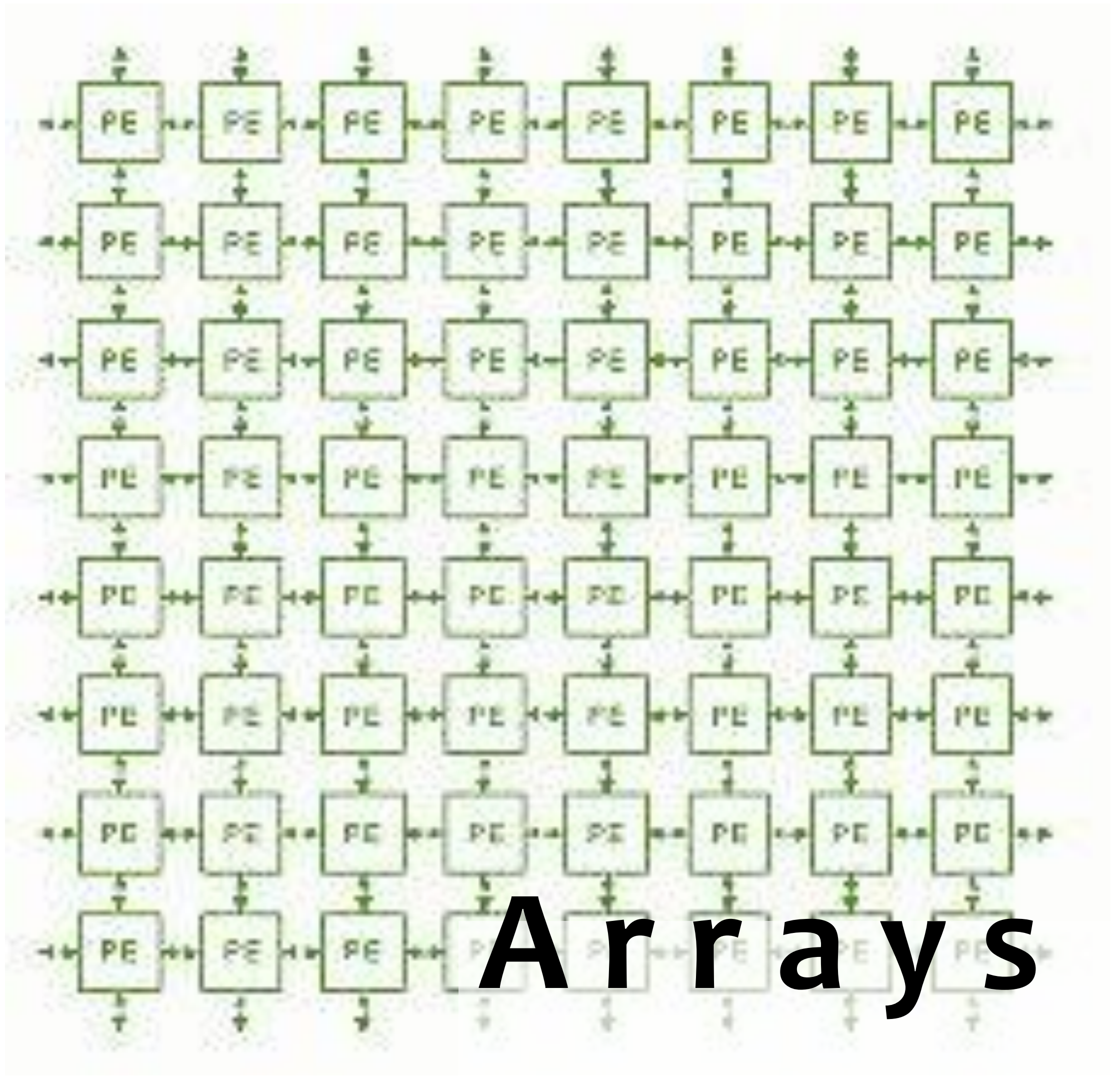


Arrays

1D-Arrays

Objectives

To learn and appreciate the following concepts:

