Adding 2 Numbers

```
#include<stdio.h>
#include<stdlib.h>
int main(int argc, char *argv[]) {
    if (argc != 3)
        printf (“Bad args!\n");
    else {
        int a = atoi(argv[1]);
        int b = atoi(argv[2]);
        printf (“%d\n",a+b);
    }
    return 0;
}
```

```
$ ./a.out
Bad args!
```

```
$ ./a.out 3 4
7
$ ./a.out 3 -4
-1
$ ./a.out 3 four
3
```

```
$ ./a.out 3 4 5
Bad args!
```

Command Line Sorting

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

   n = argc - 1;
   ar = (int *)malloc(sizeof(int) * n);
   for (i=0; i<n; i++)
      ar[i] = atoi(argv[i+1]);

   merge_sort(ar, n); // or any other sort

   for (i=0; i<n; i++)
      printf("%d ",ar[i]);
   return 0;
}
```

```
void merge_sort (
       int *arr, int n)
{
    ...
}
```

```
$ ./a.out 1 4 2 5 3 9 -1 6 -10 10
-10 -1 1 2 3 4 5 6 9 10
```

Renaming Executable

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

   n = argc - 1;
   ar = (int *)malloc(sizeof(int) * n);
   for (i=0; i<n; i++)
      ar[i] = atoi(argv[i+1]);

   merge_sort(ar, n); // or any other

   for (i=0; i<n; i++)
      printf("%d ",ar[i]);
   return 0;
}
```

```
void merge_sort (
       int *arr, int n)
{
    ...
}
```

The flag "-o" of gcc can be used to give user-defined name to the executable, e.g.

```
$ gcc –o sort myfile.c
```

```
$ ./sort 1 4 2 5 3 9 -1 6 -10 10
-10 -1 1 2 3 4 5 6 9 10
```

Reading from and Writing to a File from C Program

Files

- What is a file?
  - Collection of bytes stored on secondary storage like hard disks (not RAM).
- Any *addressable* part of the file system in an Operating system can be a file.
  - includes such strange things as /dev/null (nothing), /dev/usb (USB port), /dev/audio (speakers), and of course, files that a user creates (/home/don/input.txt, /home/don/Esc101/lab12.c)

File Access

- 3 files are always connected to a C program :
  - stdin : the standard input, from where scanf, getchar(), gets() etc. read input from
  - stdout : the standard output, to where printf(), putchar(), puts() etc. output to.
  - stderr : standard error console.

File handling in C

1. Open the file for reading/writing etc.: fopen
   - return a *file pointer*
   - pointer points to an internal structure containing information about the file:
     - location of a file
     - the current position being read in the file
     - and so on.

```
FILE* fopen (char *name, char *mode)
```

2. Read/Write to the file

```
int fscanf(FILE *fp, char *format, …)
int fprintf(FILE *fp, char *forma
```

3. Close the File.

```
int fclose(FILE *fp)
```

Compared to scanf and printf – a new (first) argument fp is added

Opening Files

```
FILE* fopen (char *name, char *mode)
```

- The first argument is the name of the file
  - can be given in short form (e.g. “inputfile”) or the full path name (e.g. “/home/don/inputfile”)
- The second argument is the mode in which we want to open the file. Common modes include:
  - “r” : read-only. Any write to the file will fail. File must exist.
  - “w” : write. The first write happens at the beginning of the file, by default. Thus, may overwrite the current content. A new file is created if it does not exist.
  - “a” : append. The first write is to the end of the current content. File is created if it does not exist.

Opening Files

- If successful, fopen returns a *file pointer* - this is later used for fprintf, fscanf etc.
- If unsuccessful, fopen returns a NULL.
- It is a good idea to check for errors (e.g. Opening a file on a CDROM using "w" mode etc.)

Closing Files

- An open file must be closed after last use
  - allows reuse of FILE* resources
  - flushing of ***buffered*** data (to actually write!)

File I/O: Example

- Write a program that will take two filenames, and print contents to the standard output. The contents of the first file should be printed first, and then the contents of the second.
- The algorithm:
  1. Read the file names.
  2. Open file 1. If open failed, we exit
  3. Print the contents of file 1 to stdout
  4. Close file 1
  5. Open file 2. If open failed, we exit
  6. Print the contents of file 2 to stdout
  7. Close file 2

The Program: main

```
int main()
{
  FILE *fp;  char filename1[128], filename2[128];
  scanf(“%s”, filename1);
  scanf(“%s”, filename2);
  fp = fopen( filename1, "r" );
  if(fp == NULL) {
    fprintf(stderr, "Opening File %s failed\n", filename1);
    return -1;
  }
  copy_file(fp, stdout);
  fclose(fp);
  fp = fopen( filename2, "r" );
  if (fp == NULL) {
    fprintf(stderr, "Opening File %s failed\n", filename2);
    return -1;
  }
  copy_file (fp, stdout);
  fclose(fp);
  return 0;
}
```

The Program: copy_file

```
void copy_file(FILE *fromfp, FILE *tofp)
{
  char ch;

  while ( !feof ( fromfp ) ) {
    fscanf  ( fromfp, "%c", &ch );
    fprintf ( tofp, "%c", ch );
  }
}
```

Some other file handling functions

- `int feof ( FILE* fp );`
  - Checks whether the EOF is set for fp – that is, the EOF has been encountered. If EOF is set, it returns nonzero. Otherwise, returns 0.
- `int ferror ( FILE *fp );`
  - Checks whether the error indicator has been set for fp. (for example, write errors to the file.)

