

# File Handling

## CS10001: Programming & Data Structures



**Pallab Dasgupta**

Professor, Dept. of Computer Sc. & Engg.,  
Indian Institute of Technology Kharagpur

# What is a file?

---

- **A named collection of data, stored in secondary storage (typically).**
- **Typical operations on files:**
  - **Open**
  - **Read**
  - **Write**
  - **Close**
- **How is a file stored?**
  - **Stored as sequence of bytes, logically contiguous (may not be physically contiguous on disk).**

- The last byte of a file contains the end-of-file character (**EOF**), with ASCII code 1A (hex).
- While reading a text file, the EOF character can be checked to know the end.
- **Two kinds of files:**
  - **Text :: contains ASCII codes only**
  - **Binary :: can contain non-ASCII characters**
    - Image, audio, video, executable, etc.
    - To check the end of file here, the **file size** value (also stored on disk) needs to be checked.

# File handling in C

- In C we use `FILE *` to represent a pointer to a file.
- `fopen` is used to open a file. It returns the special value `NULL` to indicate that it is unable to open the file.

```
FILE *fptr;  
char filename[] = "file2.dat";  
fptr = fopen (filename, "w");  
if (fptr == NULL) {  
    printf ("ERROR IN FILE CREATION");  
    /* DO SOMETHING */  
}
```

# Modes for opening files

- The second argument of `fopen` is the *mode* in which we open the file. There are three modes.
  - "r" opens a file for reading.
  - "w" creates a file for writing, and writes over all previous contents (deletes the file so be careful!).
  - "a" opens a file for appending – writing on the end of the file.

- We can add a “b” character to indicate that the file is a *binary* file.
  - “rb”, “wb” or “ab”

```
fptr = fopen ("xyz.jpg", "rb");
```

# The `exit()` function

- Sometimes error checking means we want an "*emergency exit*" from a program.
- In `main()` we can use `return` to stop.
- In functions we can use `exit()` to do this.
- `Exit` is part of the `stdlib.h` library.

```
exit(-1);
```

in a function is exactly the same as

```
return -1;
```

in the main routine

# Usage of exit( )

```
FILE *fptr;  
char filename[] = "file2.dat";  
fptr = fopen (filename, "w");  
if (fptr == NULL) {  
    printf ("ERROR IN FILE CREATION");  
    /* Do something */  
    exit(-1);  
}  
.....
```



# Writing to a file using fprintf( )

- `fprintf( )` works just like `printf( )` and `sprintf( )` except that its first argument is a file pointer.

```
FILE *fptr;  
Fptr = fopen ("file.dat","w");  
/* Check it's open */  
  
fprintf (fptr, "Hello World!\n");  
fprintf (fptr, "%d %d", a, b);
```

# Reading Data Using fscanf( )

- We also read data from a file using `fscanf( )`.

```
FILE *fptr;
Fptr = fopen ("input.dat", "r");
/* Check it's open */
if (fptr == NULL)
{
    printf("Error in opening file \n");
}
fscanf (fptr, "%d %d",&x, &y);
```

# Reading lines from a file using `fgets( )`

We can read a string using `fgets( )`.

```
FILE *fptr;
char line [1000];
/* Open file and check it is open */
while (fgets(line,1000,fptr) != NULL)
{
    printf ("Read line %s\n",line);
}
```

`fgets( )` takes 3 arguments – a string, maximum number of characters to read, and a file pointer. It returns `NULL` if there is an error (such as `EOF`).

# Closing a file

- We can close a file simply using `fclose()` and the file pointer.

```
FILE *fptr;
char filename[] = "myfile.dat";
fptr = fopen (filename, "w");
if (fptr == NULL) {
    printf ("Cannot open file to write!\n");
    exit(-1);
}
fprintf (fptr, "Hello World of filing!\n");
fclose (fptr);
```

# Three special streams

- Three special file streams are defined in the `<stdio.h>` header
  - `stdin` reads input from the keyboard
  - `stdout` send output to the screen
  - `stderr` prints errors to an error device (usually also the screen)
- What might this do?

```
fprintf (stdout, "Hello World!\n");
```

# An example program

```
#include <stdio.h>
main()
{
    int i;

    fprintf(stdout, "Give value of i \n");
    fscanf(stdin, "%d", &i);
    fprintf(stdout, "Value of i=%d \n", i);
    fprintf(stderr, "No error: But an example to
    show error message.\n");
}
```

**Give value of i**  
**15**  
**Value of i=15**  
**No error: But an example to show error message.**

# Input File & Output File redirection

- One may redirect the standard input and standard output to other files (other than `stdin` and `stdout`).
- Usage: Suppose the executable file is `a.out`:

```
$ ./a.out <in.dat >out.dat
```

`scanf()` will read data inputs from the file “`in.dat`”, and `printf()` will output results on the file “`out.dat`”.

