

CSE 1201

Data Structure

Week-1

Lecture 01

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Basic Terminology

Data: It is simply a value or set of values

Data Item: refers to single unit of values

Entity: It is something that has certain properties or attributes

Example: In an organization *Employee* is an entity, its attributes are (ID, Name, Age, Sex, Salary) etc.

Information: refers to meaningful or processed data.

Example: 21 is simply a data but if it is an age then it is an information

Field: One attribute refers to a field

Record: Several fields constitute a record

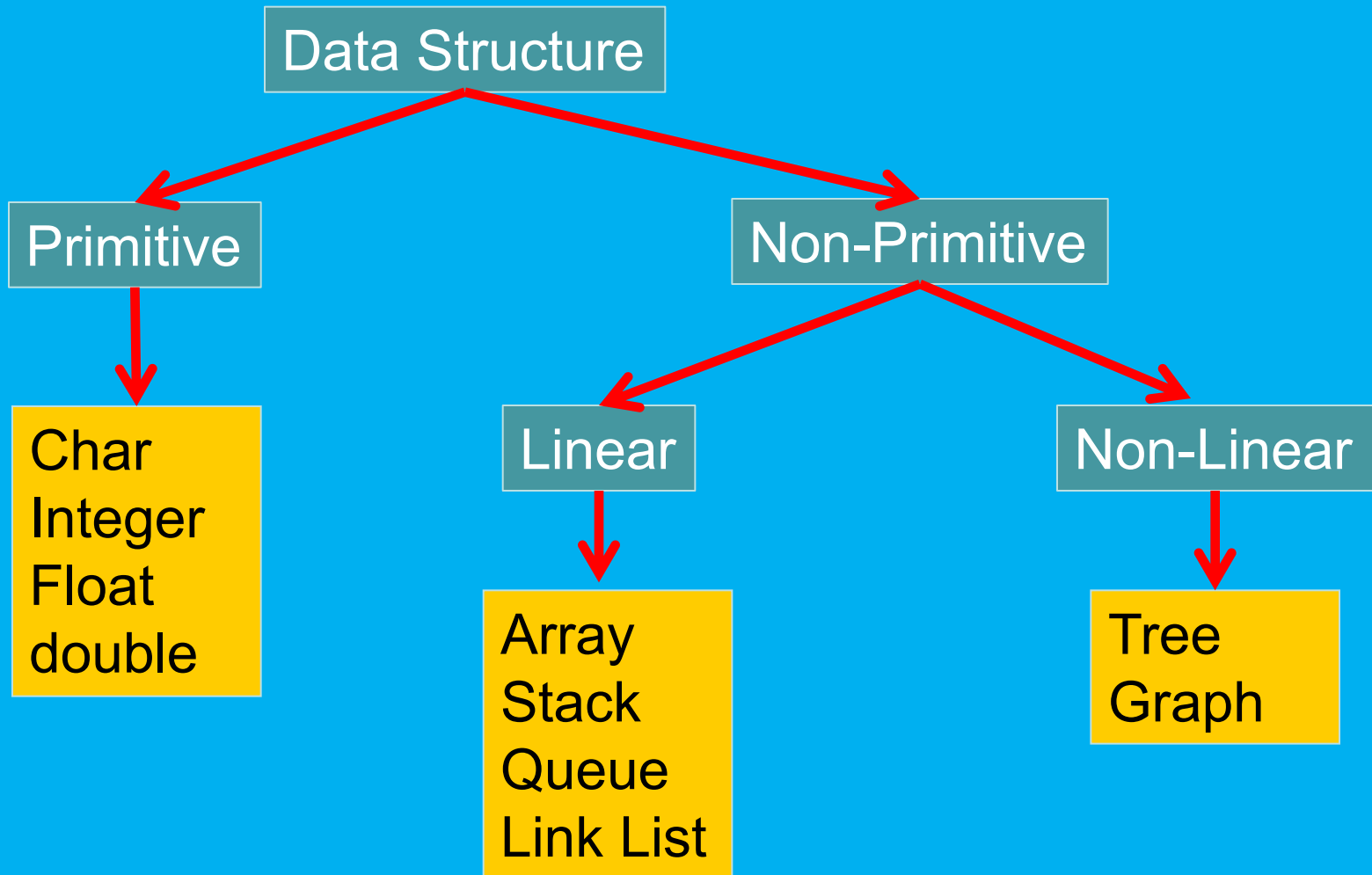
File: Several records constitute a file

Database: Several file makes a database

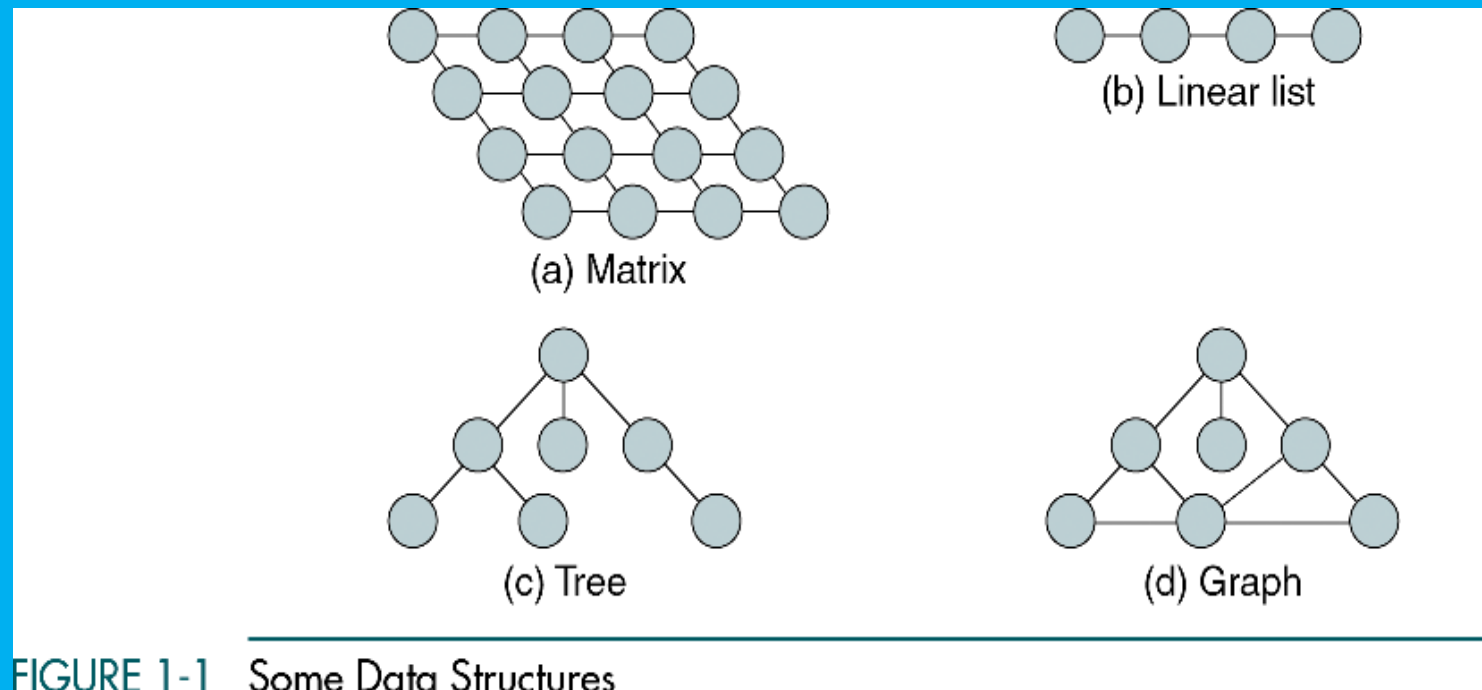
Key: a field that can uniquely identify a record (ID, Roll, SSN etc)