- **Declare, initialize and access 1D array.**
- **Write programs using common data structures namely arrays and strings and solve problems.**

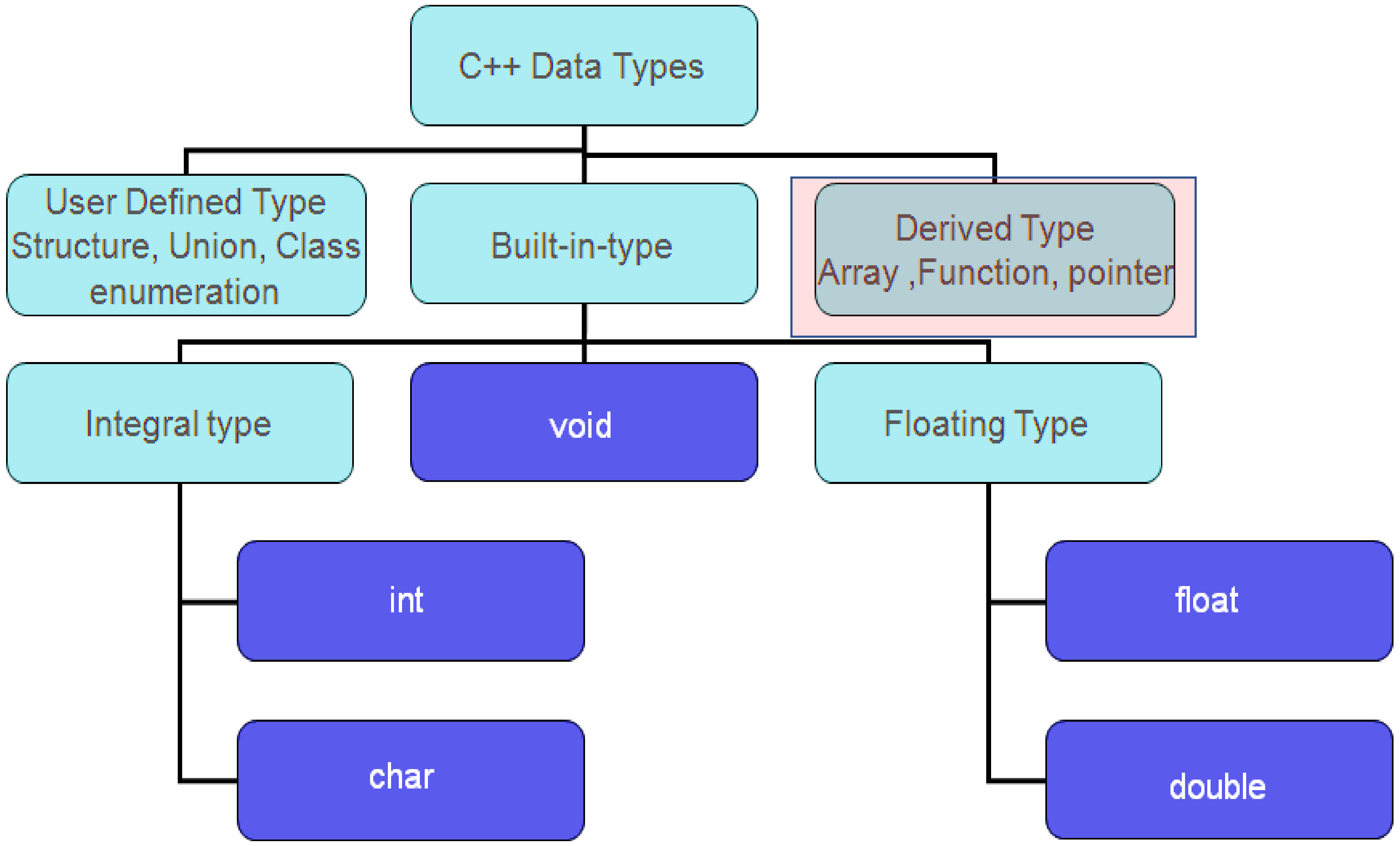
Session outcome

- At the end of session student will be able to

  →Declare, initialize and access 1D array

  →Write programs using 1D array

Revisit – Data types



Arrays

- **An array is a group of related data items that share a common name**.

