CSE-281: Data Structures and Algorithms

Data Structures
(Chapter-1)

Ref: Schaum's Outline Series, Theory and problems of Data Structures
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Arrays

- The simplest type of data structure is a linear (or one-dimensional) array.
- list of a finite number n of similar data elements referenced respectively by a set of n consecutive numbers, usually 1, 2, 3, ..., n.

- choose the name A for the array, then the elements of A are denoted by bracket notation

A[1], A[2], A[3]..... A[N]

- the number K in A[K] is called a subscript and A[K] is called a subscripted variable.

Example

- A linear array STUDENT consisting of the names of six students is pictured in Table. Here STUDENT[1] denotes John Brown, STUDENT[2] denotes Sandra Gold, and so on.

	STUDENT
0	Jhon Brown
1	Sandra Gold
2	Akbar
3	AB De
4	Alan Smith
5	Tom Jones

Example

- Linear arrays are called one-dimensional arrays because each element in such an array is referenced by one subscript.

- A two-dimensional array is a collection of similar data elements where each element is referenced by two subscripts.

- Example 2
- A chain of 28 stores, each store having 4 departments, may list its weekly sales (to the nearest dollar)., then

Example

Store \ Dept.	1	2	3	4
1	2872	805	3211	1560
2	2196	1223	2525	1744
3	3257	1017	3686	1951
. . .	. . .	. . .	. . .	. . .
28	2618	931	2333	982

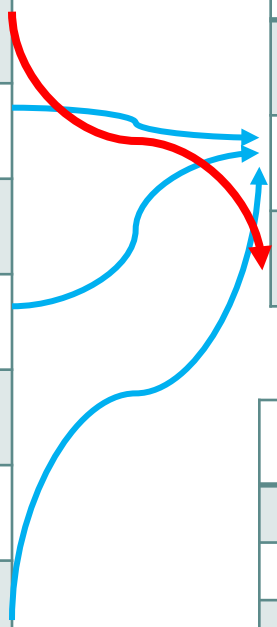
SALES[1, 1] = 2872,
SALES[1, 2] = 805,
SALES[1, 3] = 3211,
SALES[28, 4] = 982

Linked Lists

	Customer	Salesperson
1	Adams	Smith
2	Brown	Ray
3	Clark	Jones
4	Drew	Ray
5	Evans	Smith
6	Farmer	Jones
7	Geller	Ray
8	Hill	Smith
9	Infeld	Ray

Linked Lists

	Customer	Pointer
1	Adams	3
2	Brown	2
3	Clark	1
4	Drew	2
5	Evans	3
6	Farmer	1
7	Geller	2
8	Hill	3
9	Infeld	2

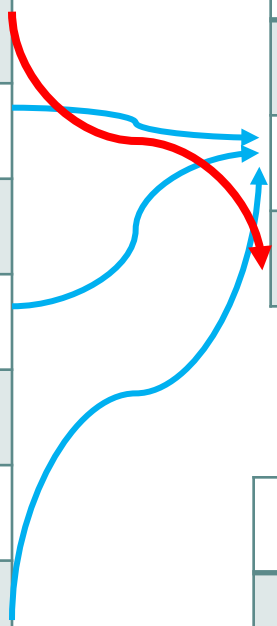


Salesperson	
Jones	1
Ray	2
Smith	3

	Customer	Salesperson
1	Adams	Smith
2	Brown	Ray
3	Clark	Jones
4	Drew	Ray
5	Evans	Smith
6	Farmer	Jones
7	Geller	Ray
8	Hill	Smith
9	Infeld	Ray

Linked Lists

	Customer	Pointer
1	Adams	3
2	Brown	2
3	Clark	1
4	Drew	2
5	Evans	3
6	Farmer	1
7	Geller	2
8	Hill	3
9	Infeld	2



