Lecture 12

File Processing

Fundamentals of Computer and Programming

Instructor: Morteza Zakeri, Ph.D. (m-zakeri@live.com)

Spring 2024

Modified Slides from Dr. *Hossein Zeinali* and *Dr. Bahador Bakhshi*

Computer Engineering Department, Amirkabir University of Technology

What We Will Learn

- Introduction
  - Text *vs.* Binary files
- Text File Operations
  - Open / Close
  - Read / Write
- Binary File Operations
  - Open / Close
  - Read / Write
- Bugs and avoiding them

What We Will Learn

- Introduction
  - Text *vs.* Binary files
- Text File Operations
  - Open/Close
  - Read/Write
- Binary File Operations
  - Open/Close
  - Read/Write
- Bugs and avoiding them

Introduction

- Data storages of computers
- **1.** Main memory (RAM)
  - It is volatile
  - Read / Write data using variables
- **2.** Secondary storage (Hard Disk)
  - It is not volatile (non-volatile)
  - Read / Write data using files

Text and Binary Files

- How does computer store data?
  - They are coded
- When data are stored in main memory
  - It is variable
  - Its coding is specified by the type: int, char, …
- When data are stored in secondary memory
  - It is file
  - Coding is specified by the file type: Text or Binary

Text Files

- ASCII encoding
  - American Standard Code for Information Interchange
- Each line is a string
- Each line is terminated by **`\n`**
- Human-readable files
  - Editable by a text editor (*e.g.* Notepad++)
- Examples: C source files (**`.c`**) , Every **`.txt`** files

Binary Files

- Binary encoding
  - int, double, float, struct, … are directly (as **0**, **1**) stored in the file.
- Human unreadable files
  - Is not editable by text editor
  - Needs special editor (HxD) which understands the file
- Examples
  - **`.exe`** files
  - Media files, such as **`.mp3`**, **`.mkv`**
  - Image files, such as **`.bmp`**, **`.jpg`**

Working with Files

- Until now
  - We read/write data from/to terminal (console)
- In C
  - We can read data from a file
  - We can write data to a file

Working with Files

- Main steps in working with files
- 1) Open file
  - Get a file handler from Operating System
- 2) Read/Write
  - Use the handler
- 3) Close file
  - Free the handler
- 4) Other operations
  - Check end of file, skip in file, …

