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INSTITUTE OF SCIENCE AND TECHNOLOGY, CHENNAI.

18CSS101J – Programming for Problem Solving

Unit V

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COURSE LEARNING RATIONALE (CLR)	*The purpose of learning this course is to:*
CLR -1:	Think and evolve a logically to construct an algorithm into a flowchart and a pseudocode that can be programmed
CLR -2:	Utilize the logical operators and expressions to solve problems in engineering and real-time
CLR -3:	Store and retrieve data in a single and multidimensional array
CLR -4:	Utilize custom designed functions that can be used to perform tasks and can be repeatedly used in any application
CLR -5:	Create storage constructs using structure and unions. Create and Utilize files to store and retrieve information
CLR -6:	Create a logical mindset to solve various engineering applications using programming constructs in C

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COURSE LEARNING OUTCOMES (CLO)	*At the end of this course, learners will be able to:*
CLO -1:	Identify methods to solve a problem through computer programming. List the basic data types and variables in C
CLO -2:	Apply the logic operators and expressions. Use loop constructs and recursion. Use array to store and retrieve data
CLO -3:	Analyze programs that need storage and form single and multi-dimensional arrays. Use preprocessor constructs in C
CLO -4:	Create user defined functions for mathematical and other logical operations. Use pointer to address memory and data
CLO -5:	Create structures and unions to represent data constructs. Use files to store and retrieve data
CLO -6:	Apply programming concepts to solve problems. Learn about how C programming can be effectively used for solutions

LEARNING RESOURCES	
S. No	**TEXT BOOKS**
1.	*Zed A Shaw, Learn C the Hard Way: Practical Exercises on the Computational Subjects You Keep Avoiding (Like C), Addison Wesley, 2015*
2.	*W. Kernighan, Dennis M. Ritchie, The C Programming Language, 2nd ed. Prentice Hall, 1996*
3.	*Bharat Kinariwala, Tep Dobry, Programming in C, eBook*
4.	*http://www.c4learn.com/learn-c-programming-language/*

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UNIT V

INTRODUCTION

Initializing Structure, Declaring Structure variable- Structure using typedef, Accessing members – Nested structure Accessing elements in a structure array – Array of structure Accessing elements in a structure array –Passing Array of Structure to function- Array of Pointers to structures- Bit Manipulation of structure and pointer to structure – Union Basic and declaration – Accessing Union Members Pointers to union

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UNIT V

INTRODUCTION

Dynamic memory allocation, malloc, realloc , free – Allocating Dynamic Array- Multidimensional array using dynamic memory allocation- file: opening, defining, closing, File Modes, File Types- Writing contents into a file – Reading file contents – Appending an existing file- File permissions and rights- changing permissions and rights.

INTRODUCTION TO STRUCTURE

- Problem:
  - How to group together a collection of data items of different types that are logically related to a particular entity??? (**Array**)

Solution: ***Structure***

STRUCTURE

- A Structure is a collection of variables of different data types under a single name.
- The variables are called members of the structure.
- The structure is also called a user-defined data type.

Defining a Structure

- Syntax:

```
struct structure_name
        {
        data_type member_variable1;  data_type
        member_variable2;
        ……..……;  data_type member_variableN;
        };
```

Once structure_name is declared as new data type, then variables of that type can be declared as:

```
struct structure_name structure_variable;
```

Note: The members of a structure do not occupy memory until they are associated with a structure_variable.

- Example

```
struct student
        {
        char name[20];
        int roll_no;
        float marks;
        char gender;
        long int phone_no;
        };
struct student st;
```

- Multiple variables of *struct student* type can be declared as:

```
struct student st1, st2, st3;
```

Defining a structure…

- Each variable of structure has its own copy of member variables.
- The member variables are accessed using the dot (.) operator or member operator.
- For example: *st1.name* is member variable *name* of *st1* structure variable while *st3.gender* is member variable *gender* of *st3* structure variable.