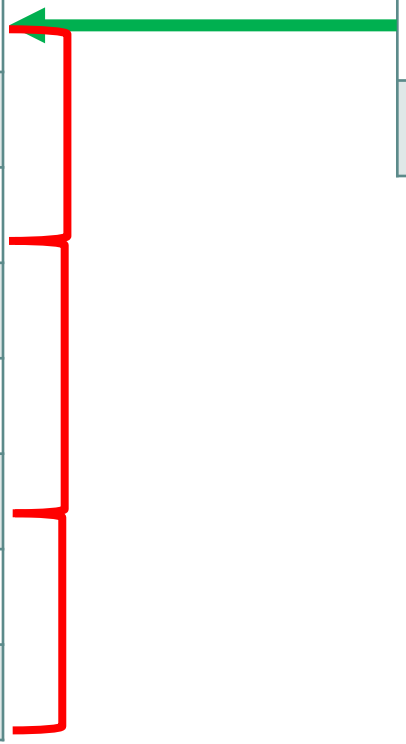
Salesperson	
Jones	1
Ray	2
Smith	3

Salesperson	pointer
Jones	3, 6
Ray	2, 4, 7, 9
Smith	1, 5, 8

Linked Lists

	Customer	Link
1	Adams	5
2	Brown	4
3	Clark	6
4	Drew	7
5	Evans	8
6	Farmer	0
7	Geller	9
8	Hill	0
9	Infeld	0

Salesperson	pointer
Jones	3
Ray	2
Smith	1



Linked Lists

- Although the terms "pointer" and "link" are usually used synonymously,
- we will try to use the term "pointer" when an element in one list points to an element in a different list,
- and to reserve the term "link" for the case when an element in a list points to an element in the same list

Trees

- Data frequently contain a hierarchical relationship between various elements.
- The data structure which reflects this relationship is called a rooted tree graph or, simply, a tree.

- For example, an employee personnel record may contain the following data items:
- Social Security Number, Name, Address, Age, Salary, Dependents

