Linear Array

Mst. Rashida Akhtar

Assistant Professor

Dept. of CSE, VU

Linear Arrays

A linear array is a list of finite number n of homogeneous data elements such that :

a) The elements of the array are referenced respectively by an index set consisting of n consecutive numbers.

b) The elements of the array are stored respectively in successive memory locations.

The number n of elements is called the length or size of the array.

Three numbers define an array : lower bound, upper bound, size.

a. The lower bound is the smallest subscript you can use in the array (usually 0)

b. The upper bound is the largest subscript you can use in the array

c. The size / length of the array refers to the number of elements in the array , It can be computed as upper bound - lower bound + 1

Let, Array name is A then the elements of A is, by the 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.

Linear Arrays

Example :

A linear array DATA consisting of the name of six elements

DATA

1	247
2	56
3	429
4	135
5	87
6	156

DATA[1] = 247

DATA[2] = 56

DATA[3] = 429

DATA[4] = 135

DATA[5] = 87

DATA[6] = 156

Linear Arrays

Example :

An automobile company uses an array AUTO to record the number of 'automobile' sold each year from 1932 through 1984.

AUTO[k] = Number of auto mobiles sold in the year *K*

$LB = 1932$

$UB = 1984$

$Length = UB – LB+1 = 1984 – 1932+1 =53$

Representation of linear array in memory

Let *LA* be a linear array in the memory of the computer. The memory of the computer is a sequence of addressed locations.

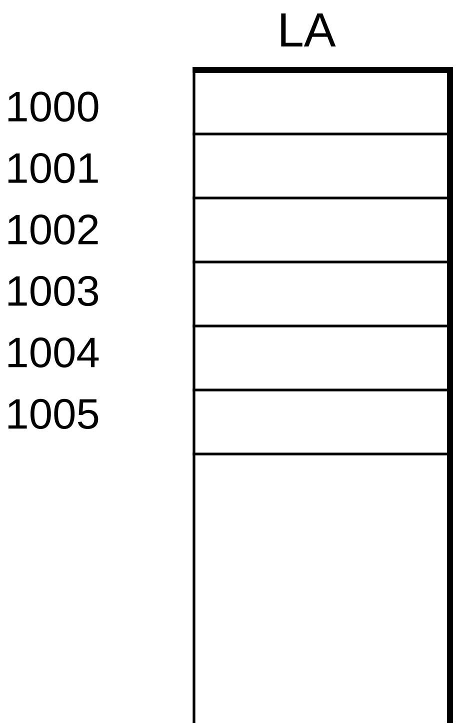


Fig : Computer memory

The computer does not need to keep track of the address of every element of LA, but needs to keep track only of the first element of LA, denoted by

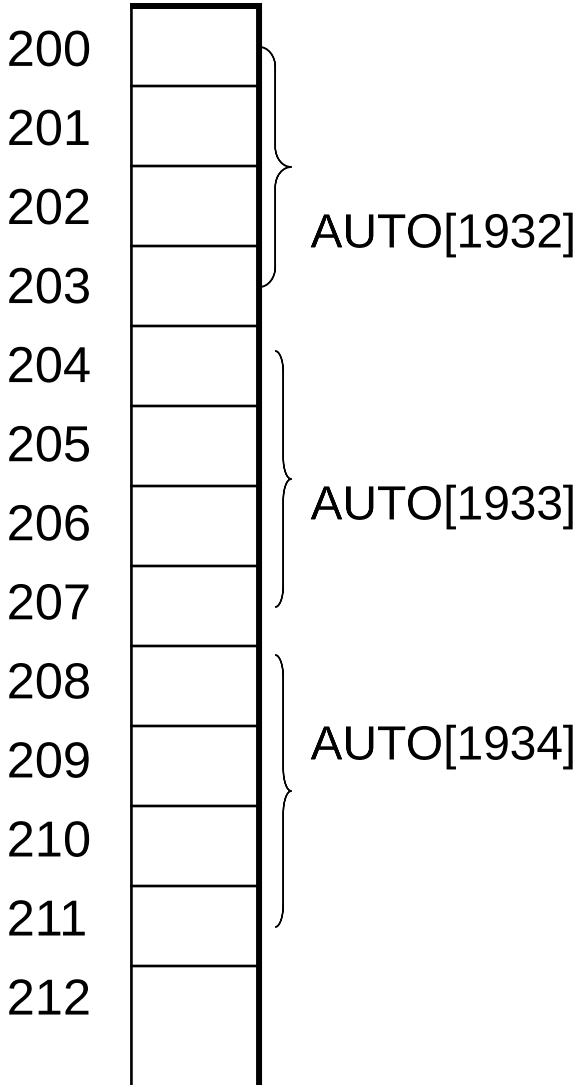
Base(LA)