- The array elements are placed in contiguous **memory locations.**

- A particular value in an array is indicated by writing an integer number called **index number** or **subscript** in **square brackets** after the array name.

- The least value that an index can take in array is 0..

Arrays

Array Declaration:

```
data-type name [size];
```

where data-type is a valid data type (like int, float, char...)

✓name is a valid identifier

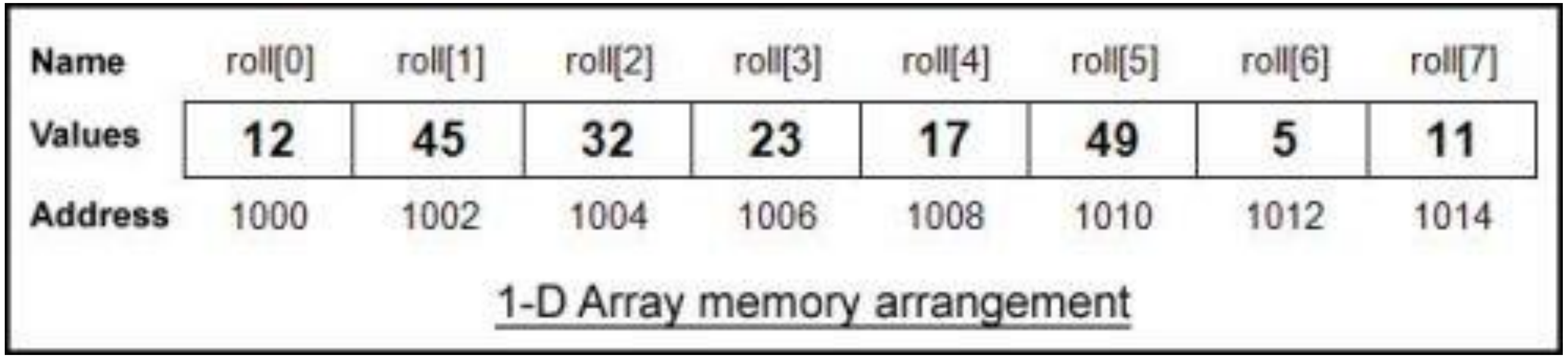
✓size specifies how many elements the array has to contain.

- size field is always enclosed in square brackets [ ] and takes static values.

- For example an array salary containing 5 elements is declared as follows

```
int  salary [5];
```

Arrays - *One Dimensional*



Name	roll[0]	roll[1]	roll[2]	roll[3]	roll[4]	roll[5]	roll[6]	roll[7]
Values	12	45	32	23	17	49	5	11
Address	1000	1002	1004	1006	1008	1010	1012	1014

1-D Array memory arrangement

- A **linear list** of fixed number of data items of same type.
- These items are accessed using the same name using a single subscript. E.g. **roll[0], roll[1]….** or **salary [1], salary [4]**
- A list of items can be given one variable name using only one subscript and such a variable is called a **single-subscripted variable** or a **one- dimensional array.**

Arrays - 1D

Total size:

The Total memory that can be allocated to 1Darray is computed as

```
Total size =size *(sizeof(data_type));
```

where size→ number of elements in 1-D array

data_type→ basic data type

sizeof()→ **is an unary operator which returns the size of data type in bytes.**

Arrays - 1D

How to read & display the values of an array and store it !

```
int main() {
  int arr[50],n; // declaration of  ‘arr’
  printf(" enter value  of n\n“);   // no of elements
  scanf(“%d”, &n);                  // reading the limit into n
 for(int i=0;i<n;i++)
   {
        scanf(“%d”,&arr[i]);  // reading n elements
   }
for(int j=0; j<n;j++) //displaying n elements
  {
       printf(“%d”,arr[j]);
       printf(“\t”);
   }
        return 0;
 }
```

