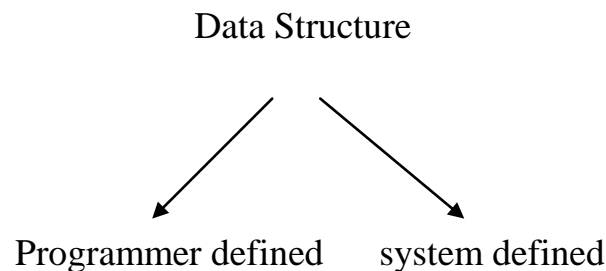


**Programming technique by using java**  
Second class  
Teaching by salma.h.abdalla  
**Computer Engineering & Information Technology**

**Lesson 9//**

**Structure Data Type**

- A data structure is a data object that contains other data object as its element or components.
- Structured Data Object = Data Structure
- A component may be elementary or it may be another data structure



⇒ The Major Attributes of Specifying data structures include

1- Number of components

- Fixed Size DS ( The number of Components is invariant during its lifetime). ( Array, record).
- Variable size DS ( The Number of Component changes dynamically ).

( Stacks, Lists , sets, tables and files)

< Insert , Delete >

Variable size Dots often use a Pointer data type that allows fixed-size Dots to be linked together explicitly by programmer.

2- Type of each component

—————→ Homogeneous: its components are same type <array, string, sets, file>

—————→ Heterogeneous: its components are of different type <records, lists>.

3- Names to be used for selecting components A DS type needs a selection mechanism for identifying individual components of the DS.

Array → sequence of subscripts

Record → the name

Stack, files → The Top or current component.

4- Maximum number of components.

5- Organization of Components.

- Linear Sequence of Components. → Vectors, records, string, stacks, lists, and files.
- Multidimensional → Multidimensional array, records of records and vector of vectors.

## ⇒ Operation on DS:-

1- Component Selection Operations

- Random Selection : An arbitrary component of the DS is accessed <array>
- Sequential Selection : Components are selected in a predetermined order .

2- Whole-data – structure Operations

- Addition of two arrays.
- Assignment of one record to another.
- Union operation on sets.

3- Insertion/deletion of components.

4- Creation / destruction of DSs. For v[4]

- Referencing operation : It determines the current location of the name v(its L-value) returning as its result a pointer to the location of the vector DO designated the name V.
- The selection Operation: It takes the pointer to the vector together with the subscript of the designated component of the vector, and returns a pointer to the location of that particular component within the vector.



### **Implementation of DS types:**

Storage representation depends on :

- Efficient selection of Component from a DS.
- Efficient overall storage management for the language implementation.

- **Storage Representations:**

It includes storage for components of the structure and an optional descriptor that stores some or all of the attributes of the structure

#### **Basic representation**

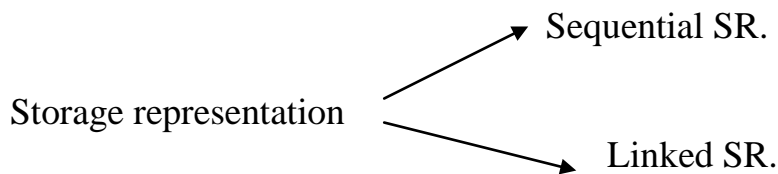
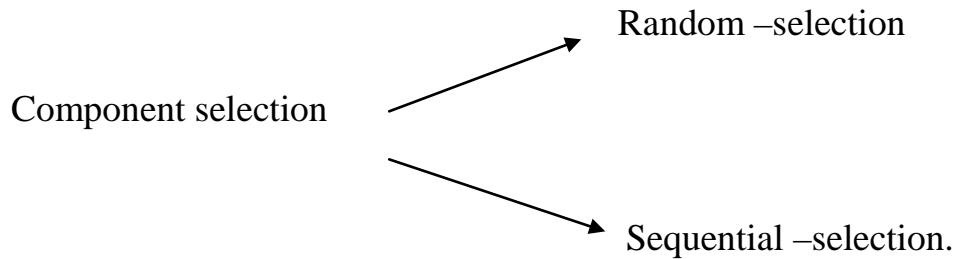
- Sequential representation : in Which the DS is stored in a single continuous block of storage that includes both descriptor & Component homogeneous variable- size.
- Linked representation : in which the data structure is stored is several non continuous blocks of storage , with the blocks lined together through pointers < used for variable – size structure , lists>.

A link (pointer) is represent by storage the address of the first location of the next block in a location reserved for the purpose in the current block .

Elementary DTs  $\longrightarrow$  direct hardware – supported storage representations and operations are common.

Structured DTs → Software simulated in the programming language.

⇒ **Implementation of Operations an DSs:**



• **Sequential representation:**

⇒ Random selection = base -address +offset

- The offset is the relative location of the selected component within the sequential block.
- The base address is the starting location of the entire block.
- The accessing formula specifies how to compute the offset of the component.

• A[n]

Base address = Location of A [0].

Offset= n \*component size.

component
component
component
.
.
component

⇒ Sequential Selection = the location of the current component + the size of the current compound.

- **Linked representation:**

⇒ Random Selection of a Component from a linked structure involves following a chain of pointers from the first block for storing in the structure to the desired components for this selection algorithm. The position of the link pointer within each component block must be known.

⇒ Sequential Selection proceed by selecting the first component and then following the link pointer from the current component to the next component for each sub sequent selection .