Called the base address of LA. Using this address Base(LA), the computer calculates the address of any element of LA by the following formula :

LOC(LA[k]) = Base(LA) + w(K – lower bound)

Where w is the number of words per memory cell for the array LA

Representation of linear array in memory



Example :

An automobile company uses an array AUTO to record the number of auto mobile sold each year from 1932 through 1984. Suppose AUTO appears in memory as pictured in fig A .

That is Base(AUTO) = 200, and w = 4 words per memory cell for AUTO. Then,

LOC(AUTO[1932]) = 200,

LOC(AUTO[1933]) =204

LOC(AUTO[1934]) = 208

the address of the array element for the year K = 1965 can be obtained by using :

LOC(AUTO[1965]) = Base(AUTO) + w(1965 – lower bound)

=200+4(1965-1932)=332

Inserting and Deleting

Inserting refers to the operation of adding another element to the Array .

Deleting refers to the operation of removing one element from the Array .

Inserting an element somewhere in the middle of the array require that each subsequent element be moved downward to new locations to accommodate the new element and keep the order of the other elements.

Deleting an element somewhere in the middle of the array require that each subsequent element be moved one location upward in order to “fill up” the array. Fig shows Milon Inserted, Sumona deleted.

STUDENT

1	Dalia Rahaman
2	Sumona
3	Mubtasim Fuad
4	Anamul Haque
5	
6	

STUDENT

1	Dalia Rahaman
2	Sumona
3	Milon
4	Mubtasim Fuad
5	Anamul Haque
6	

STUDENT

1	Dalia Rahaman
2	Milon
3	Mubtasim Fuad
4	Anamul Haque
5	
6	

Insertion

INSERTING AN ELEMENT INTO AN ARRAY:
Insert (LA, N, K, ITEM)
Here LA is linear array with N elements and K is a positive integer such that K<=N. This algorithm inserts an element ITEM into the K^{th} position in LA.

ALGORITHM :

1. Set J:=N
2. Repeat Steps 3 and 4 while J >= K
3. Set LA[J+1] := LA[J]
4. Set J := J-1
5. Set LA [K] := ITEM
6. Set N := N+1
7. Exit

Deletion

DELETING AN ELEMENT FROM A LINEAR ARRAY
Delete (LA, N, K, ITEM)

ALGORITHM

1. Set ITEM: = LA [K]
2. Repeat steps 3 and 4 for J=K to N-1
3. Set LA [J]: =LA [J+1]
4. Set J:=J+1
5. Set N:=N-1
6. Exit.

Multidimensional arrays

Two dimensional, three dimensional arrays and ….. Where elements are referenced respectively by two, three and ……subscripts.

Two – dimensional Arrays

A Two – dimensional Arrays m x n array A is a collection of m . n data elements such that each element is specified by a pair of integers (such as J, K), called subscripts.

The element of A with first subscript J and second subscript K will be denoted by A[J, K]

Columns

$$
\begin{array}{cc}
 & \begin{array}{ccc} 1 & 2 & 3 \end{array} \\
\text{Rows} \begin{array}{c} 1 \\ 2 \\ 3 \end{array} & \begin{pmatrix} A[1,1] & A[1,2] & A[1,3] \\ A[2,1] & A[2,2] & A[2,3] \\ A[3,1] & A[3,2] & A[3,3] \end{pmatrix}
\end{array}
$$

Fig: Two dimensional 3 x 3 array A

Matrix Multiplication

Algorithm 4.7: MATMUL(A, B, C, M, N)

Let A be an MXP matrix array, and let B be a PXN matrix array. This algorithm stores the product of A and B in an MXN matrix array.

1. Repeat steps 2 to 4 for I =1 to M:
2. Repeat steps 3 to 4 for J =1 to N:
3. Set C[I, J]:=0
4. Repeat for K =1 to N:

   C[I, J]:= C[I, J]+A[I, K]*B[K, J]

1. Exit