Opening Files

- Function **`fopen`** opens files

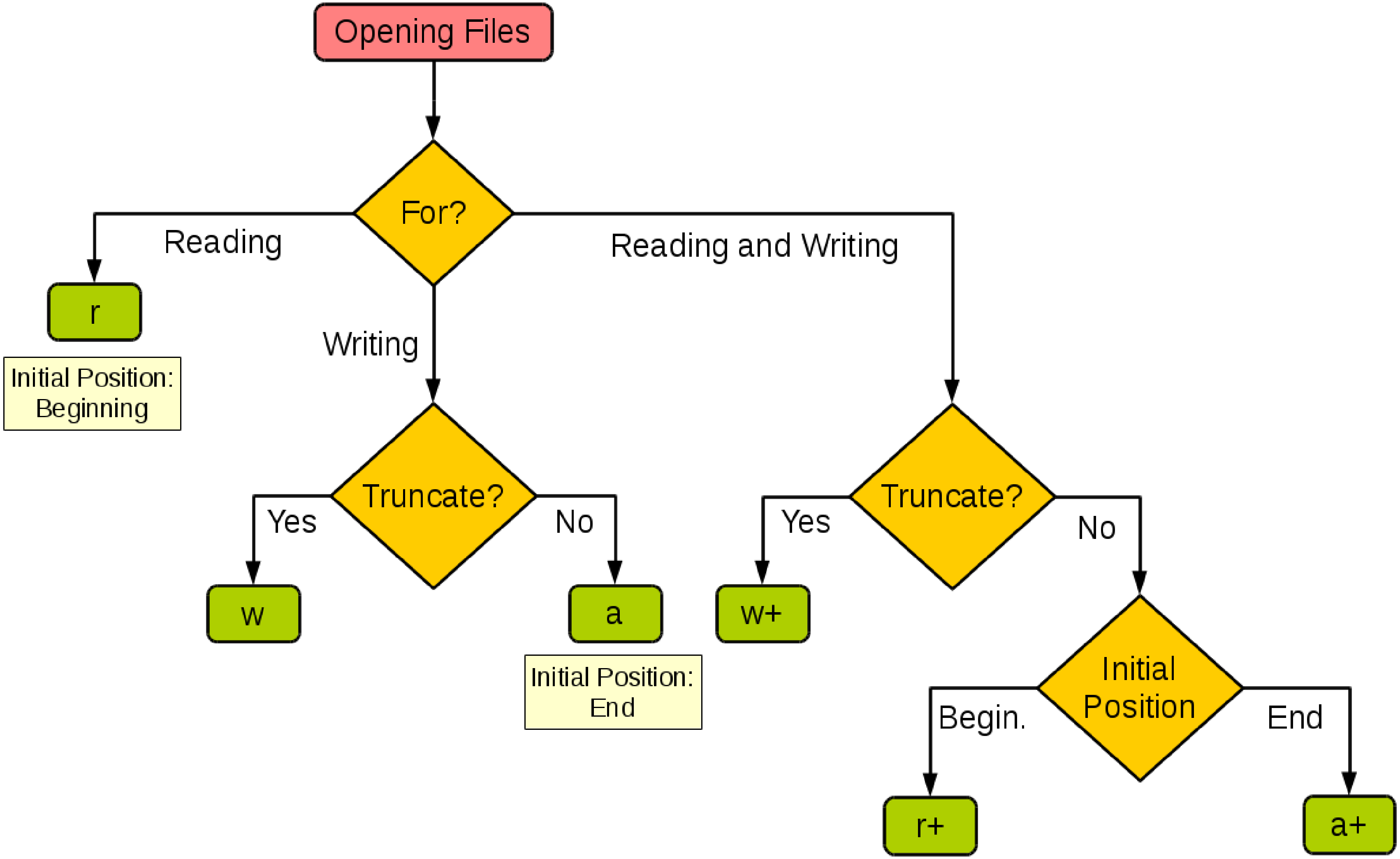
```
#include <stdio.h>

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

- **`FILE *`** is struct
  - Saves information about file.
  - We do not need to know about it.
- If cannot open file, **`fopen`** returns **`NULL`**.
- **`name`** is the name of file:
  - Absolute name: **`C:\prog\test.txt`**
  - Relative name: **`Mytest.txt`**

Opening Files: Modes

- `r`: open for read. We cannot write to the file.
- `w`: open for write. Create new file. We cannot read form the file. If file exist, its content will be destroyed.
- `a`: open for write. We cannot read form the file. If file exist, its content wont be destroyed. We write **at end of file.**
- `r+, w+, a+` : same to `r, w, a` but we can read and write.

Opening Files: Modes



Opening Files: Modes

- Files are
  - Text: Some strings
  - Binary: Image file, Video file, …

- To open binary file, we should add **`b`** to the mode.
  - **`rb`** : open binary file for read
  - **`w+b`**: create new binary file for read and write

Opening Files: Example

```
FILE *fp;
fp = fopen("c:\\test.txt", "r");
if(fp == NULL){
  printf("Cannot open file\n");
  return -1;
}
```

- Open file c:\test.txt for read

File-Position Pointer (FPP)

- File-Position Pointer
  - A pointer in file
  - Points to current location of read and write
- When file is open
  - File-Position Pointer is set to start of file
- When you read/write from/to file
  - The File-Position Pointer advance according to the size of data
    - If you read 2 bytes, it moves 2 bytes
    - If you write 50 bytes, it advances 50 bytes

Closing Files

- Each opened file should be closed.
- If we write to a file and do not close it, some of data may be LOST.
- To close the file

```
    fclose(FILE *fp);
```

Understanding fflush in C

- Functionality:
  - **`fflush`** stands for "flush buffer."
  - It is used to clear the output buffer, ensuring that data is written to the file or displayed on the console.
  - Essential when switching between reading and writing modes on a file.

- Usage:
  - Syntax: **`int fflush(FILE *stream);`**
  - It takes a pointer to the file stream as an argument.
  - Returns 0 on success, EOF on failure.