Basics of Data Structure

What is Data Structure : A data structure is a specialized format for organizing, processing, retrieving and storing data. DS Types



Example of Data Structure



Linear vs Non-Linear Data Structure

Linear data structure: A linear data structure traverses the data elements sequentially, in which only one data element can directly be reached. **Ex:** Arrays, Linked Lists

Non-Linear data structure: Every data item is attached to several other data items in a way that is specific for reflecting relationships. The data items are not arranged in a sequential structure. **Ex:** Trees, Graphs

Data Structure Operation

Four Basic Operations

1. **Traversing**:: Accessing each record exactly once so that certain items in the record may be processed.
2. **Searching**:: Finding the location of the record(s) with a given key value/conditions.
3. **Inserting**:: Adding a new record to the structure.
4. **Deleting**:: Removing a record from the structure.

Two Special Operations

1. **Sorting**:: Arranging the records in some logical order.
2. **Merging**:: Combining records from different files.

Abstract Data Type

- **Model** of a data type
 - Properties of the data
 - Operations that can be performed on that data
- **Definition:** *Abstract data type* (ADT) is a **mathematical model** with a collection of operations defined on that model.

Abstract Data Type (ADT)

**Data
Properties**

Operations

Example of Abstract Data Type (ADT)

• Integer

- ..., -4, -3, -2, -1, 0, 1, 2, 3, 4 ...

Integer ADT

Properties

- Number
- Negative / positive

Operations

- Addition
- Subtraction
- Multiplication
- Division

• SET

- {2,4,6,8,10}

SET ADT

Properties

- Group of elements

Operations

- Union
- Intersection
- Difference

- Implementation of an ADT means writing a program in a programming language.
- Data structure deals with the implementation of various ADTs.
- In this course we will examine mathematical model of various data types and implement those using C programming language.

Algorithm & Flow Chart

Algorithm is a step-by-step solution of problem

Flowchart is a pictorial presentation of an algorithm

Design Elements - Cross-Functional Flowcharts solution - Flowcharts Shapes



Process
Any processing function.



Sequential Data
Data that is accessible sequentially, such as data stored on magnetic tape.



Parallel Mode
Indicates the synchronization of two or more parallel operations.



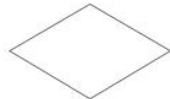
Terminator
Indicates the beginning or end of a program flow in your diagram.



Direct Data
Data that is directly accessible, such as data stored on disk drives.



Loop limit
Indicates the start of a loop. Flip the shape vertically to indicate the end of a loop.



Decision
Decision point between two or more paths in your flowchart.



Manual Input
Data that is entered manually, such as with a keyboard or barcode reader.



On-page Reference
Use this shape to create a cross-reference from one process to another on the same page of your flowchart.



Document
Data that can be read by people, such as printed output.



Card
Data that is input by means of cards, such as punch cards or mark-sense forms.



Off-page Reference shapes
Use this shapes to create a cross-reference and hyper link from a process on one page to a process on another page.



Data
Can represents any type of data in a flowchart.



Paper Tape
Data that is stored on paper tape.



Yes/No decision indicators



Predefined Process
A named process, such as a subroutine or a module.



Display
Data that is displayed for people to read, such as data on a monitor or projector screen.



Condition



Stored Data
Any type of stored data.



Manual Operation
Any operation that is performed manually (by a person).



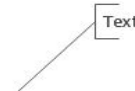
Control Transfer
A location in your diagram where control is transferred. The triangle can be positioned anywhere on the line.



Internal Storage
An internal storage device.



