DATA STRUCTURES AND ALGORITHMS

INTRODUCTION

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Content

- Basic terminologies of data structure
- Elementary data vs. group data
- Data Structure
- Introduction to different data structures
- Basic Operation on different Data structures

Introduction

- Data are simply values or set of values
  - {16, 17, 14, 10, 5}
- A data item refers to a single unit of values e.g. 10
- Data item can be of two types
  - Elementary Data: data items which cannot be divided into sub items
    - e.g. Gender, Total items, Price, Year, Roll #
  - Group Data: data items which can be divided into sub items
    - E.g. Name: First Name, Middle Name, Last Name
    - Date: Day, Month, Year
    - Address??

Data Management

- These data values can be stored in main memory of the computer (RAM) or it can be permanently stored in secondary storage unit as files or tabular database.
- This course covers the first case i.e. data storage in main memory

Data Structure

- The logical or mathematical model of a particular organization of data is called data structure.
- There are various data structures, each have their own properties
  - Arrays
  - Link Lists
  - Stack
  - Queue
  - Trees
  - Graphs etc.
- The choice of particular data structures depends on two consideration
  - It must be rich in structure to reflect the true relationship of the data in the real world
  - The structure should be simple enough that one can effectively and efficiently process the data when required.

Introduction to different data structures

- Arrays (Linear Array): A set of similar types of data items

	STUDENT
1	Ayesha
2	Suleman
3	Sheraz
4	Aimen
5	Fatime
6	Umair

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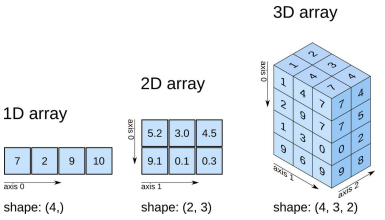
Introduction to different data structures (Cont…)

- Arrays



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Introduction to different data structures (Cont…)

- Arrays (Multi-dimensional Array):

		Stores			
		s1	s2	s3	s4
Department	d1	2872	805	3211	1560
	d2	2196	1123	4310	2111
	d3	3000	2134	3365	1090
	…	…	…	…	…
	d28	2618	1500	3111	2189

Weekly sale of four different department in 28 different stores

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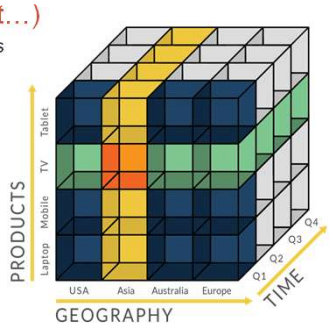
Introduction to different data structures (Cont…)

- Arrays



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Introduction to different data structures (Cont…)

- Link List: Lets introduce it with an example of a company that maintains a file where each record contains a customer and his/her salesperson

	Customers	Salesperson
1	Ahmed	Suleman
2	Bilal	Raheel
3	Basit	Junaid
4	Danish	Raheel
5	Ehsan	Suleman
6	Farhan	Junaid
7	Ghazanfer	Raheel
8	Haris	Suleman
9	Ibrahim	Raheel

Repetition of data items so, its not an efficient way of storing this type of information

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Introduction to different data structures (Cont…)

	Customers	Salesperson
1	Ahmed	3
2	Bilal	2
3	Basit	1
4	Danish	2
5	Ehsan	3
6	Farhan	1
7	Ghazanfer	2
8	Haris	3
9	Ibrahim	2

Salesperson	
Junaid	1
Raheel	2
Suleman	3

Better representation because integer pointers require less space as compared to string data

If a company wants list of customers for a specific salesperson then how many rows needs to be checked? (ALL which is not efficient)

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Introduction to different data structures (Cont…)

	Customers
1	Ahmed
2	Bilal
3	Basit
4	Danish
5	Ehsan
6	Farhan
7	Ghazanfer
8	Haris
9	Ibrahim

	Salesperson	Pointer
1	Junaid	3,6
2	Raheel	2,4,7,9
3	Suleman	1,5,8

Searching is efficient now!

Problem: Each salesperson may have many pointers and the set of pointers will change as customers are added or deleted

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Introduction to different data structures (Cont…)

- Link List

	Customers	Link
1	Ahmed	5
2	Bilal	4
3	Basit	6
4	Danish	7
5	Ehsan	8
6	Farhan	0
7	Ghazanfer	9
8	Haris	0
9	Ibrahim	0

Salesperson	Pointer	
Junaid	3	1
Raheel	2	2
Suleman	1	3

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Introduction to different data structures (Cont…)

- Queue : First In First Out (FIFO) or Last In Last Out (LILO)

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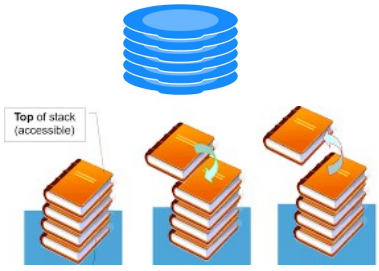
Introduction to different data structures (Cont…)

- Stack: First In Last Out (FILO) or Last In First Out (LIFO)



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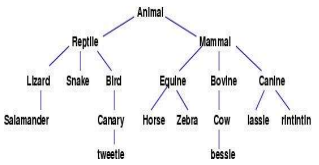
Introduction to different data structures (Cont…)

- Trees

1. Animal
   2. Reptile
      3. Lizard
         4. Salamander
      3. Snake
      3. Bird
         4. Canary
            5. Tweetle
   2. Mammal
      3. Equine
         4. Horse
         4. Zebra
      3. Bovine
         4. Cow
            5. Bessle
      3. Canine
         4. Lassle
         4. Rintintin



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Introduction to different data structures (Cont…)

- Graphs: Cycles are allowed.

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Basic Operation

- Traversing: To visit each data element once
- Searching: To look for some data element
- Insertion: To add an element
- Deletion: To remove an element
- Sorting: To arrange data in some order
- Merging: To combine data elements of similar data structure.

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Thank You