```
FILE *filePtr = fopen("example.txt", "w");
fprintf(filePtr, "Hello, World!");
fflush(filePtr); // Ensure data is written immediately
```

What We Will Learn

- Introduction
  - Text *vs.* Binary files
- Text File Operations
  - Open/Close
  - Read/Write
- Binary File Operations
  - Open/Close
  - Read/Write
- Bugs and avoiding them

Reading/Writing Text File

- **fscanf** reads from a file. **fscanf** is the same as **scanf**.
- Returns **EOF** if the End-of-File has been reached.
- **fprintf** writes to a file. **fprintf** is the same as **printf**.

```
int fscanf(FILE *fp,"format",
  parameters);

int fprintf(FILE *fp,"format",
  parameters);
```

Text File: Example

- Assume we have a file in the following format:

<Number of students>

<id of student 1> <grade of student 1>

<id of student 2> <grade of student 2>

…

<id of student n> <grade of student n>

Text File: Example

برنامه‌ای که شماره و نمره دانشجویان را از
فایل بخواند و میانگین را محاسبه کند.

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

int main(void){
  FILE *fpin;
  char inname[20];
  int num, i, id;
  float sum, average, grade;

  printf("Enter the name of input file: ");
  scanf("%s", inname);

  fpin = fopen(inname, "r");
  if(fpin == NULL){
      printf("Cannot open %s\n", inname);
      return -1;
  }
```

Text File: Example

ادامه

```
   /* Read the number of students */
   fscanf(fpin,"%d", &num);

   /* Read the id and grade from file */
   sum = 0;
   for(i = 0; i < num; i++){
       fscanf(fpin, "%d %f", &id, &grade);
       sum += grade;
   }

   average = sum / num;
   printf("Average = %f\n", average);

   fclose(fpin);
   return 0;
}
```

Text File: Example 2

برنامه‌ای که شماره و نمره دانشجویان را از فایل بخواند
و لیست دانشجویانی که نمره آنها بیشتر از میانگین
است را در فایل دیگری بنویسد.

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

int main(void){
   FILE *fpin, *fpout;
   char inname[20], outname[20];
   int num, i, id;
   float sum, average, grade;

   printf("Enter the name of input file: ");
   scanf("%s", inname);

   printf("Enter the name of output file: ");
   scanf("%s", outname);

   fpin = fopen(inname, "r");
   if(fpin == NULL){
        printf("Cannot open %s\n", inname);
        return -1;
   }
```

Text File: Example 2

ادامه

```
fpout = fopen(outname, "w");
if(fpout == NULL){
    printf("Cannot open %s\n", outname);
    return -1;
}

/* Read the number of students */
fscanf(fpin, "%d", &num);

/* Read the id and grade from file */
sum = 0;
for(i = 0; i < num; i++){
    fscanf(fpin, "%d %f", &id, &grade);
    sum += grade;
}

average = sum / num;
```

Text File: Example 2

ادامه

```
  fclose(fpin);
  fpin = fopen(inname, "r");
  fscanf(fpin,"%d", &num);

  fprintf(fpout, "%f\n", average);
  for(i = 0; i < num; i++){
      fscanf(fpin, "%d %f", &id, &grade);
      if(grade >= average)
            fprintf(fpout, "%d: %s\n", id, "passed");
      else
            fprintf(fpout, "%d: %s\n", id, "failed");
  }
  fclose(fpin);
  fclose(fpout);
  return 0;
}
```

Reading/Writing Characters (Text Files)

- To write a character to file

```
fputc(char c, FILE *fp)
```

- To read a char from file

```
char fgetc(FILE *fp);
```

  - Returns EOF if reaches to the End-of-File.

Text File: Example copy files

برنامه‌ای که اسم یک فایل ورودی و خروجی را
از کاربر بگیرد و فایل ورودی را در خروجی کپی
کند.

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

int main(void){

   FILE *fpin, *fpout;
   char inname[20], outname[20];
   char c;

   printf("Enter the name of input file: ");
   scanf("%s", inname);

   printf("Enter the name of output file: ");
   scanf("%s", outname);
   fpin = fopen(inname, "r");
   if(fpin == NULL){
       printf("Cannot open %s\n", inname);
       return -1;
   }
```

Text File: Example copy files

ادامه

```
  fpout = fopen(outname, "w");
  if(fpout == NULL){
      printf("Cannot open %s\n", outname);
      return -1;
  }

  while((c = fgetc(fpin)) != EOF)
      fputc(c, fpout);

  fclose(fpin);
  fclose(fpout);

  return 0;
}
```

Checking End of File

- Each file has two indicators:
  - End of fie indicator
  - Error indicator
- These indicators are set when we want to read but there is not enough data or there is an error.
- How to use
  - Try to read
  - If the number of read object is less than expected
    - Check end of file → **`feof`**
    - Check error of file → **`ferror`**
- **`feof`** tells that an attempt has been made to read past the end of the file, which is **not** the same as that we just read the last data item from a file. We have to read one past the last data item for **`feof`** to return nonzero.