Defining a structure…

```
struct student
        {
        char name[20];
        int roll_no;
        float marks;
        char gender;
        long int phone_no;
        }st1, st2, st3;
```

```
struct
{
char name[20];  int
roll_no;  float marks;
char gender;
long int phone_no;
}st1, st2, st3;
```

Structure initialization

- Syntax:

struct structure_name structure_variable={value1, value2, …., valueN};

- Note: C does not allow the initialization of individual structure members within the structure definition template.

```
struct student
    {
    char name[20];
    int roll_no;
    float marks;
    char gender;
    long int phone_no;
    };
void main()
{
struct  student  st1={“ABC",  4,  79.5,  'M',  5010670};
clrscr();
printf("Name\t\t\tRoll No.\tMarks\t\tGender\tPhone No.");
printf("\n.....\n");
printf("\n %s\t\t %d\t\t %f\t%c\t %ld",  st1.name, st1.roll_no, st1.marks,
    st1.gender, st1.phone_no);
getch();
}
```

Partial Initialization

- We can initialize the first few members and leave the remaining blank.
- However, the uninitialized members should be only at the end of the list.
- The uninitialized members are assigned default values as follows:
  - Zero for integer and floating point numbers.
  - '\0' for characters and strings.

```
struct student
    {
    char name[20];
    int roll;
    char remarks;
    float marks;
    };
void main()
{
struct student s1={“name", 4};
clrscr();
printf("Name=%s", s1.name);
printf("\n Roll=%d", s1.roll);
printf("\n Remarks=%c", s1.remarks);
printf("\n Marks=%f", s1.marks);
getch();
}
```

Accessing member of structure/ Processing a structure

- By using dot (.) operator or period operator or member operator.
- Syntax:

  structure_variable.member

- Here, *structure_variable* refers to the name of a *struct* type variable and *member* refers to the name of a member within the structure.

Question

- Create a structure named *student* that has *name*, *roll and mark* as members. Assume appropriate types and size of member. Write a program using structure to read and display the data entered by the user.

```
struct student
        {
        char name[20];
        int roll;
        float mark;
        };

void main()
{
struct student s;
clrscr();
printf("Enter name:\t");
gets(s.name);
printf("\n Enter roll:\t");
scanf("%d", &s.roll);
printf("\n Enter marks:\t");
scanf("%f", &s.mark);
printf("\n Name \t Roll \t Mark\n");
printf("\n.....\n");
printf("\n%s\t%d\t%f", s.name, s.roll, s.mark);
getch();
}
```

Copying and Comparing Structure Variables

- Two variables of the same structure type can be copied in the same way as ordinary variables.
- If *student1* and *student2* belong to the same structure, then the following statements are valid:

  student1=student2; student2=student1;
- However, the statements such as:

  student1==student2 student1!=student2

  are not permitted.
- If we need to compare the structure variables, we may do so by comparing members individually.

Here, structure has been declared global i.e. outside of main() function. Now, any function can access it and create a structure variable.

```
struct student
    {
 char name[20];
 int roll;
 };
void main()
{
struct student student1={“ABC", 4, };
struct student student2;
clrscr();
student2=student1;
printf("\nStudent2.name=%s",
student2.name);
printf("\nStudent2.roll=%d",
student2.roll);
if(strcmp(student1.name,student2.na
me)==0 &&
    (student1.roll==student2.roll))
    {
    printf("\n\n student1 and student2
    are same.");
    }
getch();
}
```

How structure elements are stored?

- The elements of a structure are always stored in contiguous memory locations.
- A structure variable reserves number of bytes equal to sum of bytes needed to each of its members.
- Computer stores structures using the concept of "word boundary". In a computer with two bytes word boundary, the structure variables are stored left aligned and consecutively one after the other (with at most one byte unoccupied in between them called slack byte).

How structure elements are stored?

- When we declare structure variables, each one of them may contain slack bytes and the values stored in such slack bytes are undefined.
- Due to this, even if the members of two variables are equal, their structures do not necessarily compare.
- That's why C does not permit comparison of structures.

Array of structure

- Let us consider we have a structure as:

```
struct student
{
char name[20];
int roll;
char remarks;
float marks;
};
```

- If we want to keep record of 100 students, we have to make 100 structure variables like st1, st2, …,st100.
- In this situation we can use array of structure to store the records of 100 students which is easier and efficient to handle (because loops can be used).

Array of structure…

- Two ways to declare an array of structure:
- *struct student*
  - *{*
  - *char name[20]; int roll;*
  - *char remarks; float marks;*
  - *}st[100];*

```
struct student
        {
        char name[20];
        int roll;
        char remarks;
        float marks;
        };
struct student st[100];
```

- Write a program that takes roll_no, fname lname of 5 students and prints the same records in ascending order on the basis of roll_no

Reading values

```
for(i=0; i<5; i++)
    {
       printf("\n Enter roll number:");  scanf("%d",
       &s[i].roll_no);

       printf("\n Enter first name:");  scanf("%s",
       &s[i].f_name);

       printf("\n Enter Last name:");  scanf("%s",
       &s[i].l_name);
    }
```

Sorting values

```
for(i=0; i<5; i++)
    {
        for(j=i+1; j<5; j++)
        {
            if(s[i].roll_no<s[j].roll_no)
            {
                temp = s[i].roll_no;
                s[i].roll_no=s[j].roll_no;
                s[j].roll_no=temp;
            }
        }
    }
```

Question

- Define a structure of employee having data members name, address, age and salary. Take the data for n employees in an array and find the average salary.
- Write a program to read the *name*, *address*, and *salary* of 5 employees using array of structure. Display information of each employee in alphabetical order of their name.