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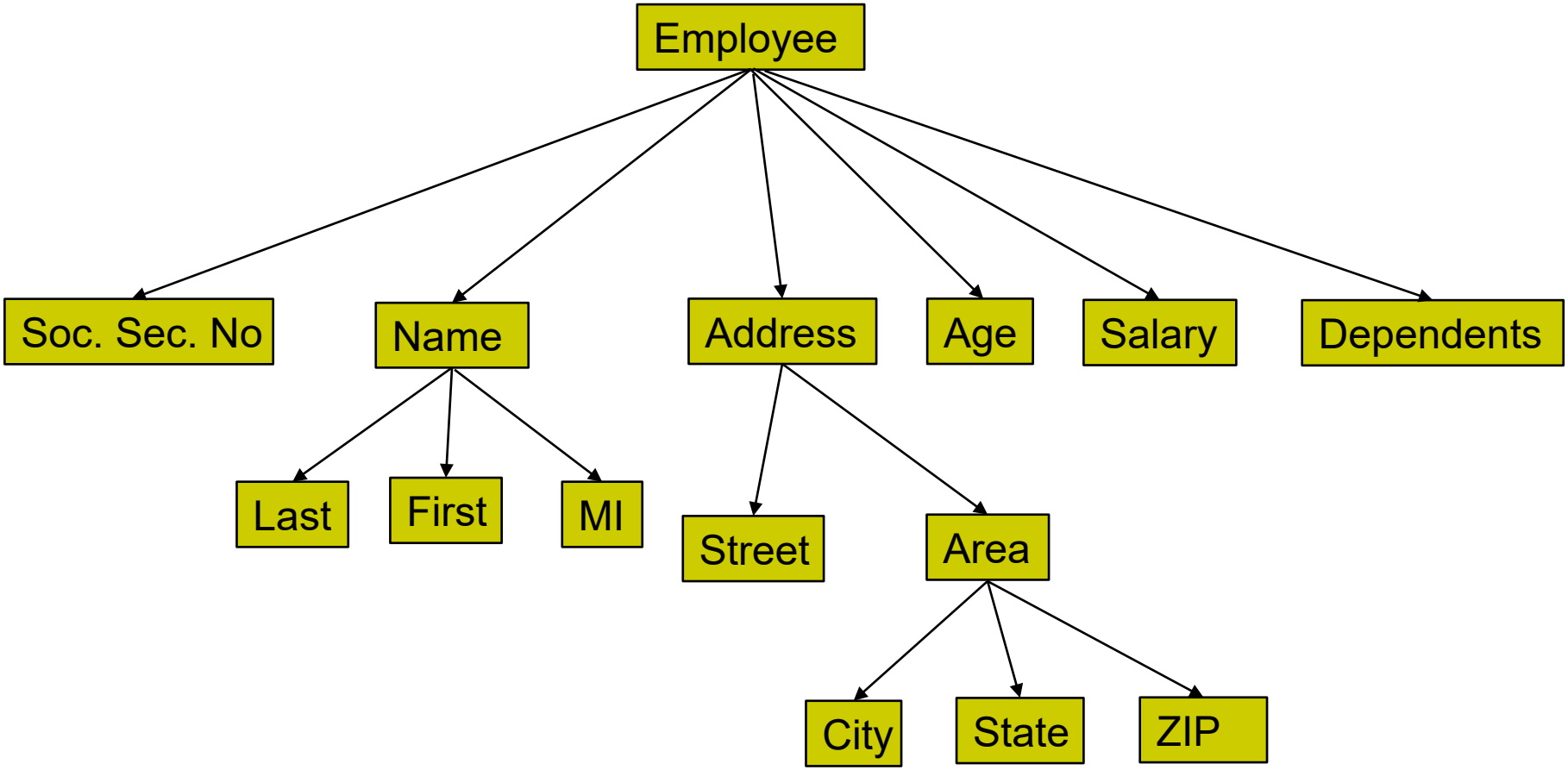
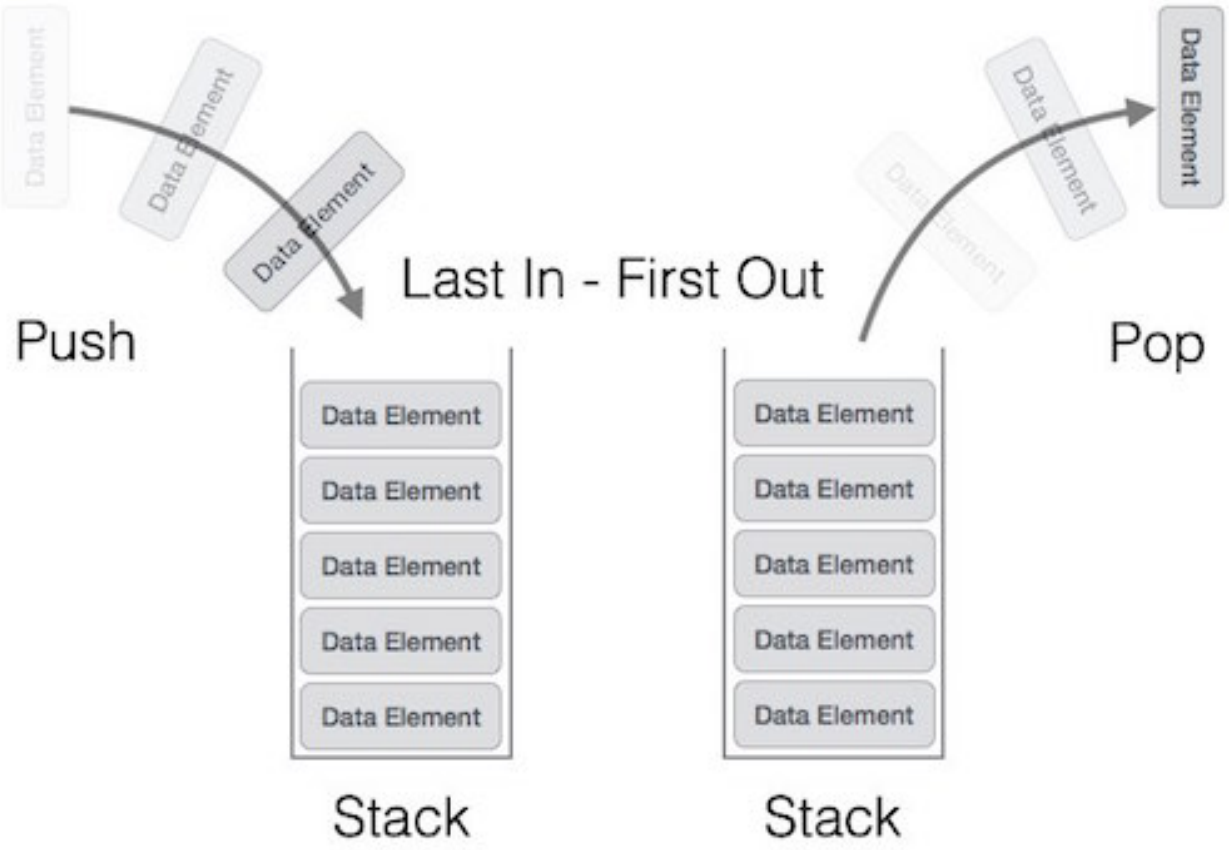
Trees