Checking End of File

- Previous example with **`feof`**

```
while(1){
    c = fgetc(fpin);
    if(feof(fpin))
        break;
    fputc(c, fpout);
}
```

Read/Write a Line (Text File)

- We can read a line of file
  - **`fscanf`** reads until the first white space

```
char * fgets(char *buff, int
maxnumber , FILE *fp);
```

- Read at most **`maxnumber - 1`** chars
- Reading stops after **`EOF`** or \n, if a \n is read it is stored in buffer
- Add ‘\0’ to the end of string
- If reach to end of file without reading any character, return NULL

Read/Write a Line (Text File)

- We can write a line to file

```
int fputs(char *buff, FILE *fp);
```

- Write the string buff to file
- Does NOT add \n at the end
- On success, a non-negative value is returned. On error, the function returns **EOF**.

Example: Count the number of lines

```
char buf[500]; // 500 > every line

fpin = fopen(inname, "r");
if(fpin == NULL){
    printf("Cannot open %s\n", inname);
    return -1;
}

while( fgets(buf, 500, fpin) != NULL )
    count++;

printf("Number of Lines = %d\n", count);
```

Example: Copy files

برنامه‌ای که اسم یک فایل ورودی و خروجی را
از کاربر بگیرد و فایل ورودی را در خروجی کپی
کند.

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

int main(void){

   FILE *fpin, *fpout;
   char inname[20], outname[20];
   char buf[1000];

   printf("Enter the name of input file: ");
   scanf("%s", inname);

   printf("Enter the name of output file: ");
   scanf("%s", outname);
   fpin = fopen(inname, "r");
   if(fpin == NULL){
       printf("Cannot open %s\n", inname);
       return -1;
   }
```

Example: Copy files

ادامه

```
  fpout = fopen(outname, "w");
  if(fpout == NULL){
      printf("Cannot open %s\n", outname);
      return -1;
  }

  while(fgets(buf, 1000, fpin) != NULL)
      fputs(fpout, buf);

  fclose(fpin);
  fclose(fpout);

  return 0;
}
```

Example: Reverse copy files

File 1:

```
3 30
1 2 3 4 5 6 7
12 34 56 78 90
123 456
```

File 2:

```
654 321
09 87 65 43 21
7 6 5 4 3 2 1
```

تابعی که اطلاعات دو فایل را بگیرد و فایل اول را به صورت برعکس در فایل دوم بنویسید.

تعداد خطها و حداکثر طول هر خط در ابتدای فایل اول مشخص شده است.

Example: Reverse copy files – v1

```
void reverse_copy1(FILE *fpin, FILE *fpout){
     int lines, max_len, i = 0, j;
     fscanf(fpin, "%d %d\n", &lines, &max_len);
     char arr[lines * max_len];
     do{
        char c = fgetc(fpin);
        if(feof(fpin))
           break;
        arr[i++] = c;
     }while(1);

     for(j = i - 1; j > -1; j--)
           fputc(arr[j], fpout);
}
```

What happen if input file is to large?!!

Huge memory allocation!

May not feasible

Example: Reverse copy files – v2

```
void reverse_copy2(char *inname, char *outname){
    FILE * fpin = fopen(inname, "r"); FILE * fpout = fopen(outname, "w");
    if((fpin == NULL) || (fpout == NULL)){ printf("Error");  exit(-1); }
    int lines, max_len, i, j, k;
    fscanf(fpin, "%d %d\n", &lines, &max_len);
    fclose(fpin);
    char arr[max_len];
    for(i = 0; i < lines; i++){
        int tmp1, tmp2;
        FILE * fpin = fopen(inname, "r");
        fscanf(fpin, "%d %d\n", &tmp1, &tmp2);

        for(j = 0; j < lines - i; j++)
            fgets(arr, max_len, fpin);

        fclose(fpin);