Array within Structure

- We can use single or multi dimensional arrays of type *int* or *float*.
- Eg.

```
struct student
{
char name[20];
int roll;
float marks[6];
};
struct student s[100];
```

- Here, the member *marks* contains six elements, *marks[0]*, *marks[1]*, …, *marks[5]* indicating marks obtained in six different subjects.
- These elements can be accessed using appropriate subscripts.
- For example, *s[25].marks[3]* refers to the marks obtained in the fourth subject by the 26th student.

Array within structure…

Reading Values

```
    for(i=0;i<n;i++)
{
        printf("\n Enter information about student%d",i+1);  printf("\n
        Name:\t");
        scanf(" %s",  s[i].name);  printf("\n
        Class:\t");  scanf("%d", &s[i]._class);
        printf("\n Section:");  scanf(" %c",
        &s[i].section);
        printf("\n Input marks of 6subjects:\t");  for(j=0;j<6;j++)
        {
                scanf("%f", &temp);
                s[i].marks[j]=temp;
}       }
```

Structure within another Structure (Nested Structure)

- Let us consider a structure *personal_record* to store the information of a person as:
- *struct personal_record*

```
{
char name[20]; int day_of_birth;
int month_of_birth; int year_of_birth;
float salary;
}person;
```

Structure within another Structure (Nested Structure)…

- In the structure above, we can group all the items related to birthday together and declare them under a substructure as:

```
struct Date
        {
        int day_of_birth;  int month_of_birth;  int
        year_of_birth;
        };
struct personal_record
        {
        char name[20];  struct Date birthday;  float
        salary;
        }person;
```

Structure within another Structure (Nested Structure)…

- Here, the structure *personal_record* contains a member named *birthday* which itself is a structure with 3 members. This is called structure within structure.
- The members contained within the inner structure can be accessed as:

  person.birthday.day_of_birth
  person.birthday.month_of_birth person.birthday.
  year_of_birth
- The other members within the structure personal_record are accessed as usual:

  person.name person.salary

```
printf("Enter name:\t");
scanf("%s", person.name);
printf("\nEnter day of birthday:\t");
scanf("%d", &person.birthday.day_of_birth);
printf("\nEnter month of birthday:\t");
scanf("%d", &person.birthday.month_of_birth);
printf("\nEnter year of birthday:\t");
scanf("%d", &person.birthday.year_of_birth);
printf("\nEnter salary:\t");
scanf("%f", &person.salary);
```

Structure within another Structure (Nested Structure)…

- ***Note:- More than one type of structures can be nested…***

```
struct  date
        {
        int day;
        int month;
        int year;
        };

struct name
      {
      char first_name[10];
      char middle_name[10];
      char last_name[10];
      };

struct personal_record
      {
      float salary;
      struct date birthday,deathday;
      struct name full_name;
      };
```

Assignment

- Create a structure named ***date*** that has ***day***, ***month*** and ***year*** as its members. Include this structure as a member in another structure named ***employee*** which has ***name***, ***id*** and ***salary*** as other members. Use this structure to read and display employee's name, id, date of birthday and salary.

Pointer to Structure

- A structure type pointer variable can be declared as:

```
struct book
        {
        char name[20];
        int pages;  float price;
        };
struct book *bptr;
```

- However, this declaration for a pointer to structure does not allocate any memory for a structure but allocates only for a pointer, so that to access structure's members through pointer ***bptr***, we must allocate the memory using ***malloc()*** function.
- Now, individual structure members are accessed as:

bptr->name ***bptr->pages*** ***bptr->price***

OR

(*bptr).name ***(*bptr).pages*** ***(*bptr).price***

- Here, **->** is called arrow operator and there must be a pointer to the structure on the left side of this operator.

```
struct book *bptr;

bptr=(struct book *)malloc(sizeof(struct book));

printf("\n Enter name:\t");
scanf("%s", bptr->name);
printf("\n Enter no. of pages:\t");
scanf("%d", &bptr->pages);
printf("\n Enter price:\t");
scanf("%f", & bptr->price=temp)
```

Pointer to Structure…

- Also, the address of a structure type variable can be stored in a structure type pointer variable as follows:

```
struct book
        {
        char name[20];  int pages;
        float price;
        };
struct book b, *bptr;  bptr=&b;
```

- Here, the base address of *b* is assigned to *bptr* pointer.

