



Introduction to Data Structures and Algorithm

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Intended Learning Outcomes

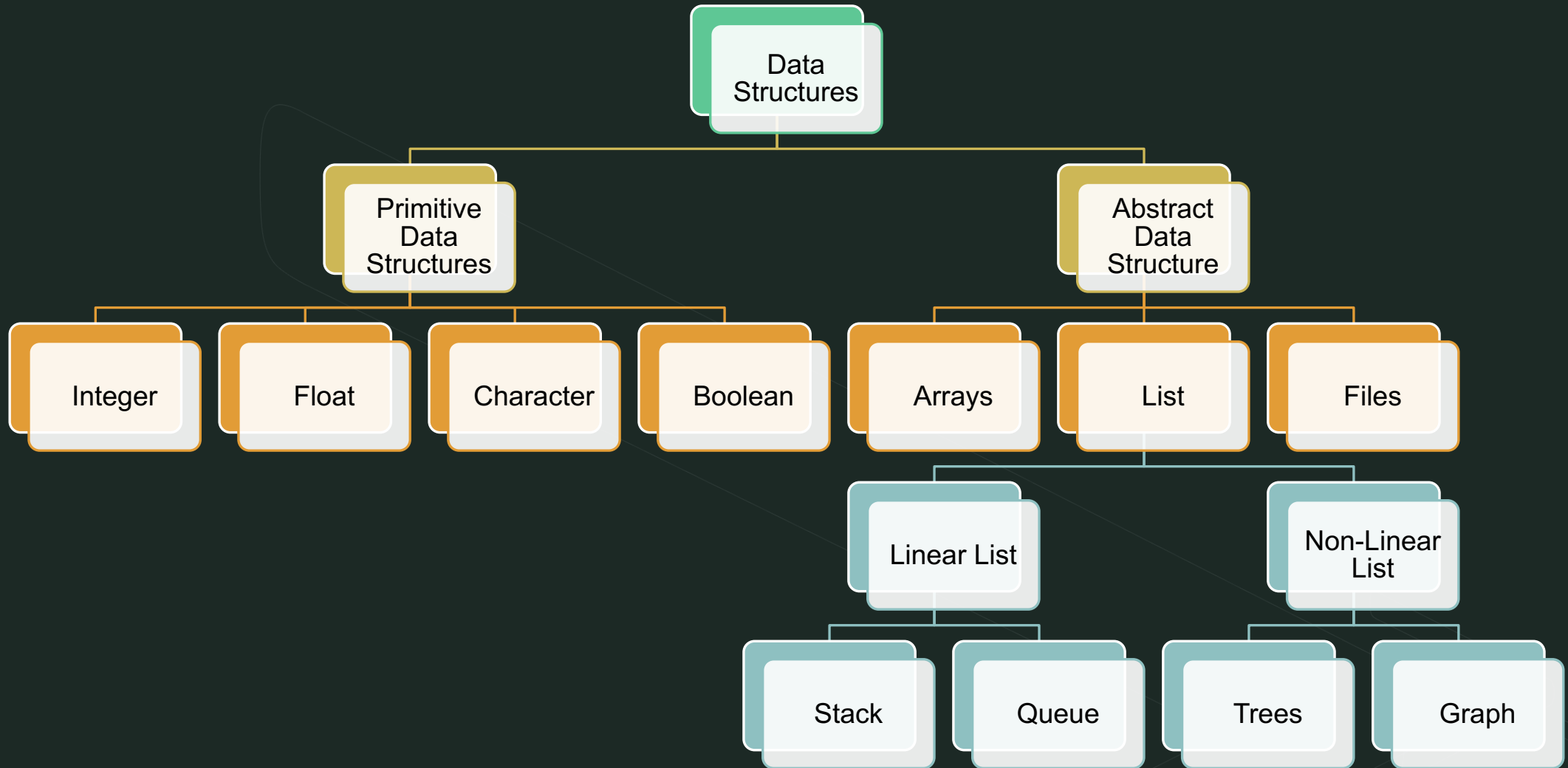
- Understand the underlying concepts about data structures and algorithms
- Identify different types of Data Structures and its characteristics
- Discuss the need for choosing and selecting data structures
- Determine the Data Structure Philosophy

What is Data Structure?

