

File Handling in C Language

Module 01 - Concept of File and File Handling in C Language



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Concept of Files in C

A **file** is a collection of data stored on a disk or storage device. In C, files are used to store data permanently, so it can be accessed and modified later.



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Various operations like insertion, deletion, opening closing etc can be done upon a file. File handling in C allows you to:

- **Create files** for storing data.
- **Read files** to retrieve data.
- **Write files** to save data.
- **Update files** for modifications.



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File Operations in C

1. **Opening a file:** Open a file to read, write, or both.
2. **Reading or writing:** Perform operations like adding or retrieving data.
3. **Closing the file:** Ensure all operations are completed and free system resources.



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In C programming, **files** are categorized based on how data is stored and accessed. The two primary types of files are:

1. Text Files

- **Description:** Stores data in human-readable format, like plain text.
- **Structure:** Data is organized in lines, and each line ends with a newline character (\n).
- **Storage:** Characters are stored as ASCII values, which occupy one byte each.
- **Example:** A file containing "Hello World" is saved as plain text.
- **Access:** Can be opened with any text editor (e.g., Notepad).
- **File Modes:** "r", "w", "a", "r+", "w+", "a+".



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2. Binary Files

- **Description:** Stores data in binary format (0s and 1s), which is machine-readable.
- **Structure:** Data is stored in raw binary form, without any newline or formatting characters.
- **Storage:** Data occupies the same space in the file as it does in memory.
- **Example:** A file storing numbers 123 is saved as binary values, not ASCII characters.



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- **Access:** Cannot be opened with a text editor. Requires special programs or C functions to view.
- **File Modes:** "rb", "wb", "ab", "rb+", "wb+", "ab+".

File Opening in C

Files in C are opened using the fopen() function. The syntax is:

```
FILE *ptr = fopen("filename", "mode");
```

- **FILE *ptr:** This is a file pointer, which stores information about the file.
- **"filename":** The name of the file (e.g., "data.txt").
- **"mode":** How you want to open the file (explained below).

File Opening Modes

The file opening modes determine what kind of operation can be performed on the file:

Mode	Description	Action
"r"	Open file for reading.	File must exist; otherwise, it returns <code>NULL</code> .
"w"	Open file for writing.	Creates a new file if it doesn't exist; overwrites if it does.
"a"	Open file for appending.	Adds new data to the end of the file; creates file if it doesn't exist.
"r+"	Open file for reading and writing.	File must exist.
"w+"	Open file for reading and writing.	Creates a new file if it doesn't exist; overwrites if it does.
"a+"	Open file for reading and appending.	Creates a file if it doesn't exist; appends new data while allowing reading.
"b"	Add to any mode for binary file handling.	E.g., "rb", "wb".

Reading from File

Steps to Read from a File

1. **Open the File:** Use the fopen() function in read mode ("r" for text files or "rb" for binary files).
2. **Read the Data:** Use file input functions like fscanf(), fgets(), or fread() to read data.
3. **Close the File:** Use the fclose() function to close the file and free up resources.

File Input Functions

Function	Purpose	Mode
fscanf()	Reads formatted data from a file	Text
fgets()	Reads a line of text from a file	Text
fread()	Reads raw binary data from a file	Binary

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Solved Example: Reading a Text File Line by Line Using fgets()

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```
#include <stdio.h>
```

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```
void main() {  
    FILE *filePtr;  
    char line[100];
```

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```
    // Open the file in read mode  
    filePtr = fopen("example.txt", "r");  
    if (filePtr == NULL) {  
        printf("Error: Could not open file.\n");  
        return;  
    }
```

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```
    // Read and display each line  
    while (fgets(line, sizeof(line), filePtr)) {  
        printf("%s", line);  
    }
```

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```
    // Close the file  
    fclose(filePtr);  
}
```

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Explanation:

- **fopen():** Opens the file example.txt in read mode.
- **fgets():** Reads a line (up to 99 characters) and stores it in the line array.
- **fclose():** Closes the file after reading.

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Writing to a File

Steps to Write to a File

- 1. Open the File:** Use the fopen() function with write modes:
 - o "w": Write mode (creates a new file or overwrites an existing file).
 - o "a": Append mode (adds data to the end of an existing file without overwriting).
 - o "wb" or "ab": Binary versions of the above.
- 2. Write the Data:** Use functions like fprintf(), fputs(), or fwrite() to write data.
- 3. Close the File:** Use the fclose() function to save changes and free resources.

File Output Functions

Function	Purpose	Mode
fprintf()	Writes formatted text to a file	Text
fputs()	Writes a string to a file	Text
fwrite()	Writes raw binary data to a file	Binary

Solved Example: Writing Text to a File Using fprintf()

```
#include <stdio.h>

void main() {
    FILE *filePtr;

    // Open the file in write mode
    filePtr = fopen("output.txt", "w");
    if (filePtr == NULL) {
        printf("Error: Could not open file.\n");
        return;
    }

    // Write data to the file
    fprintf(filePtr, "Name: John Doe\n");
    fprintf(filePtr, "Age: 25\n");
    fprintf(filePtr, "Country: USA\n");

    // Close the file
    fclose(filePtr);

    printf("Data written successfully!\n");
}
```

Explanation:

- `fopen()`: Opens or creates the file `output.txt` in write mode.
- `fprintf()`: Writes formatted text (like `printf()`) but to a file).
- `fclose()`: Closes the file after writing.

File Closing in C

File closing is the process of properly terminating a file's usage in a program to ensure that:

1. All data is saved.
2. System resources (like memory or file descriptors) are released.

How to Close a File

The `fclose()` function is used to close a file in C. Its syntax is:

```
int fclose(FILE *filePtr);
```

Parameters: `filePtr` is the pointer to the file that needs to be closed.

Why Is File Closing Important?

1. **Saves Data:** Ensures that any data buffered during writing is flushed (saved) to the file.
2. **Releases Resources:** Frees the memory or file descriptors used by the program.
3. **Prevents Corruption:** Helps avoid file corruption by ensuring the file isn't left open after the program ends.

What Happens If You Don't Close a File?

1. **Buffered Data Loss:** Some data written to the file might remain in the buffer and not be saved.
2. **Resource Leaks:** The program may consume unnecessary system resources.
3. **Undefined Behavior:** Leaving a file open may cause unexpected behavior, especially in larger applications.

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Solved Example: Closing a File Using fclose()

```
#include <stdio.h>

void main() {
    FILE *filePtr;

    // Open the file in write mode
    filePtr = fopen("example.txt", "w");
    if (filePtr == NULL) {
        printf("Error: Could not open file.\n");
        return;
    }

    // Write some data to the file
    fprintf(filePtr, "This is an example file.\n");

    // Close the file
    if (fclose(filePtr) == 0) {
        printf("File closed successfully.\n");
    } else {
        printf("Error closing the file.\n");
    }
}
```

Assignment

Ques 1: Write a program to read data from file and close using fclose function.
Ques 2: Write a program to read the contents of a file and display it on the screen.

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