Some other file handling functions

- **`int fseek(FILE *fp, long int offset, int origin);`**
  - To set the current position associated with fp, to a new position = origin + offset.
  - Origin can be:
    - SEEK_SET: beginning of file
    - SEEK_CURR: current position of file pointer
    - SEEK_END: End of file
  - Offset is the number of bytes.
- **`int ftell(FILE *fp)`**
  - Returns the current value of the position indicator of the stream.

Opening Files: More modes

- There are other modes for opening files, as well.
  - "r+" : open a file for read and update. The file must be present.
  - "w+" : write/read. Create an empty file or overwrite an existing one.
  - "a+" : append/read. File is created if it doesn't exist. The file position for reading is at the beginning, but output is appended to the end.

File I/O example

```
#include <stdio.h>
int main () {
    FILE * fp = fopen("file.txt","w+");
    fputs("This is tutorialspoint.com", fp);
    fseek( fp, 7, SEEK_SET );
    fputs(" C Programming Language", fp);
    fclose(fp);

    int c;
    fp = fopen("file.txt","r");
    while(1)  {
        c = fgetc(fp);
        if( feof(fp) ) break;
        printf("%c", c);
    }
    fclose(fp);
    return 0;
}
```

```
This is C Programming Language
```

FileI/O: stdout vs stderr

- What is the output of following program when run on a terminal:

```
#include <stdio.h>
int main()
{
   int input;
   scanf("%d", &input);
   fprintf(stdout, "Printing to STDOUT %d\n", input);
   fprintf(stderr, "Printing to STDERR %d\n", input);
   return 0;
}
```

INPUT
5

```
Printing to STDOUT 5
Printing to STDERR 5
```

FileI/O: stdout vs stderr

- What is the output of following program when run on a terminal:

```c
#include <stdio.h>
int main()
{
   int input;
   scanf("%d", &input);
   fprintf(stdout, "Printing to STDOUT %d", input);
   fprintf(stderr, "Printing to STDERR %d", input);
   return 0;
}
```

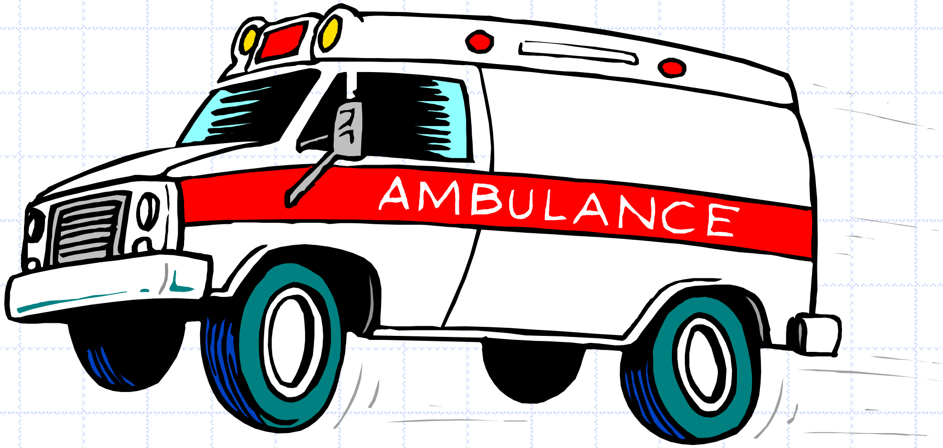
INPUT
5

~~Printing to STDOUT 5Printing to STDERR 5~~

```
Printing to STDERR 5Printing to STDOUT 5
```

Stdout vs. Stderr (Intuition)

vs.



An Exercise

- Often, events in a system are logged on to a particular file. (e.g. usb drive mounted, user logs off etc.)
- These log files can be quite large. We are usually interested in the latest events (maybe the last 10 events.)
- The unix command “tail <filename>” prints the last 10 lines of <filename>. Can you program this?
- (Hint: Start at end of file, and use fseek.)

“Computer science is not about machines, in the same way that astronomy is not about telescopes. There is an essential unity of mathematics and computer science.”

-- 1990s Folklore. Sometimes attributed to Edsger W. Dijkstra.