        for(k = strlen(arr) - 1; k >= 0; k--)
            fputc(arr[k], fpout);
   }
   fclose(fpout);
}
```

So many open/close
Lot of dummy read

Return value of fprintf

- On success, the total number of characters written is returned.
- If a writing error occurs, the error indicator is set and a negative number is returned.
  - You can check the success by calling **`ferror(FILE *)`** which return a value different from zero if the error indicator of the stream was set.

Return value of fscanf

- On success, the function returns the number of items of the argument list successfully filled.
  - This count can match the expected number of items or be less (even zero) due to a matching failure, a reading error, or the reach of the end-of-file.
- If a reading error happens or the end-of-file is reached while reading, the proper indicator is set (`feof` or `ferror`).

What We Will Learn

- Introduction
  - Text vs. Binary files
- Text File Operations
  - Open/Close
  - Read/Write
- Binary File Operations
  - Open/Close
  - Read/Write
- Bugs and avoiding them

Binary Files: A Different File Format

- Data in binary files are
  - Not encoded in **ASCII** format
  - Encoded in binary format
- We must use different functions to read/write from/to binary files
  - Why?
  - Because, data should not be converted to/from ASCII encoding in writing/reading the files

No Conversion to ASCII

- In text files, everything is saved as ASCII codes
  - `fprintf(fp, “%d”, 10)`
  - Saves 2 bytes in the file: ASCII ‘1’ ASCII ‘0’
    - 00110001 00110000
  - `fscanf(fp, “%d”, &i)`
  - Read 2 bytes from file (ASCII ‘1’ ASCII ‘0’) and convert it to base 2 which mean integer number 10

- In binary files, there is not any binary to text conversion, everything is read/write in binary format
  - `int i = 10; fwrite(&i, sizeof(int), 1, fp)`
  - Saves 4 bytes in the file: The code of 10 in base 2:
    - 00000000 00000000 00000000 00001010
  - `fread(&i, sizeof(int), 1, fp)`
  - Reads 4 bytes from file into i (without any conversion)

Writing to Binary Files

```
int fwrite(void *buf, int size, int num,
  FILE *fp)
```

- Writes **`num`** objects from **`buf`** to **`fp`**.
- Size of each object is **`size`**.
- Returns the number of written objects.
- If (**`return val < num`**)
  - There is an error

Reading from Binary Files

```
int fread(void *buf, int size, int num,
  FILE *fp)
```

- Reads **`num`** objects from file **`fp`** to **`buf`**. Size of each object is **`size`**.
- Returns the number of read objects.
- If (return `val < num`)
  - There is an error
  - Or EOF → Check with **`feof`**

`fread`: Examples

- Reading 1 int from binary file fp

```
int i;
fread(&i, sizeof(int), 1, fp);
```

- This means
  - Read 1 object from file **`fp`**. Save result in **`&i`**. The size of the object is **`sizeof(int)`**
- It reads 4 bytes from file and saves in **`&i`**
  - We read an integer from file and save it in **`i`**

fread: Examples

- Read five floats

```
float farr[5];
fread(farr, sizeof(float), 5, fp);
```

- This means
  - Read 5 objects from file **fp**. Save result in **farr**. The size of each object is **sizeof(float)**
- It reads 20 bytes from file and saves in **farr**
  - We read 5 floats from file and save them in **farr**

`fwrite`: Examples

- Writing 1 char to binary file **`fp`**

```
char c = 'A';
fwrite(&c, sizeof(char), 1, fp);
```

- This means
  - Write 1 object from **`&c`** into file **`fp`**. Size of the object is **`sizeof(char)`**
- It writes 1 byte from address **`&c`** and saves result in file
  - We write char **`c`** to the file

fwrite: Examples

- Writing 4 doubles to binary file **fp**

```
double darr[4];
fwrite(darr, sizeof(double),4,fp);
```

- This means
  - Write 4 object from **darr** into file **fp**. Size of the object is **sizeof(double)**
- It writes 32 bytes from address **darr** and saves result in file
  - We write the array of double to the file

Working with binary files: Example