Initializing one-dimensional array

```
int number[3] ={0,0,0}; or {0} ;
```

→ declares the variable number as an array of size 3 and will assign 0 to each element.

```
int age[ ] ={16,25,32,48,52,65};
```

→ declares the age array to contain 6 elements with initial values 16, 25, 32, 48, 52, 65 respectively

Initializing one-dimensional array

Initialize all the elements of an integer array 'values' to zero

```
int values[20];
```

Begin for loop

Initialize counter

Set limit for counter

```
for ( int  i=0; i<20;  i++)
```

Initialize element in array 'values'

```
values[i]=0;
```

Increment counter

Printing one-dimensional array

For example

```
int x[3] = {9,11,13};
printf("%d\n",x[0]);
printf("%d\n",x[1]);
printf("%d\n",x[2]);
```

or

```
int x[3] = {9,11,13};
for (int i = 0; i<3; i++)
printf("%d\n",x[i]);
```

Output:

```
9
11
13
```

Program to read n elements into an array and print it

```
int a[10], i, n;
printf("enter no of numbers“);
scanf(“%d”,&n);
printf(“enter n numbers  \n”);
for(i=0;i<n;i++)
 scanf(“%d\n”, &x[i]);

printf(“\nNumbers entered are:\n”);
for(i=0;i<n;i++)
 printf(“%d\n”, a[i]);
```

Output:

```
enter no of numbers
3
enter n numbers
9
11
13
Numbers entered are:
9
11
13
```

Program to add two array elements and store the corresponding sum elements in another array

```
int a[10], b[10], c[10],n, m, i;
printf("enter no. of numbers in first array\n“);
scanf(“%d”,&n);
//first  array reading
for(i=0;i<n;i++)
     scanf(“%d”,&a[i]);
printf("enter no of numbers in second array\n“);
scanf(“%d”,&m);
//second array reading
for(i=0;i<m;i++)
     scanf(“%d”,&b[i]);
```

```
if(m==n)
{      //addition
  for(i=0;i<m;i++)
        c[i]=a[i]+b[i];

  printf(“Sum of given array elements\n”);

  for(i=0;i<n;i++)
        printf(“%d\n”,c[i]);
}
else
printf("cannot add“);
}
```

Displaying elements of an array in reverse order.

```
int a[10], n, i;

printf(“Enter values\n“);

for(i=0;i<n;i++)

  scanf(“%d”, &a[i]);

printf(“\nReverse order printing of array\n”);

for(i=n-1;i>=0;i--)  // reverse loop

  printf(“%d\n”, a[i]);
```

Example : a[ ]={1, 2, 3, 4, 5}

```
Enter values
   n=5
   1 2 3 4 5
   Reverse printing of array
   5   4    3    2    1
```

Array before	**Array after**
a[0]=1	**a[0]=1**
a[1]=2	**a[1]=2**
a[2]=3	**a[2]=3**
a[3]=4	**a[3]=4**
a[4]=5	**a[4]=5**

Write a program to reverse an array using only one array

```
int a[20], i, j, n, temp;

printf("enter  n \n“);

scanf(“%d”, &n);

printf("\n Enter values for an array“);

for(i=0;i<n;i++)

 scanf(“%d”, &a[i]);
```

Example : a[ ]={1, 2, 3, 4, 5}

```
Enter values
   n=5
   1 2 3 4 5
   Reversed array
   5   4    3    2    1
```

Array array	**Reversed**
a[0]=1	**a[0]=5**
a[1]=2	**a[1]=4**
a[2]=3	**a[2]=3**
a[3]=4	**a[3]=2**
a[4]=5	**a[4]=1**

Contd…

Reversing an array

```
for(i=0, j=n-1; i<n/2; i++, j--)
{
    temp=a[i];
    a[i]=a[j];
    a[j]=temp;
}
printf("\n Reversed array: \n“);
for(i=0;i<n;i++)
printf(“%d\t”, a[i]);
}
```

```
for(i=0; i<n/2; i++)
{
    temp=a[i];
    a[i]=a[n-i-1];
    a[n-i-1]=temp;
}
printf("\n Reversed array: \n“);
for(i=0;i<n;i++)
printf(“%d\t”, a[i]);
}
```