Pointer to Structure…

- Now the members of the structure book can be accessed in 3 ways as:

b.name	*bptr->name*	*(*bptr).name*
b.pages	*bptr->pages*	*(*bptr).pages*
b. price	*bptr-> price*	*(*bptr).price*

Pointer to array of structure

- Let we have a structure as follows:

```
struct book
        {
        char name[20];  int pages;
        float price;
        };
struct book b[10], *bptr;
```

- Then the assignment statement *bptr=b;* assigns the address of the zeroth element of *b* to *bptr*.

Pointer to array of structure…

- The members of *b[0]* can be accessed as:

bptr->name *bptr->pages* *bptr->price*

- Similarly members of *b[1]* can be accessed as:

(bptr+1)->name *(bptr+1)->pages* *(bptr+1)->price*

- The following *for* statement can be used to print all the values of array of structure *b* as:

```
for(bptr=b;bptr<b+10;bptr++)
printf("%s %d %f", bptr->name, bptr->pages, bptr->price);
```

Problem

- Define a structure of employee having data members name, address, age and salary. Take data for n employee in an array **dynamically** and find the average salary.
- Define a structure of student having data members name, address, marks in C language, and marks in information system. Take data for n students in an array dynamically and find the total marks obtained.

Function and Structure

- We will consider four cases here:
  - ***Passing the individual members to functions***
  - ***Passing whole structure to functions***
  - ***Passing structure pointer to functions***
  - ***Passing array of structure to functions***

Passing structure member to functions

- Structure members can be passed to functions as actual arguments in function call like ordinary variables.
- Problem: Huge number of structure members
- Example: Let us consider a structure *employee* having members *name*, *id* and *salary* and pass these members to a function:

display(emp.name,emp.id,emp.salary);

```
Void display(char e[],int id ,float sal)
{
printf("\nName\t\tID\t\tSalary\n);
printf("%s\t%d\t%.2f",e,id,sal);
}
```

Passing whole structure to functions

- Whole structure can be passed to a function by the syntax:
- ***function_name(structure_variable_name);***
- The called function has the form:
- ***return_type function_name(struct tag_name structure_variable_name)***
  - {
  - ……;
  - }

display(emp);

```
void display(struct employee e)
{
printf("\nName\tID\tSalary\n");
printf("%s\t%d\t%.2f",e.name,e.id,e.salar);
}
```

Passing structure pointer to functions

- In this case, address of structure variable is passed as an actual argument to a function.
- The corresponding formal argument must be a structure type pointer variable.
- Note: Any changes made to the members in the called function are directly reflected in the calling function.

```
display(&emp);


void display(struct employee *e)
{
printf("\nName\tID\tSalary\n");
printf("%s\t%d\t%.2f",e->name,e->id,e->salary);
}
```

Passing array of structures to function

- Passing an array of structure type to a function is similar to passing an array of any type to a function.
- That is, the name of the array of structure is passed by the calling function which is the base address of the array of structure.
- Note: The function prototype comes after the structure definition.

display(emp); //emp is array name of size 2

```
void display(struct employee ee[])
{
int i;
printf("\n Name\t\t ID\t\t Salary\n");
for(i=0;i<2;i++)
    {
    printf("%s\t\t%d\t\t%.2f\n",ee[i].name,ee[i].id,ee[i].salary);
    }
}
```

Structure using typedef

- It allows us to introduce synonyms for data types which could have been declared some other way.
- It is used to give New name to the Structure.
- New name is used for Creating instances, Passing values to function,declaration etc…

Example:

```
#include<stdio.h>
 int main()
 {
typedef int Number;
 Number num1 = 40,num2 = 20;
 Number answer;
answer = num1 + num2;
printf("Answer : %d",answer);
return(0);
}
```

Output :

Answer : 60

- In the above program we have used typedef to create alias name to data type. We have created alias name to ‘int’ data type. We have given new name to integer data type i.e ‘Number’.

- In the second example, **Record** is **tag-name**. **’employee’** is nothing but **New Data Type**. We can now create the variables of type **’employee’** Tag name is optional.