- One way of tree structure



Stack

- A stack, also called a last-in first-out (LIFO) system, is a linear list in which insertions and deletions can take place only at one end, called the top.



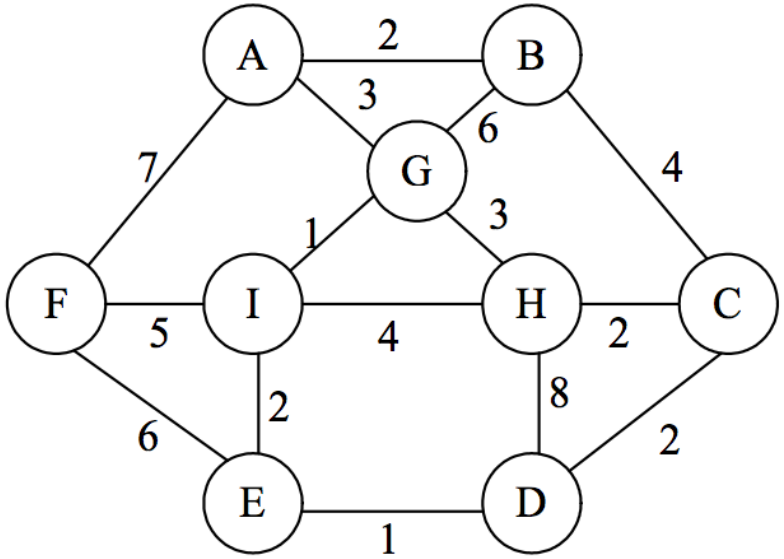
Queue

- A queue, also called a first in first out (FIFO) system, is a linear list in which deletions can take place only at one end of the list,
- the "front" of the list, and insertions can take place only at the other end of the list, the "rear" of the list.
- This structure operates in much the same way as a line of people waiting at a bus stop,

