ARRAYS

Case

- You are required to store the following data for the Health Ministry Department of India:
  - »Name of states and union territories along with capitals
  - »Population of each
  - »Literacy rate of each

- Compute and display the state with highest population and literacy rate.
- OR
- You have to store marks of 100 students and calculate their average

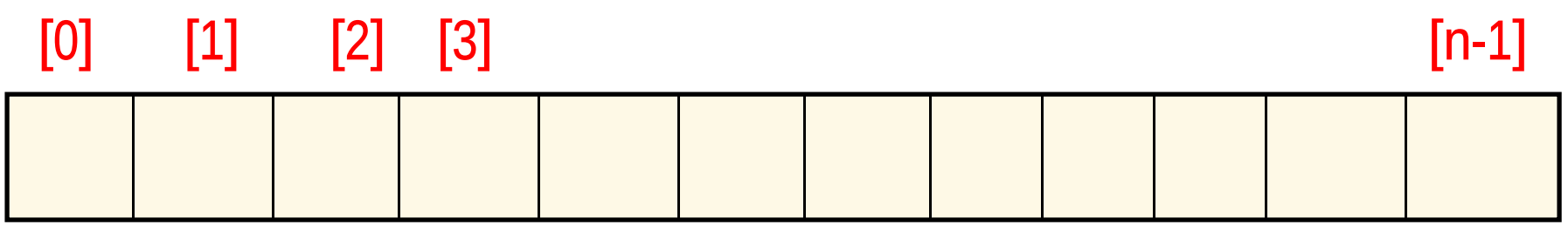
Notion of an array

- Array
  - Homogeneous collection of variables of same type.
  - Group of consecutive memory locations.
  - Linear and indexed data structure.
- To refer to an element, specify
  - Array name
  - Position number (Index)