Different Ways of Declaring Structure using Typedef :

```
typedef struct
{
char ename[30];
int ssn;
int deptno;
 }
employee;
```

```
typedef struct Record
 {
char ename[30];
 int ssn;
 int deptno;
}
employee;
```

Live Example : Using Typedef For Declaring Structure

```
#include<stdio.h>
 typedef struct b1
{
 char bname[30];
 int ssn;
 int pages;
}
book;
book b1 = {"Let Us C",1000,90};
 int main()
{
printf("\nName of Book :s",b1.bname);
printf("\nSSN of Book : %d",b1.ssn);
printf("\nPages in Book : %d",b1.pages);
return(0);
}
```

OUTPUT:

```
Name of Book : Let Us C
 SSN of Book : 1000
 Pages in Book : 90
```

Pointer to Structure Array

- Like we have array of integers, array of pointers etc, we can also have array of structure variables. And to use the array of structure variables efficiently,
- we use **pointers of structure type**. We can also have pointer to a single structure variable, but it is mostly used when we are dealing with array of structure variables.

Accessing Structure Members with Pointer

```
#include <stdio.h>
struct Book
{ char name[10];
 int price; }
 int main()
{
struct Book a; //Single structure variable struct Book* ptr; //Pointer of Structure type ptr = &a;
 struct Book b[10]; //Array of structure variables struct Book* p; //Pointer of Structure type
 p = &b;
 return 0;
 }
```

Accessing Structure Members with Pointer

- To access members of structure using the structure variable, we used the dot . operator.

- But when we have a pointer of structure type, we use arrow -> to access structure members.

Accessing Structure Members with Pointer

```
#include <stdio.h>
 struct my_structure {
 char name[20];
 int number;
int rank;
};
 int main()
{
 struct my_structure variable = {"StudyTonight", 35, 1}; struct my_structure *ptr; ptr = &variable;
printf("NAME: %s\n", ptr->name);
printf("NUMBER: %d\n", ptr->number);
printf("RANK: %d", ptr->rank);
return 0;
}
```

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Bit Manipulation

- Suppose we want to store the gender of the person , then instead of wasting the complete byte we can manipulate single bit. We can consider Single bit as a flag. Gender of Person can be stored as **[M/F]** . By Setting the **flag bit**
- **1** we can set Gender as **“Male”** and “**Female**” by setting bit as 0
- 1. To pack **Several data objects** in the single memory word , Bits are used.
- 2. Flags can be used in order to store the Boolean values **(T / F)**.
- 3. A method to define a structure of packed information is known as **bit fields**.

Syntax : Bit Manipulation

```
struct databits
 {
int b1 : 1;
int b2 : 1;
int b3 : 1;
int b4 : 4;
int b5 : 9;
 }data1;
```

Explanation :

- In the above example, we can say that we have **allocated specific number of bits to each structure member**.

- Integer can store 2 bytes (*) , so 2 bytes are **manipulated in bits** and 1 bit is reserved for b1. Similarly b2,b3 will get single bit.

- Similarly we can structure efficiently to **store boolean values or smaller values** that requires little membory.

How to access the Individual Bits ?

- data1.b1
- data1.b2
- data1.b3
- data1.b4
- data1.b5

How to initialize Structure ?

```
struct databits
{
- -
- - -
}data1 = { 1,1,0,10,234 };
```

Initialized Result –

data1.b1 = 1
data1.b2 = 1
data1.b3 = 0
data1.b4 = 10
data1.b5 = 234

Unions

- Unions are quite similar to the structures in C.
- Union is also a derived type as structure.
- Union can be defined in same manner as structures just the keyword used in defining union in union where keyword used in defining structure was struct.

syntax

```
union car
{
char name[50];
int price;
 };
```

Union variables can be created in similar manner as structure variable.

```
union car
{
 char name[50];
 int price;
}c1, c2, *c3;
```

OR

```
union car
{
char name[50];
```

Accessing members of an union

- The member of unions can be accessed in similar manner as that structure. Suppose, we you want to access price for union variable c1 in above example, it can be accessed as c1.price. If you want to access price for union pointer variable c3, it can be accessed as (*c3).price or as c3->price.

Example


```
#include <stdio.h>
 union job
{
char name[32];
float salary;
int worker_no;
 }u;
struct job1
{
char name[32];
 float salary;
int worker_no;
 }s;
int main()
{
```

output

size of union = 32

size of structure = 40

Memory allocation

There is difference in memory allocation between union and structure as suggested in below example. The amount of memory required to store a structure variables is the sum of memory size of all members.

Fig: Memory allocation in case of structure

But, the memory required to store a union variable is the memory required for largest element of an union.

