶ [Algorithm Mon-Wed \(google.com\)](#)

▶ [Algorithm Tue-Thurs \(google.com\)](#)



The screenshot shows a Google Form titled "Algorithm Tue-Thurs". At the top, it displays the user's email "suman17july@gmail.com" with a "Switch account" link and a "Not shared" status. Below this is a legend indicating that an asterisk (*) denotes a required question. The form contains two text input fields: "Student ID *" and "Password *", each with a "Your answer" label and a text entry line. At the bottom left is a purple "Submit" button, and at the bottom right is a "Clear form" link.

Expectation from Students



Spoon feeding
teaches us nothing,
except the
shape of the spoon.

► Code Practice

- You should practice all the algorithm explained in the class by yourself, in order to do the assignment well
- There wont be any Spoon Feeding.
- Assignments will be re-evaluated by TA. Don't make their life hard. Do as expected.
- Copying code is not allowed, the tool comes with plagiarism checker,
A very heave -ve penalty will be given to your if caught

What is Algorithm?

It's a set of **computational steps**, that transforms **input** to **output**.

Algorithm should have
Definiteness, Finiteness,
Effectiveness

What kind of problems are solved using Algorithms

▶ Human Genome Project

- Given two sequence of symbols, find longest common subsequence (Matching two DNA stands)

▶ Internet

- Routing Algorithms
- Search engines

▶ Commerce

- Public-key cryptography
- Digital signature generations

▶ Maximizing profit

- Oil company- Where to put well to maximize profit
- Election candidate – where to campaign to win election
- Airlines – assign crew to flights in least expensive ways
- ISP – where to install 5G devices to provide best quality to mobile users

Difference between Data Structure and Algorithm

▶ Data Structure

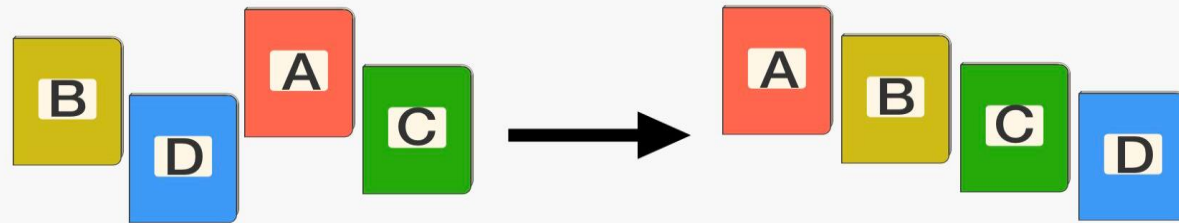
- It's a way to organize and store data.
- No Single data structure works well for all purposes.
- Its important to know the strength and limitations of several of them
- Ex – Arrays, Lists, Tree, Graph, Stack, Queues, Hash tables, Maps

▶ Algorithms

- Step by step procedure for performing a task.
- Specific data structure can help design a good algorithm to solve the problem
- Data structure is pre-requisite for Algorithm course

Lets Start

Sorting Algorithms



Types of Sorting Algorithm

	 Insertion	 Selection	 Bubble	 Shell	 Merge	 Heap	 Quick	 Quick3
 Random								
 Nearly Sorted								
 Reversed								
 Few Unique								