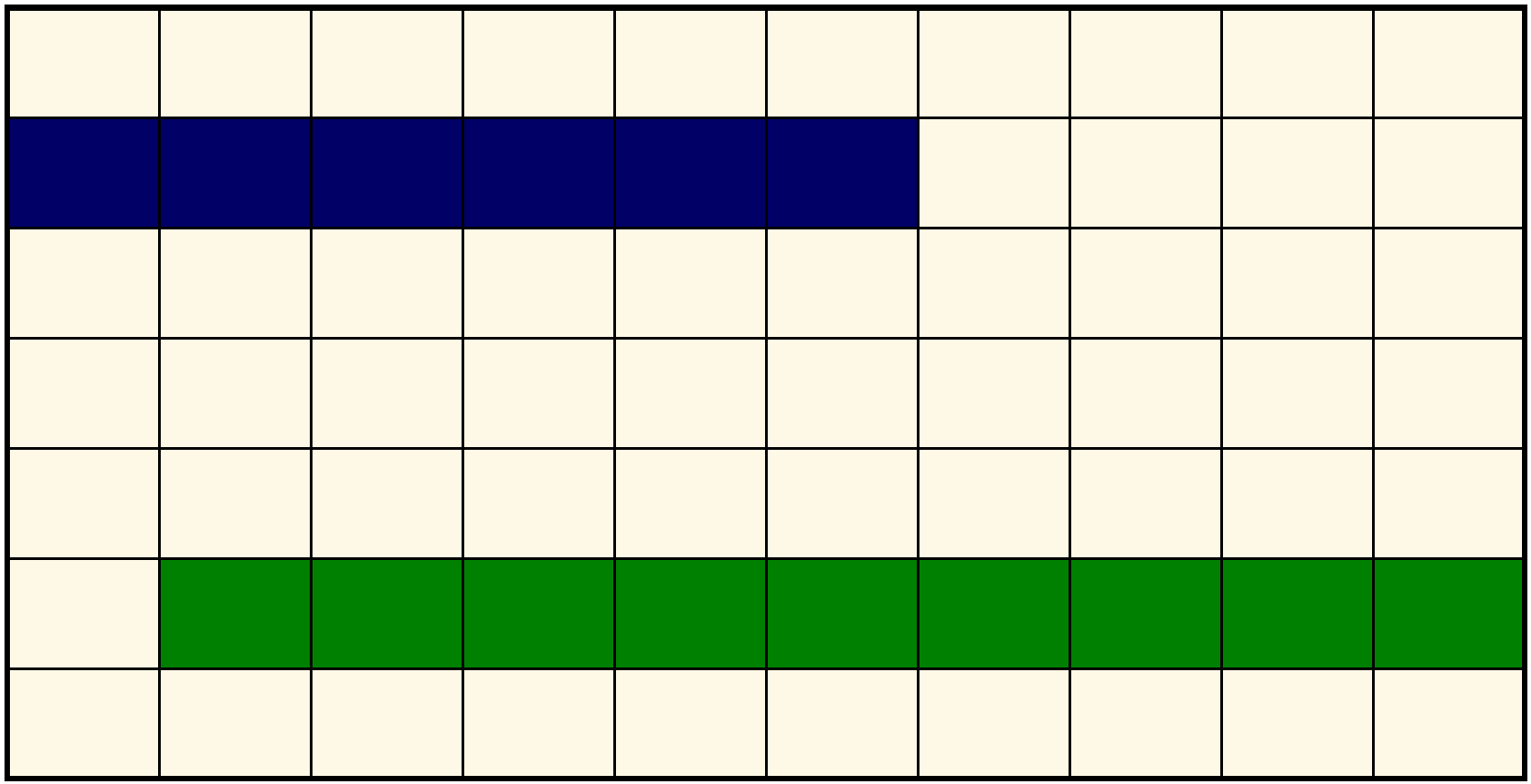
Single Dimension Arrays

Array Format

- Elements of an array can be integers, floats, characters etc.
- All the elements share a common name with an index called subscript.
- In an array of n elements:



Memory Layout



Declaration

- When declaring arrays, specify
  - Data type of array (integers, floats , characters…..)
  - Name of the array.
  - Size: number of elements

```
array_type   array_name[ size ]   ;
```

  - Example:
    - » int student[10] ;
    - » float my_array [300] ;

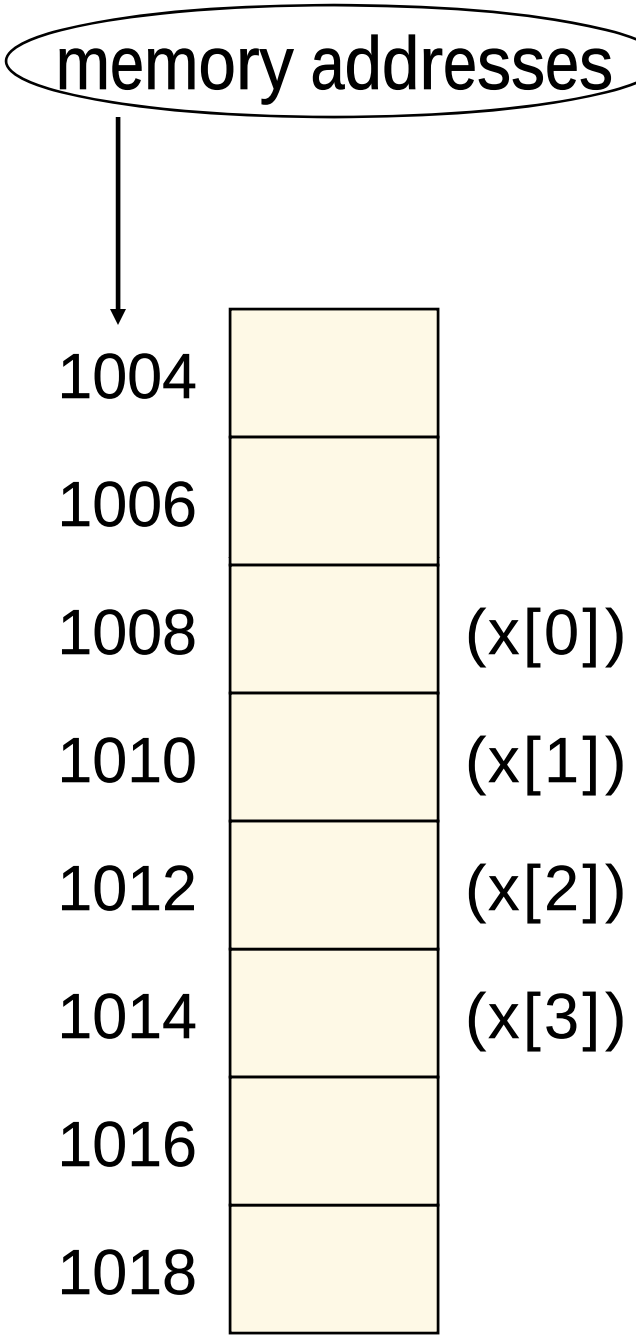
Example

- For example,

  int x [4] ;

  Square bracket

- An array of integers of 4 elements.
- Note that the starting memory address is determined by the operating system (just like that of simple variable).
- Contiguous memory locations are allocated.