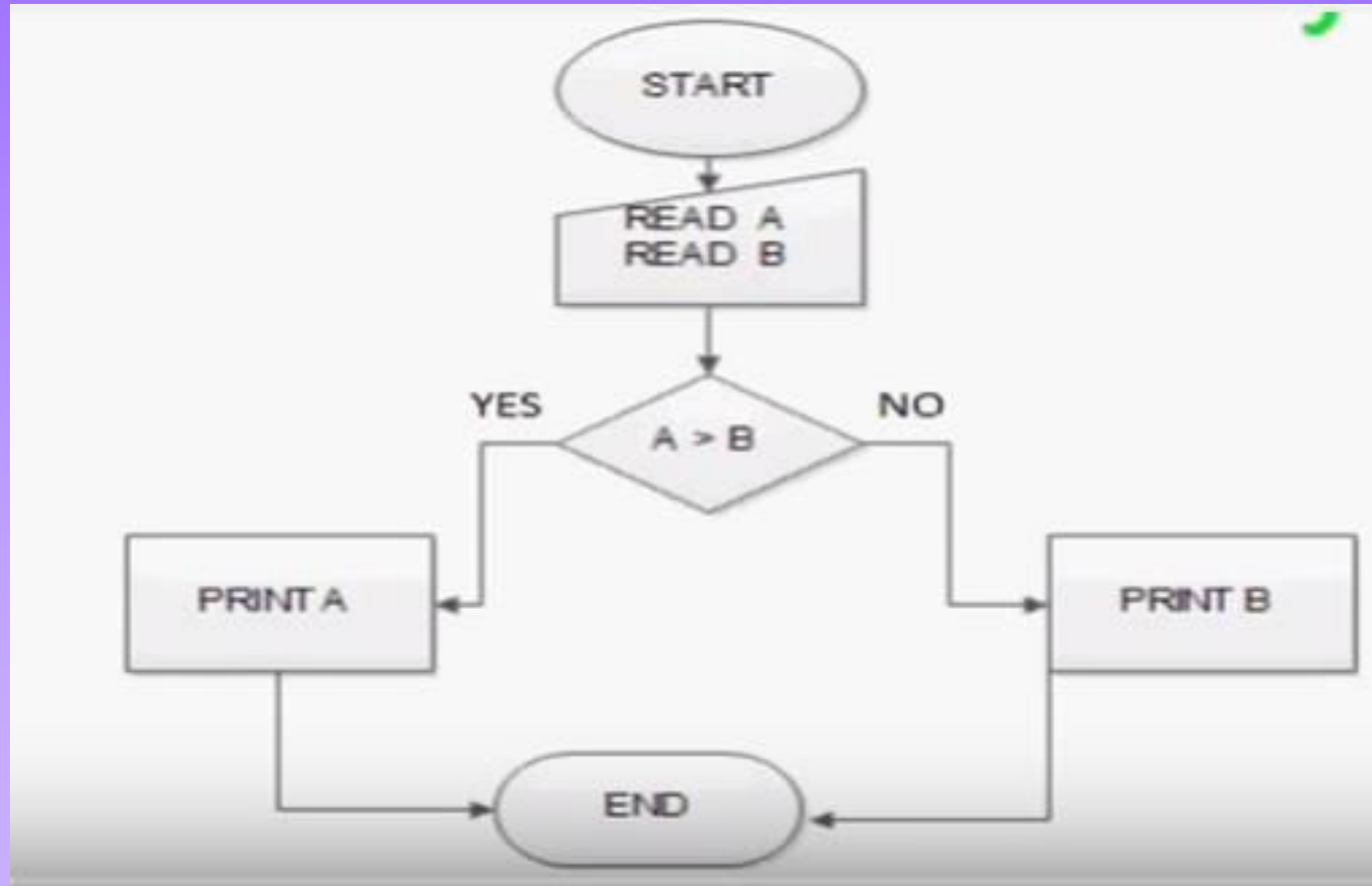
Preparation
A modification to a process, such as setting a switch or initializing a routine.



Annotation
Adjustable text box with bracket you can use to add callouts or notes. Bracket height adjusts as text is typed.

