

# DATA STRUCTURE

## □ FUNDAMENTALS OF DATA STRUCTURE PART1

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# DATA ITEM

- AN ELEMENTARY DESCRIPTION OF THINGS, EVENTS, ACTIVITIES, AND TRANSACTIONS THAT ARE RECORDED, CLASSIFIED, AND STORED, BUT NOT ORGANIZED TO CONVEY ANY SPECIFIC MEETING.

# INFORMATION

IS DATA THAT HAVE BEEN ORGANIZED SO THAT THEY HAVE MEANING AND VALUE TO THE RECIPIENT

# DATA STRUCTURE

- A COLLECTION OF DATA ELEMENTS WHOSE ORGANIZATION IS CHARACTERIZED BY ACCESSING (MECHANISM FOR ORGANIZING INFORMATION) OPERATION THAT ARE USED TO STORE AND RETRIEVE THE INDIVIDUAL OF ELEMENTS.

# ALGORITHM

- IT IS FINITE SET OF INSTRUCTIONS WHICH, IF FOLLOWED, ACCOMPLISH A PARTICULAR TASK.

# PROGRAM

- AN IMPLEMENTATION OF AN ALGORITHM IN SOME PROGRAMMING LANGUAGE SUCH AS C,C#,ECT.



# HOW TO CHOOSE THE SUITABLE DATA STRUCTURE

FOR EACH SET OF, DATA THERE ARE DIFFERENT METHODS TO ORGANIZE THESE DATA IN A PARTICULAR DATA STRUCTURE. TO CHOOSE THE SUITABLE DATA STRUCTURE, WE MUST USE THE FOLLOWING CRITERIA.

- 1- DATA SIZE AND THE REQUIRED MEMORY.
- 2- THE DYNAMIC NATURE OF THE DATA.
- 3- THE REQUIRED TIME TO OBTAIN ANY DATA ELEMENT FROM THE DATA STRUCTURE.
- 4- THE PROGRAMMING APPROACH AND THE ALGORITHM THAT WILL BE USED TO MANIPULATE THESE.

# DATA STRUCTURE TYPES

- BUILT-IN: ARRAY , STRUCTURE
- LINKED : LINKED LIST, BINARY TREE



# BUILT – IN DATA STRUCTURES

- PROGRAMMING LANGUAGE USUALLY PROVIDE SOME DATA STRUCTURES THAT ARE BUILT INTO THE LANGUAGE, FOR INSTANCE, C X C++ PROVIDE STRUCTURES AND ARRAYS OF VARIOUS DIMENSIONS

# ARRAYS

- ARRAY IS THE FIRST DATA STRUCTURE THAT IS BUILT IN THE C LANGUAGE SO IT CAN BE CONSIDERED AS A DATA TYPE IN THE LANGUAGE. THE SIMPLEST FORM OF ARRAY A ONE DIMENSIONAL ARRAY THAT MAY BE DEFINED ABSTRACTLY AS A FINITE ORDERED SET OF HOMOGENOUS ELEMENTS.
- **FINITE** : MEANS THAT THESE IS A SPECIFIC NUMBER OF ELEMENTS IN THE ARRAY. THIS NUMBER MAY BE LARGE OR SMALL, BUT IT MUST EXIT.
- **ORDERED**: MEANS THAT THE ELEMENTS OF THE ARRAY ARE ARRANGED SO THAT THERE IS A ZEROth, FIRST, SECOND, THIRD, AND SO FORTH.
- **HOMOGENEOUS**: MEANS THAT ALL THE ELEMENTS IN THE ARRAY MUST BE OF THE SAME TYPE. FOR EXAMPLE AN ARRAY MAY CONTAIN ALL INTEGERS OR ALL CHARACTERS BUT MAY NOT CONTAIN BOTH.



# ARRAYS

Memory address	Index	Content
100	0	D
101	1	A
102	2	T
103	3	A

- **ONE-DIMENSIONAL ARRAY**

GENERAL ARRAY DECLARATION STATEMENT:

**DATA -TYPE** ARRAY-NAME [**NUMBER-OF-ITEMS**];

- Ex: INT AA[6];

INDIVIDUAL ELEMENTS OF THE ARRAY CAN BE ACCESSED BY SPECIFYING THE NAME OF THE ARRAY AND THE INDEX OF ELEMENT, EXAMPLE AA[3]

aa[0]	aa[1]	aa[2]	aa[3]	aa[4]	aa[5]
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- WARNING: INDICES ASSUME VALUES FROM 0 TO NUMBER-OF-ITEMS -1!!



# CALCULATING THE ADDRESS OF ARRAY ELEMENTS

## ONE DIMENSION ARRAY:

$$\text{LOCATION ( X[I])} = \text{BASE ADDRESS} + (\text{I} * \text{SIZE})$$

Ex1: LET AA[6] WHAT IS THE ADDRESS OF THE ELEMENT AA[3], BASE ADDRESS=100, SUPPOSE THAT EACH ELEMENT OF THE ARRAY REQUIRES A SINGLE UNIT OF STORAGE.

$$\begin{aligned}\text{LOCATION ( AA[3])} &= 100 + (3 * 1) \\ &= 100 + 3 \\ &= 103\end{aligned}$$

Ex2: LET INT M[7] WHAT IS THE ADDRESS OF THE ELEMENT M[3], BASE ADDRESS=110?

$$\begin{aligned}\text{LOCATION ( M[3])} &= 110 + (3 * 2) \quad \text{BECAUSE INT TYPE REQUIRED 2 BYTE STORAGES MEMORY} \\ &= 110 + 6 \\ &= 116\end{aligned}$$

- **HOME WORK**

- Q1: LET FLOAT Z[7] WHAT IS THE ADDRESS OF THE ELEMENT Z[3], BASE ADDRESS=110?
- Q2: LET CHAR Z[10] WHAT IS THE ADDRESS OF THE ELEMENT Z[7], BASE ADDRESS=150?
- Q3: LET INT A[9], LOCATION OF A[5] IS 250, WHAT IS THE BASE ADDRESS ??



# REFERENCES

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