```
#include <stdio.h>
struct point{
   int x, y;
};
int main(void){
   FILE *fp;
   struct point p;
   int i;
   fp = fopen("c:\\point.bin", "wb");
   if(fp == NULL){
       printf("Cannot create file\n");
       return -1;
   }
   for(i = 0; i < 5; i++){
       printf("Enter X and Y: ");
       scanf("%d %d", &p.x, &p.y);
       fwrite(&p, sizeof(p), 1, fp);
   }
   fclose(fp);
   return 0;
}
```

برنامه‌ای که x و y برای ۵ نقطه را از کاربر می‌گیرد و آنها را در یک فایل باینری ذخیره می‌کند.

Working with binary files: Example

```
#include <stdio.h>
struct point{
   int x, y;
};
int main(void){
   FILE *fp;
   struct point p;
   int i;
   fp = fopen("c:\\point.bin", "rb");
   if(fp == NULL){
       printf("Cannot read from file\n");
       return -1;
   }
   while(1){
       if(fread(&p, sizeof(p), 1, fp) < 1)
              break;
       printf("X = %d, and Y = %d\n", p.x, p.y);
   }
   fclose(fp);
   return 0;
}
```

برنامه‌ای که اطلاعات نقطه‌های که با مثال
قبلی در فایل ذخیره شده است را خوانده و
نمایش می‌دهد.

Sequential and Random Accesses

- The access to file is **Sequential** if
  - If we do not move the FPP manually
  - FPP advances through read and write
- The access to file is **Random**
  - FPP advances through read and write
  - We *can also* move the FPP manually
- File processing can uses *Random* access

Moving FPP, Why?

- To access randomly
- Consider **very large file**
  - *E.g.*, information about all students in the university
- Change the name of 5000th student
  - If it is saved in text file
    - Read 4999 lines, skip them and change the 5000th
  - If it is saved in binary file and each object has the same size
    - Jump to the 5000th object by **`fseek`**

Moving FPP

```
int fseek(FILE *fp, long offset, int org)
```

- Set FPP in the **`offset`** respect to **`org`**
- **`org`**:
  - **`SEEK_SET`**: start of file
  - **`SEEK_CUR`**: current FPP
  - **`SEEK_END`**: End of file
- Returns *nonzero* if it is unsuccessful, otherwise returns zero.

فرض کنید در یک فایل باینری، اطلاعات نقاط زیر به‌ترتیب نوشته شده است:

(1,1)(2,2)(3,3)(4,4)(5,5)

```
fp = fopen("point.bin", "rb");

fread(&p, sizeof(p), 1, fp);
printf("%d %d\n", p.x, p.y);

fseek(fp, 2 * sizeof(p), SEEK_SET);
fread(&p, sizeof(p), 1, fp);
printf("%d %d\n", p.x, p.y);

fseek(fp, -3 * sizeof(p), SEEK_END);
fread(&p, sizeof(p), 1,fp);
printf("%d %d\n", p.x, p.y);

fseek(fp, 1 * sizeof(p), SEEK_CUR);
fread(&p, sizeof(p), 1, fp);
printf("%d %d\n", p.x, p.y);
```

فرض کنید در یک فایل باینری، اطلاعات نقاط زیر به‌ترتیب نوشته شده است:

(1,1)(2,2)(3,3)(4,4)(5,5)

```
fp = fopen("point.bin", "rb");

fread(&p, sizeof(p), 1, fp);
printf("%d %d\n", p.x, p.y);  // 1 1

fseek(fp, 2 * sizeof(p), SEEK_SET);
fread(&p, sizeof(p), 1, fp);
printf("%d %d\n", p.x, p.y);  // 3 3

fseek(fp, -3 * sizeof(p), SEEK_END);
fread(&p, sizeof(p), 1,fp);
printf("%d %d\n", p.x, p.y);  // 3 3

fseek(fp, 1 * sizeof(p), SEEK_CUR);
fread(&p, sizeof(p), 1, fp);
printf("%d %d\n", p.x, p.y);   // 5 5
```

Other FPP related functions

- Find out where is the FPP

```
int ftell(FILE *fp)
```

- **`ftell`** returns the current FPP
  - With respect to SEEK_SET

- Reset the FPP to the start of file

```
void rewind(FILE *fp)
```

Other FPP related functions

برنامه‌ای که شماره یک نقطه و X و Y جدید را از
کاربر می‌گیرد و مختصات نقطه تعیین شده را در
فایل عوض می‌کند