Fig: Memory allocation in case of union

Diff between structure and union

- All members of structure can be accessed at any time. But, only one member of union can be accessed at a time in case of union and other members will contain garbage value.

Example

```
#include <stdio.h>
union job
{
char name[32];
float salary;
int worker_no;
 }u;
 int main()
{
printf("Enter name:\n");
scanf("%s",u.name);
printf("Enter salary: \n");
scanf("%f",&u.salary);
printf("Displaying\nName :%s\n",u.name);
 printf("Salary: %.1f",u.salary);
```

output

Enter name Hillary

Enter salary 1234.23

Displaying Name: f%Bary

Salary: 1234.2

Initially, Hillary will be stored in u.name and other members of union will contain garbage value. But when user enters value of salary, 1234.23 will be stored in u.salary and other members will contain garbage value. Thus in output, salary is printed accurately but, name displays some random string.

Accessing Union Members

- To access any member of a union, we use the **member access operator (.)**.

```
#include <stdio.h>
 #include <string.h>
 union Data
 {
int i;
float f;
char str[20];
};
 int main( )
 {
union Data data;
data.i = 10;
 data.f = 220.5;
```

output

data.i : 1917853763

data.f : 41223605803277948604527599943 68.000000

data.str : C Programming

Here, we can see that the values of **i** and **f** members of union got corrupted because the final value assigned to the variable has occupied the memory location and this is the reason that the value of **str** member is getting printed very well.

Example

- Now let's look into the same example once again where we will use one variable at a time which is the main purpose of having unions –

```
#include <stdio.h>
#include <string.h>
union Data
 { int i;
float f;
 char str[20];
};
int main( )
 {
union Data data;
data.i = 10;
printf( "data.i : %d\n", data.i);
 data.f = 220.5;
```

output

data.i : 10

data.f : 220.500000

data.str : C Programming

Dynamic Arrays

- Dynamic arrays are created using pointer variables and memory management functions malloc,calloc and realloc.

- The concept of dynamic arrays is used in creating and manipulating data structures such as linked list, stacks and queues.

File Handling in C

What is a File?

- A *file* is a collection of related data that a computers treats as a single unit.
- Computers store files to secondary storage so that the contents of files remain intact when a computer shuts down.
- When a computer reads a file, it copies the file from the storage device to memory; when it writes to a file, it transfers data from memory to the storage device.
- C uses a structure called **`FILE`** (defined in **`stdio.h`**) to store the attributes of a file.