Examples

- Integer array of 20 elements:

```
int  array_1  [ 20 ];
```

- Character array of 50 elements:

```
char array_2 [ 50 ];
```

- Float array of 100 elements:

```
float array_3 [ 100 ];
```

sizeof()

- The amount of storage required to hold an array is directly related to its data type and the size.

- Example

  Total size in bytes for a 1 D array:

  total bytes = sizeof(data type) * size of array

  int a [7] ;

  total_bytes = 2 * 7

  = 14 bytes in memory

Exercise

```
int main( void) {
float f1[10] ;
char c1[10] ;
printf(“%d”, sizeof(f1));
printf(“%d”, sizeof(c1));
return 0;
}
```

Output:

40

10

Example 1

Write a program to read 10 integers from the user and display them.

```
int main( void) {
 int  digit[ 10 ] , t  ;
 printf(“ \n Enter the value of 10 integers “ ) ;
 / * for reading 10 integers from the user using scanf    * /
            for( t = 0, t < 10 ; t + + )
                scanf(“ %d”,  &digit [ t ] );
 /* for displaying the integers using printf */
            for( t = 0, t < 10 ; t + + )
                 printf(“ %d”, digit [ t ] );
return 0;}
```

Example 2

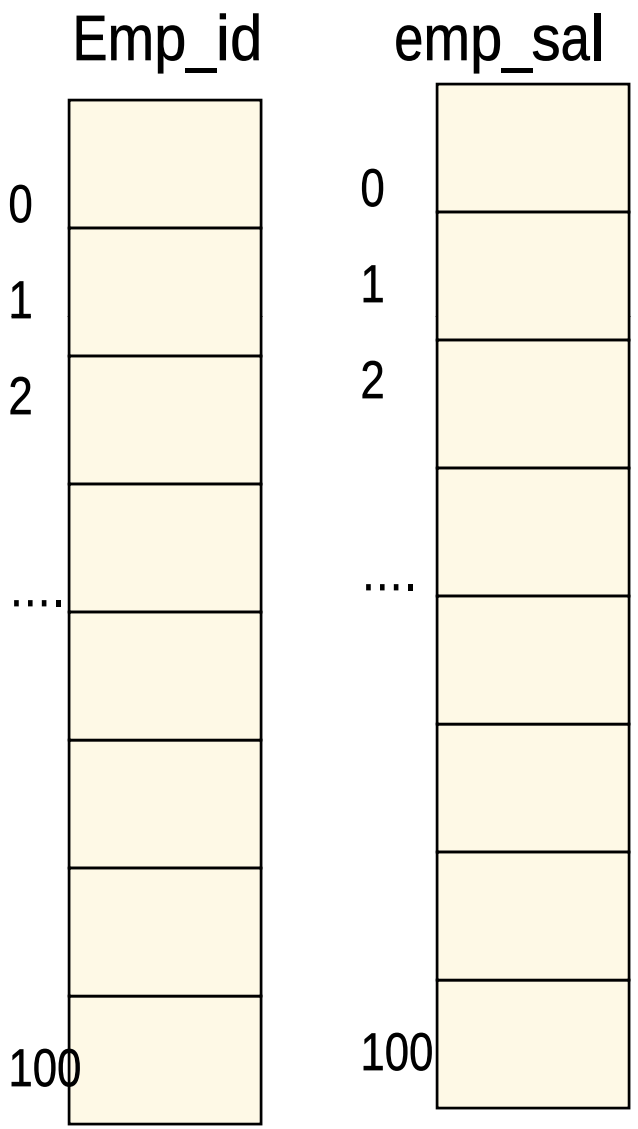
- Write a program to read 10 integers and add 5 to odd elements and 10 to even elements.

Exercise 1

- In an organization 100 employee are there. Write a program to store the employee id and salary of all the employees. Then input the employee id, and display the salary of the employee.

Solution

- Steps
  - Declare two arrays int emp_id[100] and float emp_sal[100]
  - Input the value of both the arrays from the user.
  - Input the emp_id for which salary is to be displayed.
  - Search the above id in array emp_id[ ] and get the index if match found
  - In the second array display the salary for the same index.



