

# Introduction to Computing

MCS1101B

Lecture 9

# Recall Array

```
int states[5], i;           //declaration
for (i=0; i<5; i++)
    states[i]=i;           // initialization
for (i=0; i<5; i++)
    printf("%d, ", states[i]); //access
// outputs 1, 2, 3, 4, 5,
```

```
int a[5]; int *arr;
printf("%d, %d, %d \n", sizeof(int), sizeof(a[3]), sizeof(a));
// outputs 4, 4, 20
printf ("%d", sizeof (arr));           // outputs 8
arr = a;
printf ("%d", sizeof (arr));           // outputs ??
```

- This is also called a one dimensional array or 1D array
- Sometimes we need to work on multidimensional data, e.g. 2D coordinates, matrix, system of equations
- 1D array is not convenient enough for such problems

# 2D Array

- `int arr[m][n];`
  - `m` is the number of rows and `n` is the number of columns
  - Array of `m*n` integers
  - Useful to store multidimensional data
- Accessing element at  $i^{\text{th}}$  row and  $j^{\text{th}}$  column using `arr[i][j]`
- Each `arr[i]` is an **1D array of size `n`**

## 2D Array (contd.)

```
int a[2][3], i, j; //declaration

//initialization
for (i=0; i<2; i++)
    for (j=0; j<3; j++)
        a[i][j] = i + j;

//access
for (i=0; i<2; i++)
    for (j=0; j<3; j++)
        printf("%d, ", a[i][j]);

printf("%d, %d, %d", sizeof(a), sizeof(a[1]), sizeof(a[1][2]));
//outputs 24, 12, 4
```

# 3D Array

- `int arr [m][n][p];`
  - Array of  $m*n*p$  integers
- Each `arr[i]` is an 2D array of size  $n*p$  integers
- Each `arr[i][j]` is an 1D array of  $p$  integers
- Each `arr[i][j][k]` is a single integer element

→how to calculate the address of any element in the array?

## 3D Array (contd.)

```
int a[2][3][4], i, j, k; //declaration

//initialization
for (i=0; i<2; i++)
    for (j=0; j<3; j++)
        for (k=0; k<4; k++)
            a[i][j][k] = (i + j)*k;

//access
for (i=0; i<2; i++)
    for (j=0; j<3; j++)
        for (k=0; k<4; k++)
            printf("%d, ", a[i][j][k]);

printf("%d, %d, %d, %d \n", sizeof(a), sizeof(a[1]), sizeof(a[0][2]), sizeof(a[1][0][2]));
//outputs ??
```

# Array of Pointers

- It's an array of pointer variables
- Each element in the array can contain address of a variable of the declared type
- So, array of different sized arrays can be done

```
double *buf[3];
```

```
double d0 = 8, d1[2] = {11, 12}, d2 = 10;  
buf[0] = &d0; buf[1] = &d1[0]; buf[2] = &d2;
```

```
printf("%d, %d \n", sizeof(void*), sizeof(buf));  
//prints 8, 24
```

```
printf("%p, %p, %p, %lf \n", buf, &buf[0],  
buf[1], *buf[1]);  
//prints 0x..b200, 0x..b200, 0x..b1f0, 11.000000
```

.. what will be buf[1][1] ?

# Operations on strings

- Find the length of a string
- Compare two strings
- Concatenate two strings
- Change a string to uppercase
- Change a string to lowercase
- Duplicate strings
- Split strings into words
- Split strings based on a given delimiter

- Array of strings

```
char arr[3][10] = {"IACS", "UG", "2022"};
```

- Array of pointers to strings

```
char *arr[] = {"IACS", "UG", "2022"};
```



## #include<string.h>

```
char str1[20]="A string", str2[20]="Another string";
```

strlen (str1)	// gives the length of the string $\Rightarrow$ 8
strcpy (str2,str1)	// copies str1 into str2
strncpy (str2, str1, n)	// copies first n characters from str1 into str2
strcmp (str1, str2)	// returns 0 if both strings are the same
strcmpi (str1, str2)	// compares two strings ignoring the case
strcat (str1, str2)	// concatenates str2 at the end of str1
strchr (str1, 'r')	//finds the position(pointer) of first 'r' in str1

[Link](#) to more all string.h functions with examples.

# #include<math.h>

## Some Functions:

```
double sqrt(double);  
double exp(double);  
double log(4.0);  
double log10(100.0);  
double fabs(double);  
int ceil(double);  
int floor(double);  
double pow(double, double);  
double fmod(double, double);  
double sin(double);  
double cos(double);  
double tan(double);
```

## Some Constants:

M\_PI, M\_PI\_2, M\_PI\_4

M\_1\_PI, M\_2\_PI

M\_E, M\_LOG2E, M\_LOG10E

M\_LN2, M\_LN10

[Link](#) to the full List of constants from math.h

# Command Line Arguments (CLA)

- Compile the code ⇒
  - It will generate **a.exe** file

Run the code as follows:

```
.\a.exe Hello
    argument supplied is Hello
.\a.exe Hello Hi
    Too many arguments.
.\a.exe
    One argument expected.
```

```
int main( int argc, char *argv[] )
{
    if( argc == 2 )
        printf ("argument supplied is %s\n", argv[1])

    else if ( argc > 2 )
        printf ("Too many arguments.\n");

    else
        printf ("One argument expected.\n");
}
```

# Recall File

- **FILE\*** is a datatype used to represent a pointer to a file
- To open a file we use a function called **fopen**
  - It takes two parameters
    - Name of the file
    - Mode in which it is to be opened
  - It returns a pointer to the file if the file is opened successfully, otherwise it returns **NULL**

## Example of a file creation for writing

```
FILE *fp;  
char filename[] = "a_file.dat"  
fp = fopen (filename, "w");  
if (fp != NULL)  
{  
    /* WRITE SOMETHING IN FILE */  
fclose (fp);  
}
```

# File operations

- **fputc**
- **fputs**
- **fprintf**
- **fflush**
- fgetc
- fgets
- fscanf
- feof
- ungetc

```
FILE *fp = fopen("abc.txt", "w");
```

```
if (fp != NULL) {  
    fputc('a', fp);  
    fputs("cde", fp);  
    fprintf(fp, "%d, %c, %s", 25, 'l', "hello");  
    fflush(fp);  
    fclose(fp);  
}
```

## File operations (contd)

- fputc
- fputs
- fprintf
- fflush
- **fgetc**
- **fgets**
- **fscanf**
- feof
- ungetc

```
FILE *fp = fopen("abc.txt", "r");
char buf[10];  int num;  char c;
if (fp != NULL) {
    c = fgetc(fp);        // printf ("%c", c);
    fgets(buf, 4, fp);    // printf ("%s", buf);
    fscanf(fp, "%d, %c, %s", &num, &c, buf);
    printf ("%d %c %s", num, c, buf);
    fclose(fp);
}
```

## File operations (contd)

- fputc
- fputs
- fprintf
- fflush
- fgetc
- fgets
- fscanf
- **feof**
- **ungetc**

```
char c, buf[256];
FILE *fp = fopen("abc.txt", "r");
if (fp != NULL) {
    while (!feof(fp)) {
        c = fgetc(fp);
        if (c == 'a')
            ungetc('b', fp);
        fgets(buf, 255, fp);
        printf("%s", buf);
    }
}
```

That's all.

- Questions?