► Criteria to **test** an algorithm - No of Operations. – **Big O** notation

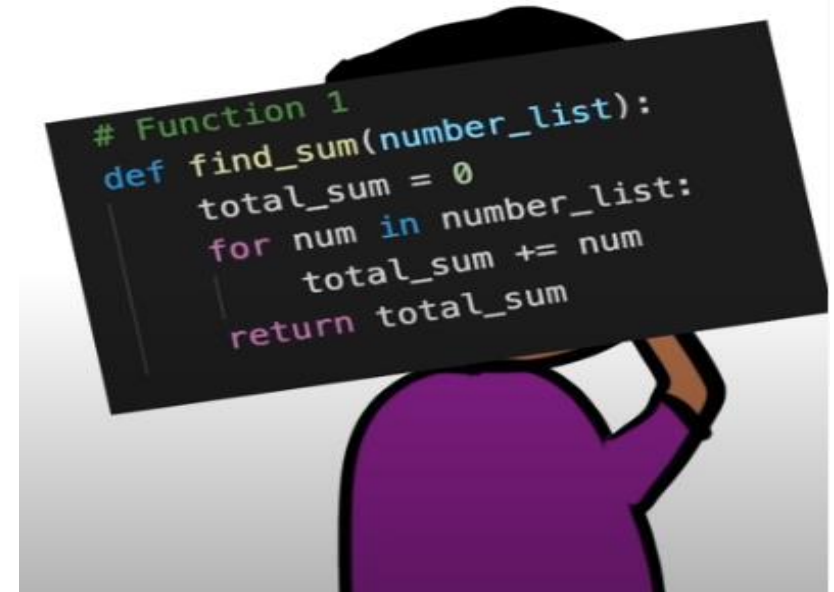
Big O

► Big O Notation

- A mathematical notation used to classify algorithms according to how their **run time** or space requirements grow **as the input size grows**.