Name	Age	Price
Cortana	7	7,500.00
Kodu	3	10,000.00
Summer	12	25,000.00
Satoshi	10	12,000.00

- Is a way to effectively perform operations of the data that has been collected and organized.
- It is about rendering data elements in terms of some relationship, for better organization and storage.

Types of Data Structures



Classification of Data Structures (Characteristics)



Linear

Array, Stack,
Queue,
LinkedList



Non-Linear

Hierarchical
(Tree, Graph,
Trie, Heaps),
Matrix



Homogeneous

Array



Non- Homogeneous

Structure,
Record, Classes,
Union



Static

Array



Dynamic

Pointers,
LinkedList

Attributes of Data Structures



Name



Type



Size



Operations



Memory Address



Lifetime



Scope

Goals of Data Structures

Correctness

Efficiency

Features of Data Structure

- Robustness
- Adaptability
- Reusability



Efficiency

A solution is said to be efficient if it solves the problem within its resource constraints



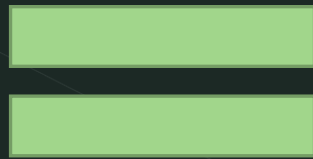
Space



Time

The Need for Data Structures

**Data
structures
organize
data**



**more efficient
programs**

The Need for Data Structures

Any organization for a collection of records can be *searched, processed in any order, or modified.*

Ex: Simple unordered array of records

Choosing **data structure and algorithm** can make the difference between a program running in a few seconds or many days.

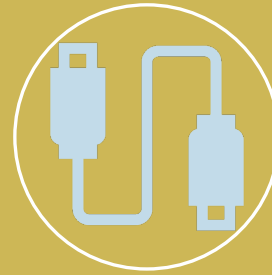
Selecting a Data Structure



**Analyze the
problem**



**Determine the
basic operations
that must be
supported.**



**Quantify the
resource
constraints for
each operation.**

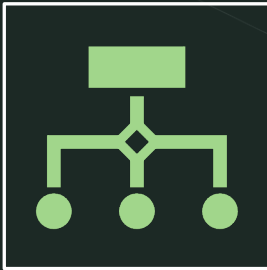


**Select the data
structure**

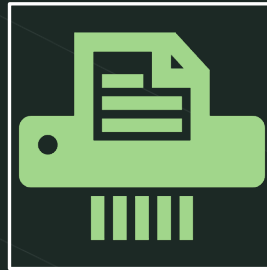


Selecting a Data Structure

Some questions we might ask often help to narrow the possibilities.



beginning, middle, or end



Can data be deleted?