Steps in Processing a File

1. Create the stream via a pointer variable using the **FILE** structure:

```
FILE *p;
```

2. Open the file, associating the stream name with the file name.
3. Read or write the data.
4. Close the file.

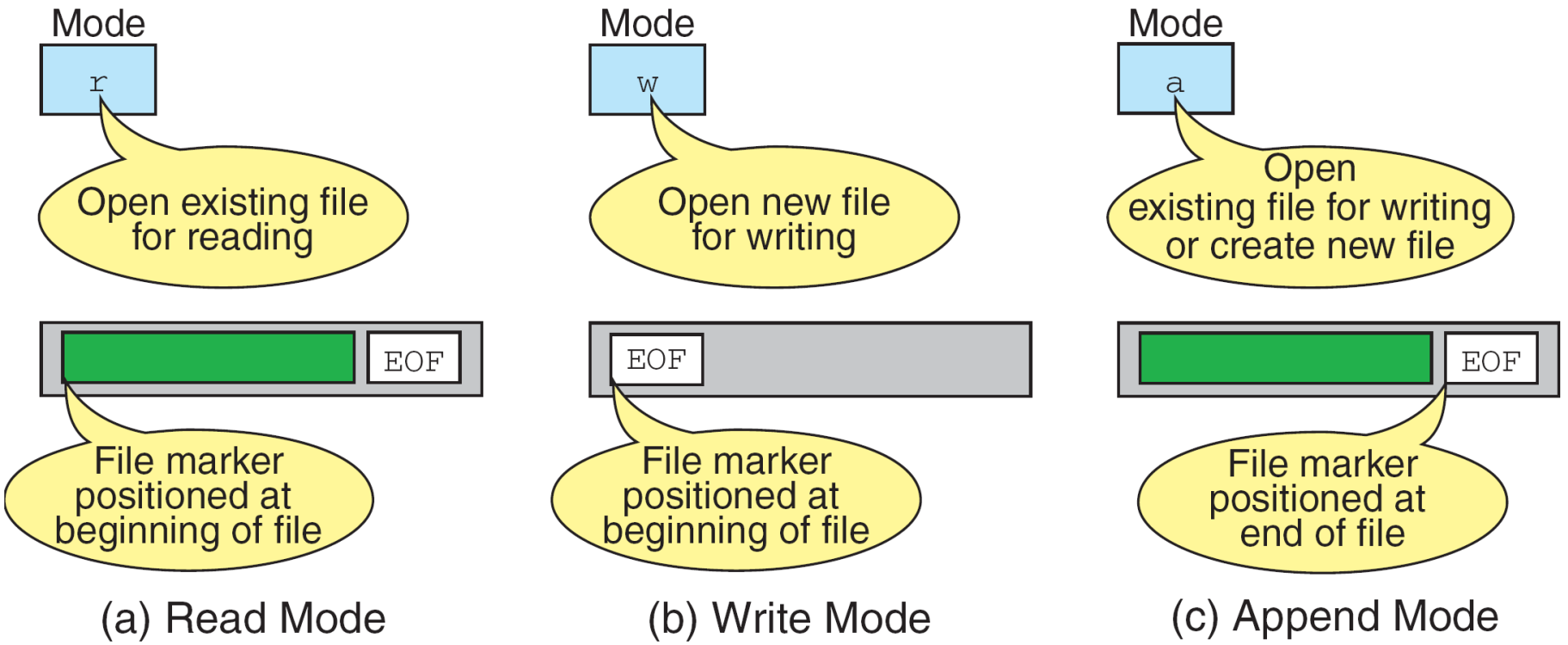
The basic file operations are

- fopen - open a file- specify how its opened (read/write) and type (binary/text)
- fclose - close an opened file
- fread - read from a file
- fwrite - write to a file
- fseek/fsetpos - move a file pointer to somewhere in a file.
- ftell/fgetpos - tell you where the file pointer is located.

File Open Modes

Mode	Meaning
r	Open text file in read mode • If file exists, the marker is positioned at beginning. • If file doesn't exist, error returned.
w	Open text file in write mode • If file exists, it is erased. • If file doesn't exist, it is created.
a	Open text file in append mode • If file exists, the marker is positioned at end. • If file doesn't exist, it is created.

More on File Open Modes



Additionally,

- r+ - open for reading and writing, start at beginning
- w+ - open for reading and writing (overwrite file)
- a+ - open for reading and writing (append if file exists)

File Open

- The file open function (**`fopen`**) serves two purposes:
  - It makes the connection between the physical file and the stream.
  - It creates “a program file structure to store the information” C needs to process the file.
- Syntax:
  filepointer=**`fopen(“filename”, “mode”);`**

More On **fopen**

- The file mode tells C how the program will use the file.
- The filename indicates the system name and location for the file.
- We assign the return value of **fopen** to our pointer variable:

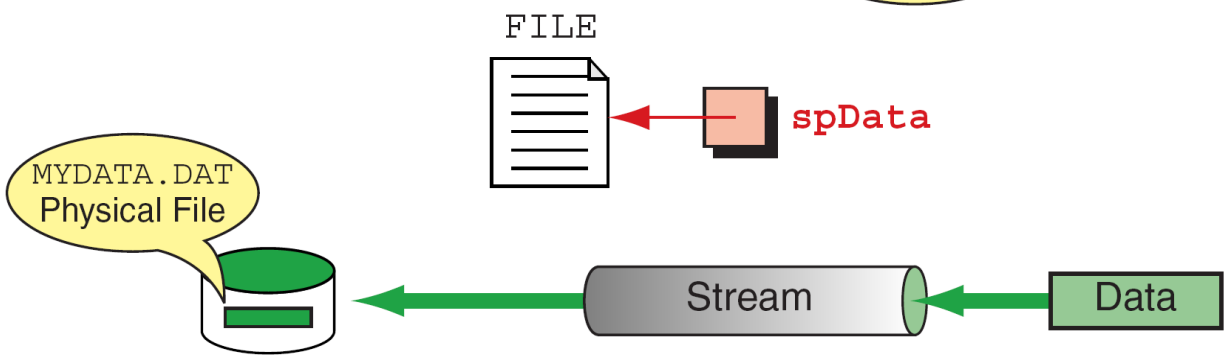
```
spData = fopen("MYFILE.TXT", "w");
spData = fopen("A:\\MYFILE.TXT", "w");
```

More On **fopen**

```
#include <stdio.h>
…
{
int main (void)
  FILE* spData;
  …
  spData = fopen("MYDATA.DAT", "w");
  …
} // main
```