ARRAY Example

Grade lists

Sporting event times/scores

Telephone numbers

Voting tallies

Digitized images

Arrays - Why?

One example:

Employees' salaries in a company.
Each salary is a float.
All the salaries could be stored as an array of floats.

Can then do things like:

Change an employee's salary
Find out an employee's salary
Get the total salary bill

and do it **more easily** than representing each salary as a single float (convenience of representation)

Arrays - Why? - Another Example

```
main()
{
    float sal1,sal2,sal3;
    scanf (“%f”,&sal1);
    scanf (“%f”,&sal2);
    scanf (“%f”,&sal3);
}
```

```
main()
{
        int sal[3], i=0;
        while (i < 3)
        {
           scanf (“%f”,&sal[i];
        }
}
```

Imagine having 100 variables…...

Initializing Integer arrays

- Another way of initializing the elements of the array is as follows:

  » int array [ ] = { 2, 20, -30, 10, 100 } ;

•The array size need not be specified explicitly when initial values are included as a part of array declaration.

•Array size will automatically be set equal to the number of initial values specified with in definition.

- int digits [10] = { 3, 30, 300} ;

- All individual array elements that are not assigned explicit initial values will automatically be set to zero.

- digits [0] = 3 digits [1] = 30 digits [2]= 300

  digits [3] = 0 digits [4]= 0 digits[5]= 0

  digits [7] = 0 digits [8] =0 digits [9] =0

Initializing Arrays

The second way is to

Initialize each array element separately

id[0]=1234;

id[2]=2883;

id[3]=2322;

id[4]=8888;

id[5]=8237;

Question

- Write a C program to create an array of integers of size 20. Swap every even index value i, with the value at index i+1.

- Ex:

2	4	5	1	0	8
0	1	2	3	4	5

4	2	1	5	8	0
0	1	2	3	4	5

Basics of character array

- If you are required to store a group of character like your name, city , or your college name, or any word or text you need to define a array of characters.

- A char variable can hold a SINGLE character only like

  char c = ‘A’ ;

  char c1=‘B’;

- What if you need to store “Sachin Tendulkar” or “MUMBAI” a string.

Character Arrays

- To hold a single string you need to declare a single dimension character array

  » char str [11] ;

- When declaring a character array to hold a string(group of characters), one need to declare the array to be one character longer than the largest string that it will hold

- Example above array str[11] will hold 10 characters and a NULL character (‘\0’) at the end

How To Enter value ?

```
/* program to read user's name and display it */
int main( )
{
char str [10 ] ;
printf( " Enter your name ");
scanf(" %s ", str);
printf( " Your name is : %s", str);
return 0;
}
```

No need to put &

- In case of character arrays

  Name of the array is the starting address of the array

```
char str[10];
&str [ 0 ]  => str
```

Disadvantage of %s

- While reading a string using %s format specifier, it does not scan the string after the space bar.

- For example

  Schin Tendulkar

  It will scan only “ Sachin ”.

  It will IGNORE any space or tab space

How to scan a complete text of words?

gets( )

- gets(argument string) : Collects a string of characters terminated by new line character ‘\n’ from the standard input stream (stdin).

- It allows to input spaces, tabs and copies all the character till new line into the argument string and append a NULL character ‘\0’ at the end of it.

- For example

```
char str [ 20 ] ;
gets( str ) ;
```

puts( )

- puts(argument string):

  It displays the string of characters from argument string to standard output till NULL character and appends a new line character at the end.

- For example

  puts (str) ;

EXAMPLE: Input ten numbers into an array, using values of 0 to 99, and print out all numbers except for the largest number..

```
/* to accept 10 values in the range 0 to 99 */
int size=10;
int value[size], i;
for (i=0; i< size; ++i)
   {  scanf (“%d”,&value[i]);
       if (value[i] > 99 || value[i] <0)
           { printf (“ enter only values within 0 -99 ”);
                 i--;    }
   }
```

```
/* to find the greatest among the list */
int maximum= 0;
for (i=0; i< size; i++)
 {
      if (maximum < value[i] )
        maximum = value[i];
     }
```

```
/* to print all the values other than the greatest */
for (i=0; i< size; i++)
 {
     if (value[i] != maximum  )
        printf (“%d”, value[i];
    }
```

Home Assignment

- Write a program to read a text from console and display the number of words and lines in the text.