Order or random

Data Structure Philosophy



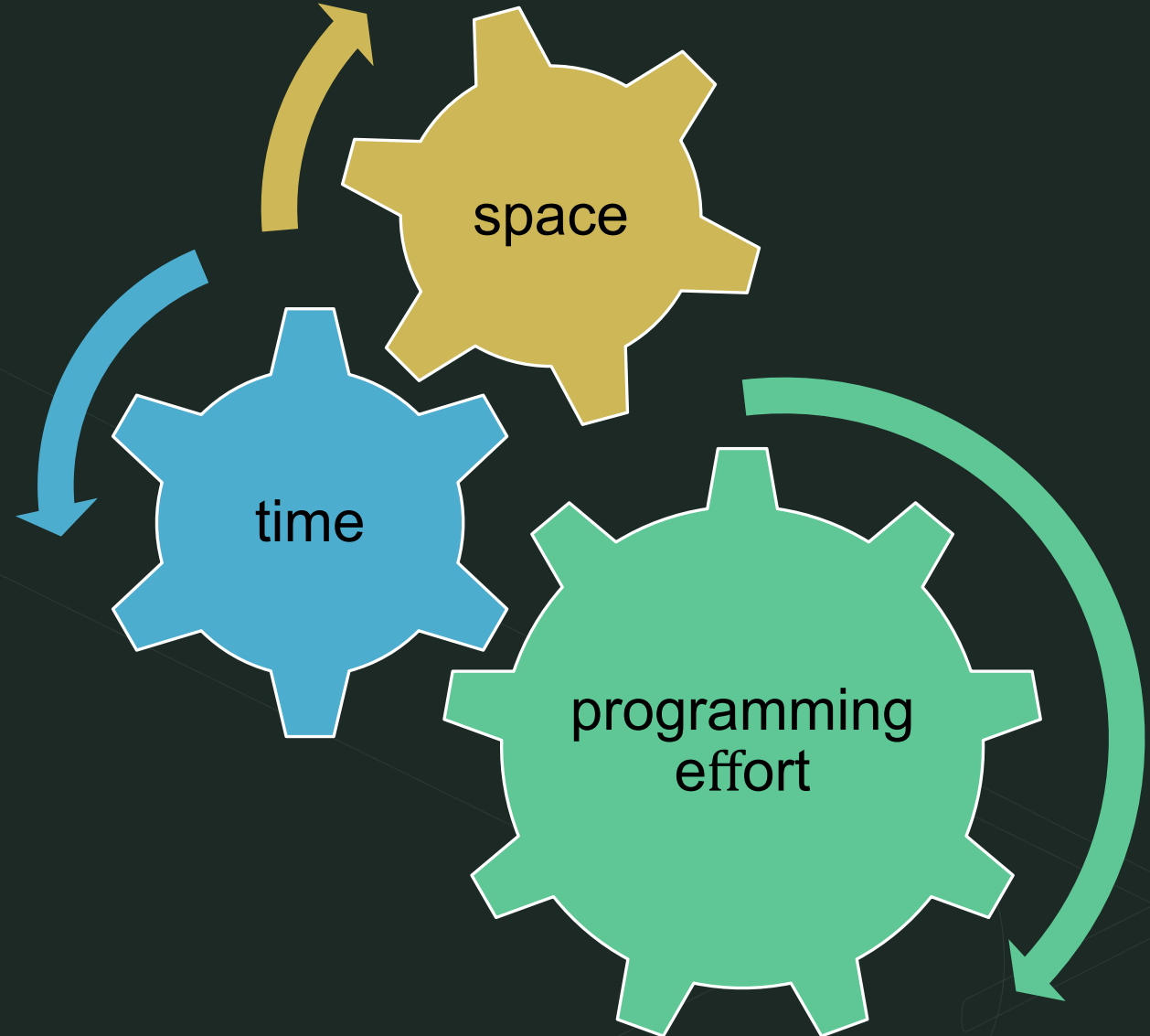
has costs and benefits.



doesn't solve all problems

Data Structure Philosophy

**A data
structure
requires:**



Data Structure Philosophy



**Each problem has
constraints on available
space and time.**



**Only after a careful analysis
of problem characteristics
can we know the best data
structure for the task.**

How About Algorithm?

Instructions

1. Combine chicken, soy sauce, and garlic in a large bowl. Mix well. ...
2. Heat a cooking pot. ...
3. When the oil is hot enough, pan-fry the marinated chicken for 2 minutes per side.
4. Pour-in the remaining marinade, including garlic. ...
5. Add dried bay leaves and whole peppercorn. ...
6. Add vinegar. ...
7. Put-in the sugar, and salt.

*a method or a process followed to solve a problem

Properties of Algorithm

- Input
- Output
- Definiteness
- Finiteness
- Correctness
- Computer-implementable instructions

Examples of Algorithm?



Sorting

Merge Sort, Quick Sort, Tim Sort, etc.



Searching

Linear Search, Binary Search.



Shortest Path:

Dijkstra's algorithm, Bellman-Ford algorithm



Note to every Programmer



There are costs and benefits for every data structure.



Learn the commonly used data structures.



Measure the effectiveness of a data structure or program.

Summary

- 1.Data Structure is about organizing and managing data
- 2.Algorithm is a step-by-step procedure to be followed to reach the desired output.
- 3.Understanding of memory allocation and space and time complexity to perform a specific operation on it.
- 4.Data Structures can use the same internal memory management and organization
- 5.Steps in an algorithm can use one or many data structure(s) to solve a problem.



Thank You