Internal File Variable

External File Name



Closing a File

- When we finish with a mode, we need to close the file before ending the program or beginning another mode with that same file.
- To close a file, we use `fclose` and the pointer variable:

```
fclose(spData);
```

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fprintf()

Syntax:

fprintf (fp,"string",variables);

Example:

```
int i = 12;
float x = 2.356;
char ch = 's';
FILE *fp;
fp=fopen(“out.txt”,”w”);
fprintf (fp, "%d %f %c", i, x, ch);
```

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fscanf()

Syntax:

fscanf (fp,"string",identifiers);

Example:

```
FILE *fp;
Fp=fopen(“input.txt”,”r”);
int i;
fscanf (fp,“%d",i);
```

getc()

Syntax:

identifier = getc (file pointer);

Example:

```
FILE *fp;
fp=fopen(“input.txt”,”r”);
char ch;
ch = getc (fp);
```

putc()

write a single character to the output file, pointed to by fp.

Example:

```
FILE *fp;
char ch;
putc (ch,fp);
```

End of File

- There are a number of ways to test for the end-of-file condition. Another way is to use the value returned by the *fscanf* function:

```
FILE *fptr1;
int istatus ;
istatus = fscanf (fptr1, "%d", &var) ;
if ( istatus == feof(fptr1) )
{
        printf ("End-of-file encountered.\n”) ;
}
```

Reading and Writing Files

```
#include <stdio.h>
int main ( )
{
  FILE *outfile, *infile ;
  int b = 5, f ;
  float a = 13.72, c = 6.68, e, g ;
  outfile = fopen ("testdata", "w") ;
  fprintf (outfile, " %f %d %f ", a, b, c) ;
  fclose (outfile) ;
  infile = fopen ("testdata", "r") ;
  fscanf (infile,"%f %d %f", &e, &f, &g) ;
  printf (" %f %d %f \n ", a, b, c) ;
  printf (" %f %d %f \n ", e, f, g) ;
}
```

Example

```
#include <stdio.h>
#include<conio.h>
void main()
{
	char ch;
	FILE *fp;
	fp=fopen("out.txt","r");
	while(!feof(fp))
		{
		ch=getc(fp);
		printf("\n%c",ch);
	}
	getch();
 }
```

fread ()

Declaration:

```
size_t fread(void *ptr, size_t size, size_t n, FILE *stream);
```

Remarks:

fread reads a specified number of equal-sized data items from an input stream into a block.

ptr = Points to a block into which data is read
size = Length of each item read, in bytes
n = Number of items read
stream = file pointer

Example

Example:

```
#include <stdio.h>
int main()
{
    FILE *f;
    char buffer[11];
    if (f = fopen("fred.txt", “r”))
    {
    fread(buffer, 1, 10, f);
    buffer[10] = 0;
    fclose(f);
    printf("first 10 characters of the file:\n%s\n", buffer);
     }
 return 0;
}
```

fwrite()

Declaration:

```
size_t fwrite(const void *ptr, size_t size, size_t n, FILE*stream);
```

Remarks:

fwrite appends a specified number of equal-sized data items to an output file.

ptr = Pointer to any object; the data written begins at ptr

size = Length of each item of data

n =Number of data items to be appended

stream = file pointer

Example

Example:

```
#include <stdio.h>
int main()
{
    char a[10]={'1','2','3','4','5','6','7','8','9','a'};
    FILE *fs;
    fs=fopen("Project.txt","w");
    fwrite(a,1,10,fs);
    fclose(fs);
    return 0;
}
```

fseek()

This function sets the file position indicator for the stream pointed to by stream or you can say it seeks a specified place within a file and modify it.

SEEK_SET	Seeks from beginning of file
SEEK_CUR	Seeks from current position
SEEK_END	Seeks from end of file

Example:

```
#include <stdio.h>

int main()

{
        FILE * f;
        f = fopen("myfile.txt", "w");
        fputs("Hello World", f);
        fseek(f, 6, SEEK_SET);        SEEK_CUR,   SEEK_END
        fputs(" India", f);
        fclose(f);
        return 0;
   }
```

ftell()

offset = ftell(file pointer);

"ftell" returns the current position for input or output on the file

```
#include <stdio.h>

int main(void)
{
   FILE *stream;
   stream = fopen("MYFILE.TXT", "w");
   fprintf(stream, "This is a test");
   printf("The file pointer is at byte %ld\n", ftell(stream));
   fclose(stream);
   return 0;
}
```

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THANK YOU……