- 1 Operation - **$O(1)$**

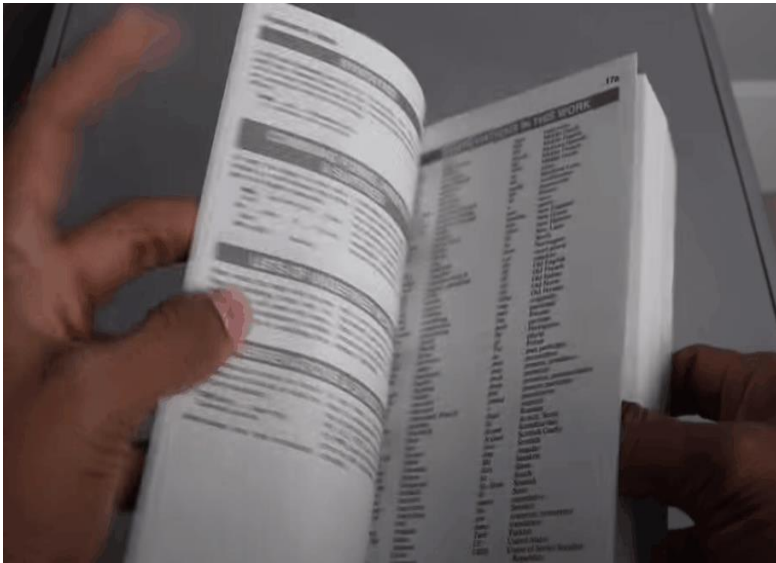


- n Operation - **$O(n)$**

Big O Searching Dictionary

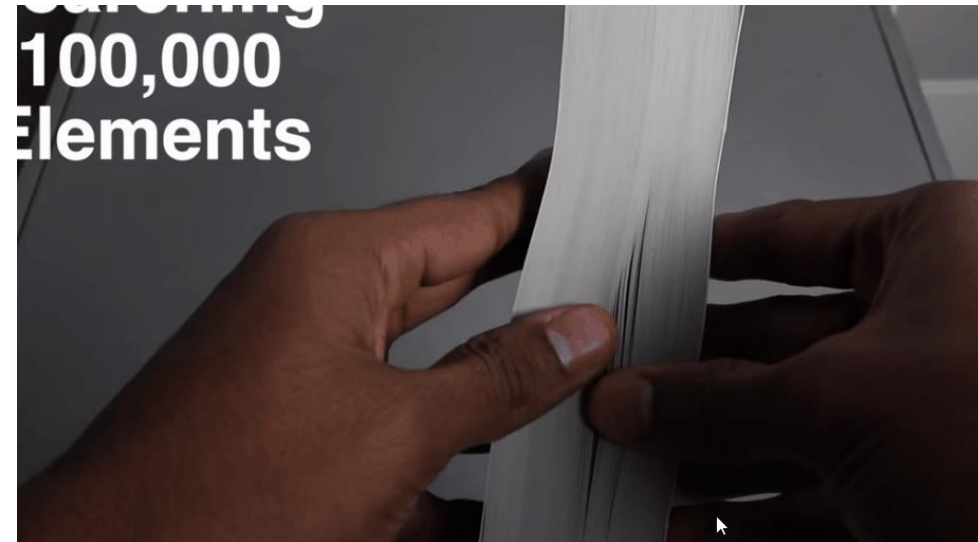
► Big O Notation

Sequential Search



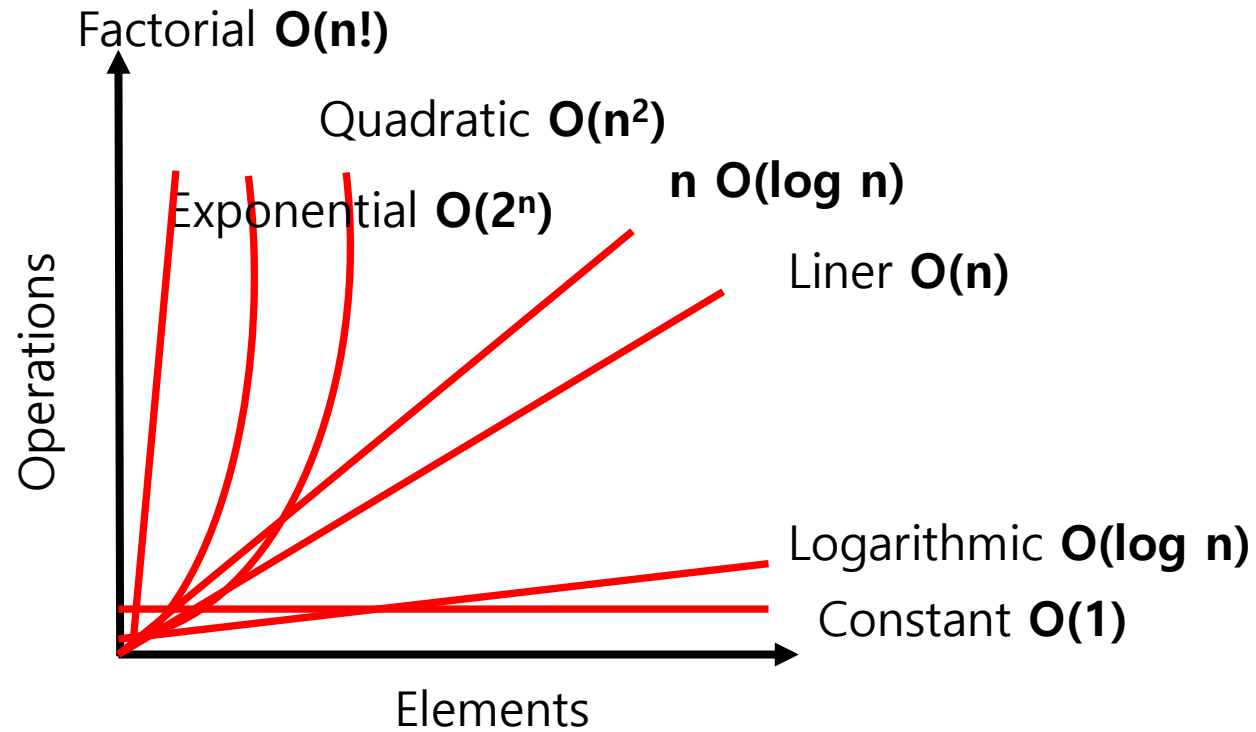
- 1 Operation - **$O(n)$**

Binary Search



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

Time Complexities of Big O



N: 17

$O(1)$: 1

$O(\log N)$: 4

$O(N)$: 17

$O(N^2)$: 289

$O(2^N)$: 131072

$O(N!)$: 3556874280960



Types of Sorting Algorithm

	 Insertion	 Selection	 Bubble	 Shell	 Merge	 Heap	 Quick	 Quick3
 Random								
 Nearly Sorted								
 Reversed								
 Few Unique								

- Criteria to **test** an algorithm - No of Operations. – **Big O** notation