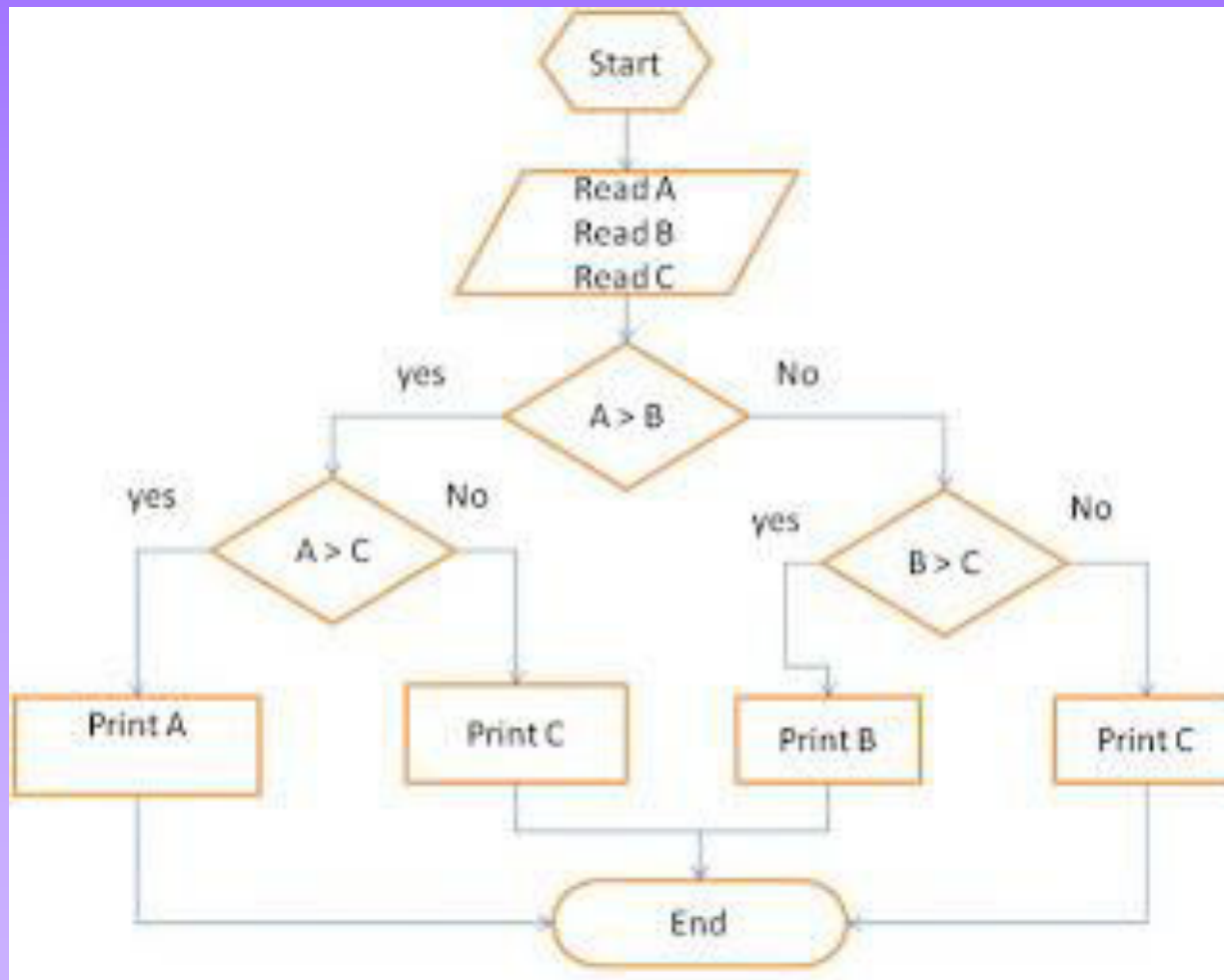
Examples of Flow Chart

Prob: Find the bigger between two numbers.



Examples of Flow Chart

Prob: Find the biggest among three numbers.



Algorithms: Complexity, Time-Space Tradeoff

Complexity: The complexity of an algorithm is the function which gives the running time and/or space in terms of input size.