Example :

a[ ]={1, 2, 3, 4, 5}

```
Output:
   Enter values for an array
   n=5
   1 2 3 4 5
   Reversed array
   5   4   3   2   1
```

Array	**Reversed array**
a[0]=1	**a[0]=5**
a[1]=2	**a[1]=4**
a[2]=3	**a[2]=3**
a[3]=4	**a[3]=2**
a[4]=5	**a[4]=1**

WAP to insert an element to an array at a given position

```
int a[100], n,i, pos, ele;
 scanf(“%d”,&n); // number of elements
printf("\nEnter the elements of array:“);
for(i=0;i<n;i++)
 scanf(“%d”,&a[i]);
printf("\nEnter the element and position  of insertion:“);
 scanf(“%d %d”,&ele,&pos);
for(i=n; i>=pos; i--)  //shift the elements to right
     a[i]=a[i-1];
a[pos-1] = ele;  //ele is inserted at  the specified  pos.
n = n + 1;     // increment the count of no of elements
printf("\nThe array after insertion is:“);
for(i=0;i<n; i++)   printf(“%d\n”,a[i]);
```

Example : insert 9 at 2nd position
a[ ]={1, 2, 3, 4, 5}

New array after inserting 9 :
a[ ]={1, 9, 2, 3, 4, 5}

WAP to delete an element from an array

```
printf("enter no of numbers“);
scanf(“%d”,&n);
printf("enter  n numbers \n“);
for(i=0;i<n;i++)
    scanf(“%d”,&a[i]);
printf("enter the position at which the element to be deleted“);
scanf(“%d”,&pos);
for(i=pos-1; i<n-1; i++)
    a[i] =a[i+1];  //shift the elements to left
n = n-1;      //decrement the count of no of elements
for(i=0;i<n;i++)
    printf(“%d”,a[i]);
```

Example : delete ele at 2nd position
a[ ]={1, 2, 3, 4, 5}

New array after deleting 2:
a[ ]={1, 3, 4, 5}

Insert an element into a sorted array

Read array elements (in sorted order) & element ‘**ele**’ to be inserted

```
//finding position
for(i=0;i<n;i++)
      if (ele<a[i])
         break;
 pos = i+1;  //position of insertion
for(i=n; i>=pos; i--)  //shift the elements to right
  a[i]=a[i-1];
a[pos-1] = ele;  //ele is inserted at  the specified  pos.
n = n + 1;     // increment the count of no of elements
```

Example: insert 3 into the array
a[ ] = {1, 2, 4, 5, 6}

New array after inserting 3 :
a[ ] = {1, 2, 3, 4, 5, 6}

1 Dimensional Arrays

1D Array:

- Syntax: type array_name[size];
- Memory Requirement:
  Total size =size *(sizeof(data_type));
- Initialization:
  type array-name [size]={list of values}
- Write and Read:

```
for(i=0;i<n;i++)                for(i=0;i<n;i++)
 scanf("%d",&a[i]);           prinft("%d\n",a[i]);
```

Tutorials on Array

- Write a program to find average of an 1-D array.
- Write a program to find second largest element in an array.
- Write a program to find union and intersection of two arrays.

Summary

- Arrays
- 1 Dimensional arrays (lists)
- Problems on 1D arrays

```
/* largest and second largest element in an array*/
    largest1 = array[0];
        /*  assume first element of array is the second largest */

    largest2 = array[1];

        for (i = 1; i < MAX; i++)
        {
            if (array[i] >= largest1)
            {
                largest2 = largest1;
                largest1 = array[i];
            }
            else if (array[i] > largest2)
            {
                largest2 = array[i];
            }
        }
```

Example: array[ ] = {22,44, 34, 9, 21}

```
44 is largest
34 is second largest
```