Data Structures Introduction

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Class	Data Struct
Type	Lecture
Materials	
Reviewed	☑

Definitions

- **Data (plural) / datum (singular)**- means value or set of values;
- **Data Item**

  - a single unit of value

  -A collection of data may be organized into fields, records or file
- **Entity**

  - something that has attributes or properties which may be assigned values

  -similar entities may be grouped together to form an entity set
- **Field** - a single elementary unit of information representing an attribute of an entity
- **Record** - is the collection of field values of a given entity
- **File**

  - is a collection of records of the entities in a given entity set

  -A value in a certain field which may uniquely determine the record in the file is called **Primary Key**

Data Structure

- It is a logical mathematical model of a particular organization of data
- It is a collection of related data set of values for organizing and accessing it

Note: the choice of a particular data model depends on the following

1. It must be rich in structure to mirror the actual relationships of the data in the real world
2. It must be simple enough that one can effectively process the data when necessary

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Algorithm

- - is a procedure in terms of the action to be executed and the order in which these actions are to be executed
- according to **Niklaus Wirth** “Data Structure + Algorithms = Program”

Complexity of Algorithms

1. **Time Complexity**

   - the number of steps executed by an algorithm

   - length of code affects the run time

   -influenced by the use of loops

2. **Memory Complexity**

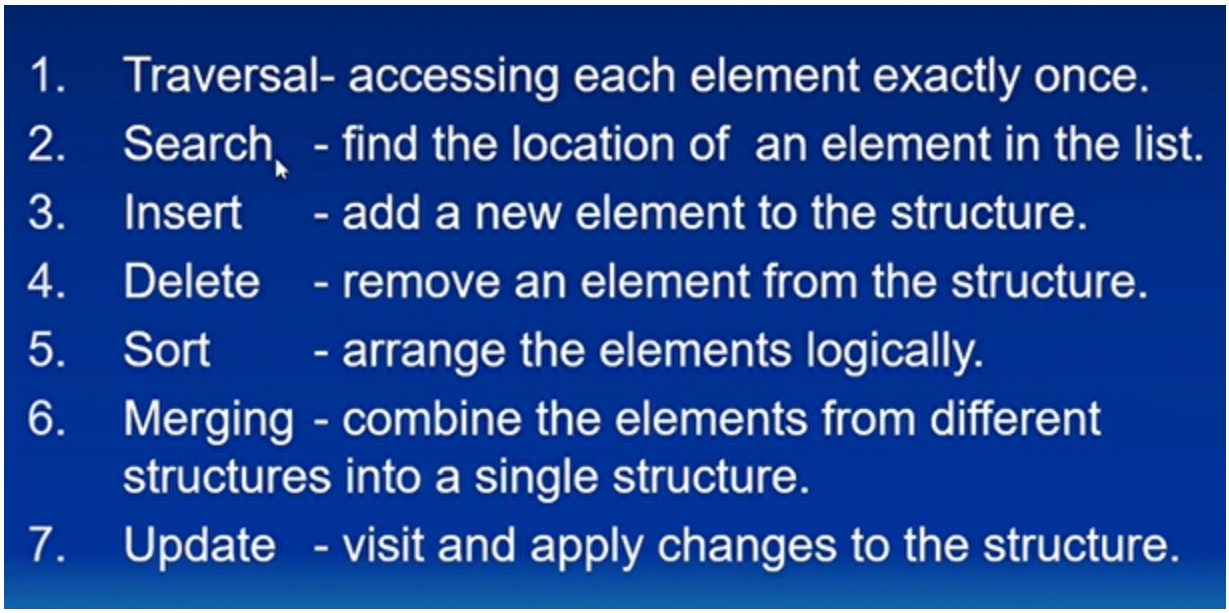
   - the amount of memory needed in the execution of an algorithm

   -solution requires a lot of space due to buffering

Factors affecting the running time of a Program

1. The input to the program
2. The quality of code generated by the compiler to create the object code
3. The nature and speed of the instructions on the machine used to execute the program (ang hardware)
4. The time complexity of the algorithm underlying the program **(factor a programmer can control)**

Basic Data Structure Operations:



Types of Data Structures

1. **Arrays**

   -group of contiguous/continuous memory locations that all have the same name and the same type

   -Its elements are stored consecutively

   -when you do an operation, you should do it within the data

2.**Linked List**

   -a linear collection of homogeneous data elements which are not necessarily stored consecutively

   -Its elements are called **NODES which has 2 parts**

   - **INFO part**
   - **Linkfield or Nextfield pointer** which contains the address of its next element
   - There is also a special value **Start/Head** that contains the address of the list element in the list

3.**Stack**

   -A linear collection of homogeneous elements wherein an element maybe added or removed from only one end called **TOP**

-It is also called:

- **LIFO structure:** Last In First Out
- **Push** to insert an element in a stack
- **POP** to delete an element in a stack

3.**Queue**

-A linear structure in which insertion and deletion are done at different ends of the list

-**insertion** at the End, **deletion** at the Front

-called a **FIFO structure** (First In First Out)

5.**Tree**

-a nonlinear structure which consists of a finite set of elements called **nodes**

-if the tree in nonempty, it has a root but every other node can be reached from it by following a unique sequence of connective arcs

6.**Graph**

-consists of a set of **nodes** (vertices) and a set of **arcs** (edges)

-each arc in a graph is specified by a pair of nodes

> *a tree is a graph, but a graph cannot be a tree*