Example

Graph

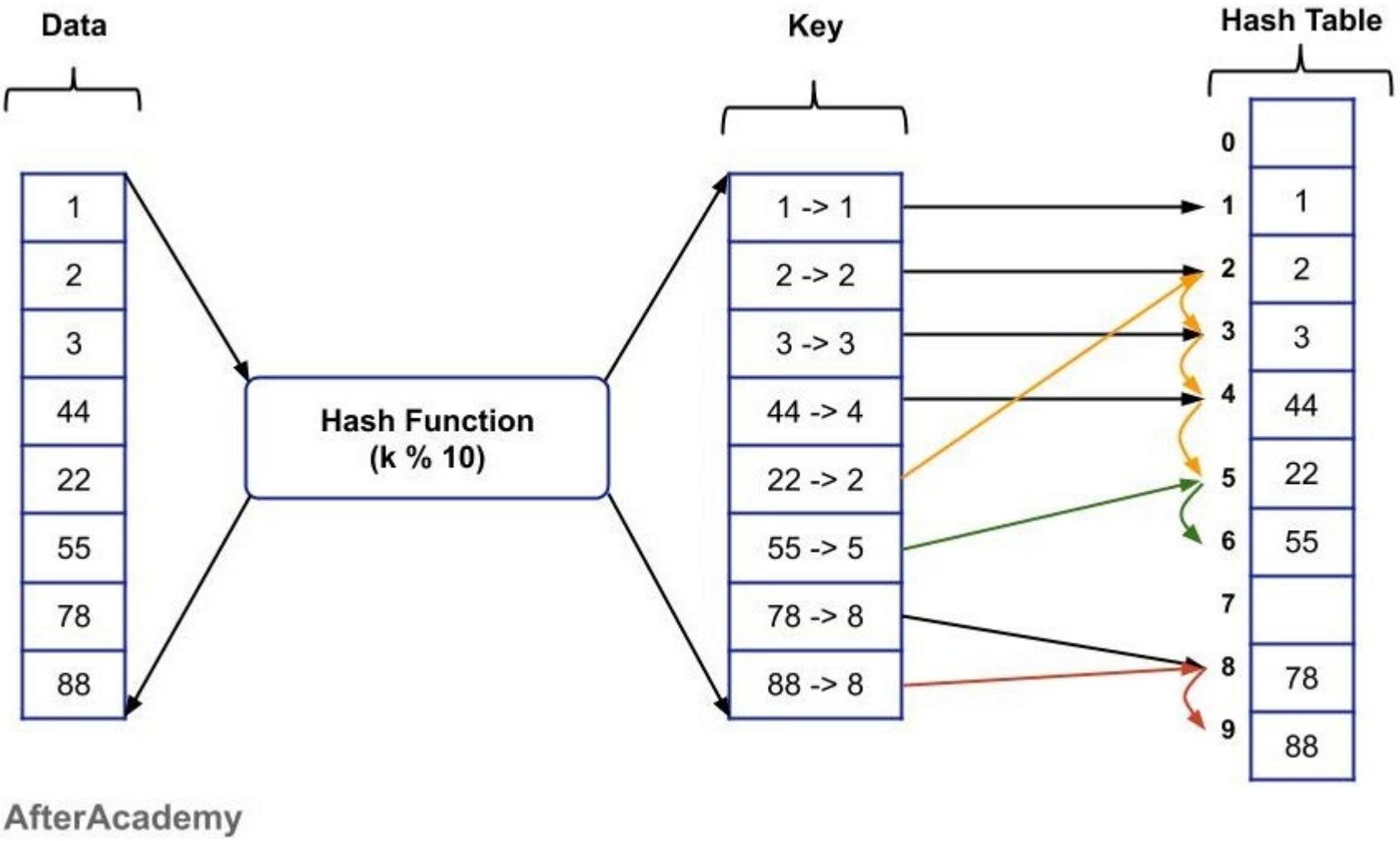
- Data sometimes contain a relationship between pairs of elements which is not necessarily hierarchical in nature.
- For example. suppose an airline flies only between the cities connected by lines



Hashing

- Hashing is a way to store data into some data structure (generally Hash Table is used) in such a way that
- the basic operations on that data i.e. the insertion, deletion, and searching can be performed with constant time.
- Here data is stored in the form of key-value pairs i.e. for each data you will assign some key
- and based on that key the insertion, deletion, and searching of your data will be performed.

Hashing


Data
Key
Hash Table
1
2
3
44
22
55
78
88
Hash Function
(k % 10)
1 -> 1
2 -> 2
3 -> 3
44 -> 4
22 -> 2
55 -> 5
78 -> 8
88 -> 8
0
1
2
3
4
5
6
7
8
9
1
2
3
44
22
55
78
88
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Thank You