# A Variation

---

```
$ ./a.out <in.dat >>out.dat
```

`scanf()` will read data inputs from the file “`in.dat`”, and `printf()` will **append** results at the end of the file “`out.dat`”.



# Reading and Writing a character

- A character reading/writing is equivalent to reading/writing a byte.

```
int getchar( );  
int putchar(int c);
```

} **stdin, stdout**

```
int fgetc(FILE *fp);  
int fputc(int c, FILE *fp);
```

} **file**

- **Example:**

```
char c;  
c = getchar();  
putchar(c);
```

## Example: use of getchar ( ) & putchar ( )

```
#include <stdio.h>
main()
{
    int c;

    printf("Type text and press return to
        see it again \n");
    printf("For exiting press <CTRL D> \n");
    while((c = getchar()) != EOF)
        putchar(c);
}
```

---

# Command Line Arguments

# What are they?

- A program can be executed by directly typing a command at the operating system prompt.

```
$ cc -o test test.c
```

```
$ ./a.out in.dat out.dat
```

```
$ prog_name param_1 param_2 param_3 ..
```

- The individual items specified are separated from one another by spaces.
  - First item is the program name.
- Variables *argc* and *argv* keep track of the items specified in the command line.

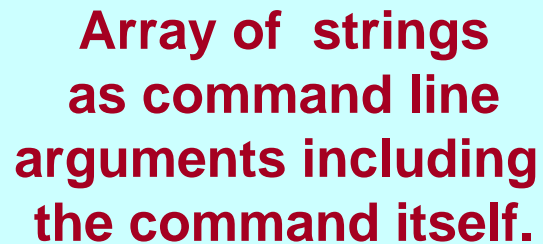
# How to access them?

- Command line arguments may be passed by specifying them under `main()`.

```
int main (int argc, char *argv[]);
```



Argument  
Count

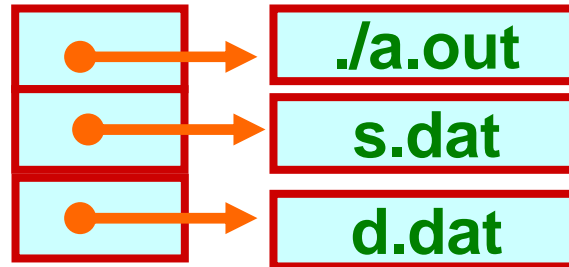


Array of strings  
as command line  
arguments including  
the command itself.

# Example: Contd.

```
$ ./a.out s.dat d.dat
```

argc=3



argv

argv[0] = `./a.out`

argv[1] = `s.dat`

argv[2] = `d.dat`

# Example: reading command line arguments

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

int main(int argc, char *argv[])
{
    FILE *ifp, *ofp;
    int i, c;
    char src_file[100], dst_file[100];

    if(argc!=3) {
        printf ("Usage: ./a.out <src_file> <dst_file> \n");
        exit(0);
    }
    else {
        strcpy (src_file, argv[1]);
        strcpy (dst_file, argv[2]);
    }
}
```

## Example: contd.

```
if ((ifp = fopen(src_file,"r")) == NULL) {
    printf ("File does not exist.\n");
    exit(0);
}

if ((ofp = fopen(dst_file,"w")) == NULL) {
    printf ("File not created.\n");
    exit(0);
}

while ((c = fgetc(ifp)) != EOF) {
    fputc (c,ofp);
}

fclose(ifp);
fclose(ofp);
}
```



## Example: with command-line arguments

- Write a program which will take the number of data items, followed by the actual data items on the command line, and print the average.

```
$ ./a.out 6 10 17 35 12 28 33
```

No. of data items



`argv[1] = "10"`

`argv[2] = "17", and so on`

# Getting numbers from strings

- Once we have got a string with a number in it (either from a file or from the user typing) we can use `atoi` or `atof` to convert it to a number.
- The functions are part of `stdlib.h`

```
char numberstring[] = "3.14";  
int i;  
double pi;  
pi = atof (numberstring);  
i = atoi ("12");
```

Both of these functions return 0 if they have a problem.

- Alternatively, we can use `sscanf ( )` .
- For example, if `argv[1]="10"` and `argv[2]="17"`, then we can read their values into integer variables as:

```
sscanf (argv[1], "%d", &n1);  
sscanf (argv[2], "%d", &n2);
```

# Reading one line at a time

- It is quite common to want to read every line in a program. The best way to do this is a while loop using `fgets()`.

```
FILE *fptr;
char tline[100];
fptr = fopen ("sillyfile.txt", "r");

/* check it's open */
while (fgets (tline, 100, fptr) != NULL) {
    printf ("%s", tline); // Print it
}

fclose (fptr);
```