```
#include <stdio.h>
struct point{
   int x, y;
};
int main(void){
   FILE *fp;
   struct point p;
   int num;
   fp = fopen("point.bin", "rb+");
   if(fp == NULL){
        printf("Cannot read from file\n");
        return -1;
   }
   printf("Enter the number of points: ");
   scanf("%d", &num);
   printf("Enter new X and Y: ");
   scanf("%d %d", &(p.x), &(p.y));
   fseek(fp, (num – 1) * sizeof(p) , SEEK_SET);
   fwrite(&p, sizeof(p), 1, fp);
   fclose(fp);
   return 0;
}
```

`fseek` in Text files

- Not very useful
- Offset counts the number of characters including ‘\n’
- Typical useful versions
  - **`fseek(fp, 0, SEEK_SET)`**
    - Go to the start of file
  - **`fseek(fp, 0, SEEK_END)`**
    - Go to the end of file

Example: Reverse copy files (revisit)

File 1:

```
3 30
1 2 3 4 5 6 7
12 34 56 78 90
123 456
```

File 2:

```
654 321
09 87 65 43 21
7 6 5 4 3 2 1
```

تابعی که دو File Handler را بگیرد و فایل اول را به صورت برعکس در فایل دوم بنویسید.

تعداد خطها و حداکثر طول هر خط در ابتدای فایل اول مشخص شده است.

Example: Reverse copy files – v3

```
void reverse_copy3(FILE *fpin, FILE *fpout){
    int lines, max_len;
    fscanf(fpin, "%d %d\n", &lines, &max_len);
    do{
        char c = fgetc(fpin);
        rewind(fpout);
        fputc(c, fpout);
    }while(!feof(fpin));
}
```

This is a wrong version!!!

Example: Reverse copy files – v3

```
void reverse_copy3(FILE *fpin, FILE *fpout){
     int lines, max_len;
     fscanf(fpin, "%d %d\n", &lines, &max_len);
     do{
        char c = fgetc(fpin);
        rewind(fpout);
        fputc(c, fpout);
     }while(!feof(fpin));
}
```

The rewind function is called inside the loop, which means the output file's pointer is set to the start before each character is written, overwriting the previous character.

Example: Reverse copy files – v4

```
void reverse_copy4(FILE *fpin, FILE *fpout){
     int lines, max_len, i, j, k;
     fscanf(fpin, "%d %d\n", &lines, &max_len);
     char arr[max_len];

     for(i = 0; i < lines; i++){
           fseek(fpin, 0, SEEK_SET);
           fscanf(fpin, "%d %d\n", &lines, &max_len);
           for(j = 0; j < lines - i; j++)
                 fgets(arr, max_len, fpin);
           for(k = strlen(arr) - 1; k >= 0; k--)
                 fputc(arr[k],fpout);
     }
}
```

High overhead, a lot of reading to seek!!

Example: Reverse copy files – v5

```
void reverse_copy5(FILE *fpin, FILE *fpout){
     int lines, max_len, i, j;
     fscanf(fpin, "%d %d\n", &lines, &max_len);
     i = 1;  j = 1;
     while(1){
        fseek(fpin, -1 * i, SEEK_END);
        char c = fgetc(fpin);
        i++;
        fputc(c, fpout);
        if(c == '\n'){
           i++; //this is due to Windows, \n is saved as "\r\n" !!!
           j++;
        }
        if(j > lines)
             break;
     }
}
```

Good, but we have to seek from end for each read → High overhead

Example: Reverse copy files – v6

```
void reverse_copy6(FILE *fpin, FILE *fpout){
     int lines, max_len, i, j;
     fscanf(fpin, "%d %d\n", &lines, &max_len);
     j = 1;
     fseek(fpin, -1, SEEK_END);
     while(1){
        char c = fgetc(fpin);
       fputc(c, fpout);
        i = 2;
        if(c == '\n'){
           i++; // This is due to Windows
           j++;
        }
        fseek(fpin, -1 * i, SEEK_CUR);
        if(j > lines)
             break;
     }
}
```

Good enough ☺

Common Bugs and Avoiding Them

- Take care about mode in **`fopen`**
  - **w** and **w+**: all data in file will be lost
  - **r**: you cannot write. **`fprintf`** does not do any thing
- Take care about text or binary
  - fscanf/fprintf don’t do meaningful job in binary files
- Check the successful open: **`fp != NULL`**
- Check EOF as much as possible.
- Close the open files.

Reference

- Reading Assignment: Chapter 11 of "C How to Program"