Time-Space Trade-Off in Algorithms: A tradeoff is a situation where one thing increases and another thing decreases. It is a way to solve a problem in:

- Either in less time and by using more space, or
- In very little space by spending a long amount of time.

The best Algorithm is that which helps to solve a problem that requires less space in memory and also takes less time to generate the output.



Quiz Time

Let's have
some fun!

Q1: A(n) _____ has different properties

A

Field

B

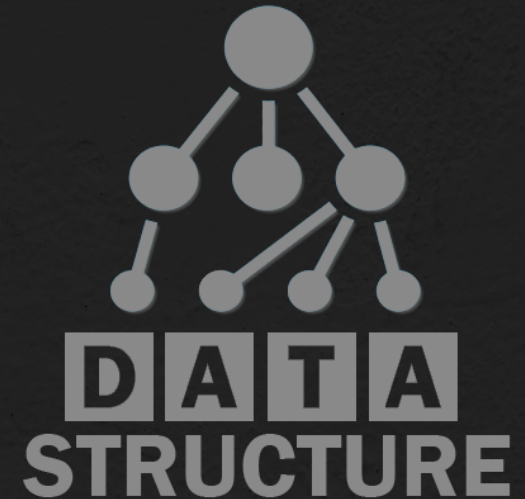
Entity

C

File

D

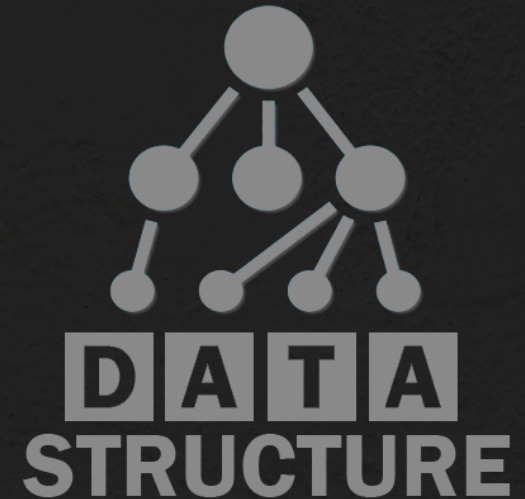
Record



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Q2: Which is NOT a primitive data structure?

- A** Boolean
- B** Arrays
- C** Integer
- D** Character



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Q2: Which is a non-linear data structure?

A Arrays

B List

C Stack

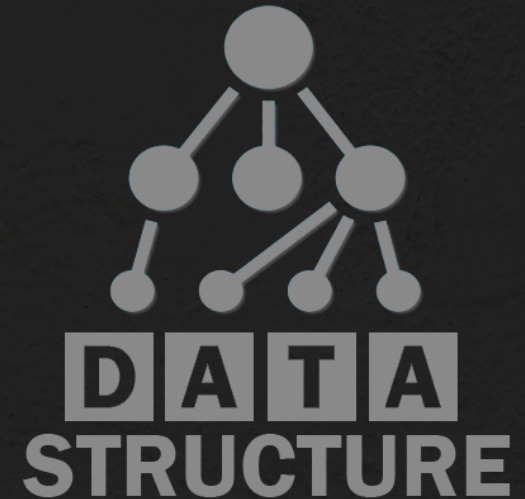
D Graph



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Q4: Which operation accesses each record exactly once so that contain item may be processed?

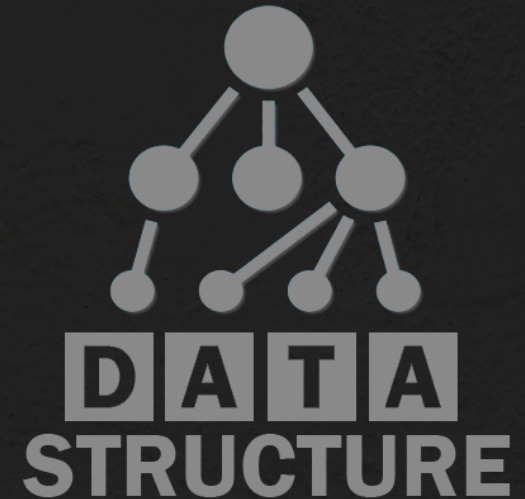
- A** Inserting
- B** Deleting
- C** Searching
- D** Traversing



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Q5: _____ involves arranging the records in a logical order

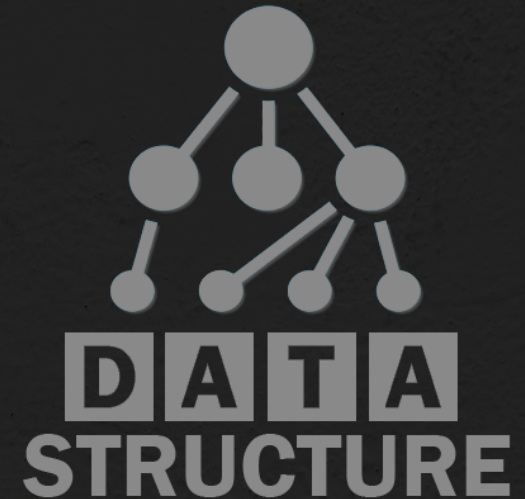
- A** Merging
- B** Sorting
- C** Searching
- D** Traversing



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Q6: Complexity is a function of _____

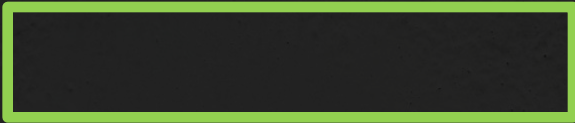
- A** Input data size
- B** Output data size
- C** Amount of time taken
- D** Total space taken



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Q7: Which symbol is used for decision making?

A



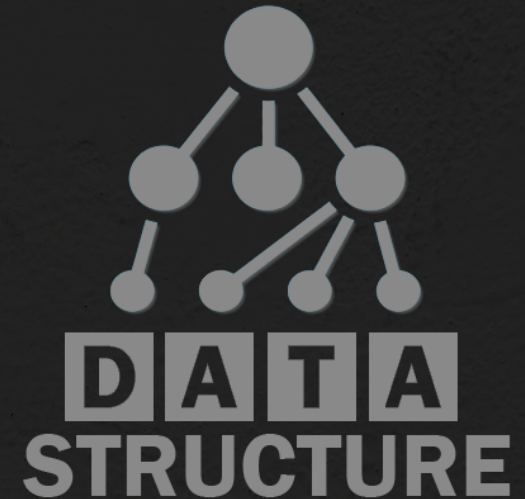
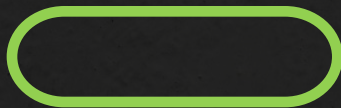
B



C



D



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Q8: Identify the device?

A

HDD

B

SDD

C

SSD

D

RAM



HDD

SSD

- | | |
|---|--|
| <input checked="" type="checkbox"/> More Physical Damage | <input checked="" type="checkbox"/> Less Physical Damage |
| <input checked="" type="checkbox"/> Noisy, Vibrate, Hot | <input checked="" type="checkbox"/> No Noise/Vibration or Heat |
| <input checked="" type="checkbox"/> Consumes More Power | <input checked="" type="checkbox"/> Consumes Less Power |
| <input checked="" type="checkbox"/> Bootup 30-40 Sec | <input checked="" type="checkbox"/> Bootup 10-13 Sec |
| <input checked="" type="checkbox"/> Write = 50-120MBps | <input checked="" type="checkbox"/> Write = 200-500MBps |
| <input checked="" type="checkbox"/> File Opens 30% Slower | <input checked="" type="checkbox"/> 30% Faster than HDD |
| <input checked="" type="checkbox"/> 1TB HDD = 5-7k BDT | <input checked="" type="checkbox"/> 1TB SSD = 30-32k BDT |

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