Escola de Engenharia
Universidade do Minho

Programação – Aula Teórica 11

Processamento de Ficheiros em C

Luís Paulo Reis

lpreis@dsi.uminho.pt

Professor Associado do Departamento de Sistemas de Informação, Escola de Engenharia, Universidade do Minho, Portugal

(Slides Baseados em Deitel e Deitel 2010 e L.P.Reis et al., 2006)

Escola de Engenharia
Universidade do Minho

File Processing in C

Outline

Escola de Engenharia
Universidade do Minho

Objectives

- **In this lesson, you will learn:**
  - To be able to create, read, write and update files
  - To become familiar with sequential access file processing
  - To become familiar with random-access file processing

Escola de Engenharia
Universidade do Minho

11.1 Introduction

- **Data files**
  - Can be created, updated, and processed by C programs
  - Are used for permanent storage of large amounts of data
    - Storage of data in variables and arrays is only temporary

Escola de Engenharia
Universidade do Minho

11.2 The Data Hierarchy

- **Data Hierarchy:**
  - Bit – smallest data item
    - Value of 0 or 1
  - Byte – 8 bits
    - Used to store a character
      - Decimal digits, letters, and special symbols
  - Field – group of characters conveying meaning
    - Example: your name
  - Record – group of related fields
    - Represented by a `struct` or a `class`
    - Example: In a payroll system, a record for a particular employee that contained his/her identification number, name, address, etc.

11.2 The Data Hierarchy

- **Data Hierarchy (continued):**
  - File – group of related records
    - Example: payroll file
  - Database – group of related files

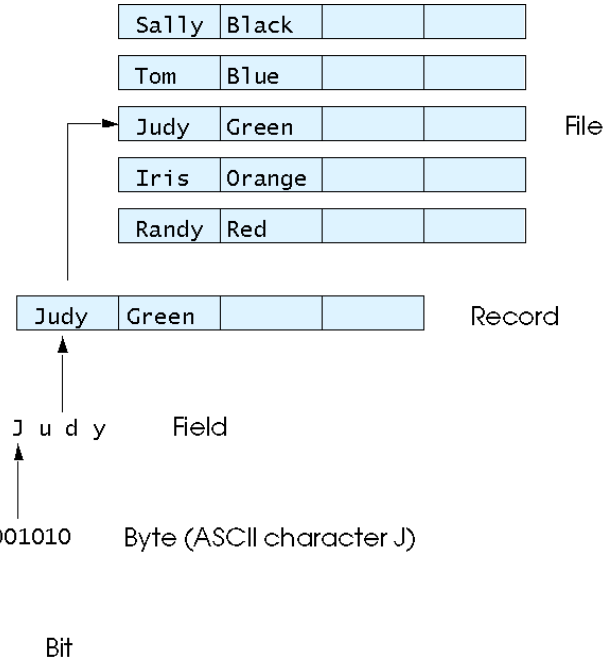


Fig. 11.1 The data hierarchy.

- **Data files**
  - Record key
    - Identifies a record to facilitate the retrieval of specific records from a file
  - Sequential file
    - Records typically sorted by key

Escola de Engenharia
Universidade do Minho

11.3 Files and Streams

- **C views each file as a sequence of bytes**
  - File ends with the *end-of-file marker*
    - Or, file ends at a specified byte
- **Stream created when a file is opened**
  - Provide communication channel between files and programs
  - Opening a file returns a pointer to a `FILE` structure
    - Example file pointers:
    - `stdin` - standard input (keyboard)
    - `stdout` - standard output (screen)
    - `stderr` - standard error (screen)

11.3 Files and Streams

- **`FILE` structure**
  - File descriptor
    - Index into operating system array called the open file table
  - File Control Block (FCB)
    - Found in every array element, system uses it to administer the file

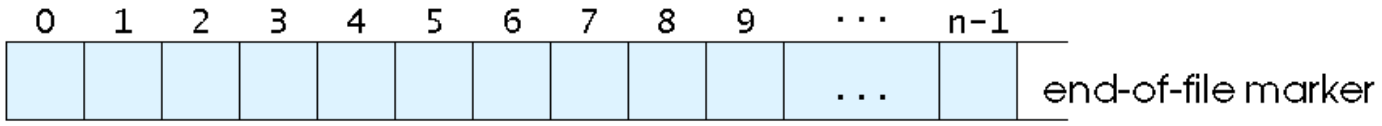


Fig. 11.2 C's view of a file of *n* bytes.

Escola de Engenharia
Universidade do Minho

11.3 Files and Streams

- **Read/Write functions in standard library**
  - `fgetc`
    - Reads one character from a file
    - Takes a `FILE` pointer as an argument
    - `fgetc( stdin )` equivalent to `getchar()`
  - `fputc`
    - Writes one character to a file
    - Takes a `FILE` pointer and a character to write as an argument
    - `fputc( 'a', stdout )` equivalent to `putchar( 'a' )`
  - `fgets`
    - Reads a line from a file
  - `fputs`
    - Writes a line to a file
  - `fscanf` / `fprintf`
    - File processing equivalents of `scanf` and `printf`

```c
/* Fig. 11.3: fig11_03.c
   Create a sequential file */
#include <stdio.h>

int main()
{
   int account;     /* account number */
   char name[ 30 ]; /* account name */
   double balance;  /* account balance */

   FILE *cfPtr;     /* cfPtr = clients.dat file pointer */

   /* fopen opens file. Exit program if unable to create file  */
   if ( ( cfPtr = fopen( "clients.dat", "w" ) ) == NULL ) {
      printf( "File could not be opened\n" );
   } /* end if */
   else {
      printf( "Enter the account, name, and balance.\n" );
      printf( "Enter EOF to end input.\n" );
      printf( "? " );
      scanf( "%d%s%lf", &account, name, &balance );

```

```
23       /* write account, name and balance into file with fprintf */
24       while ( !feof( stdin ) ) {
25          fprintf( cfPtr, "%d %s %.2f\n", account, name, balance );
26          printf( "? " );
27          scanf( "%d%s%lf", &account, name, &balance );
28       } /* end while */
29
30       fclose( cfPtr ); /* fclose closes file */
31    } /* end else */
32
33    return 0; /* indicates successful termination */
34
35 } /* end main */
```

```
Enter the account, name, and balance.
Enter EOF to end input.
? 100 Jones 24.98
? 200 Doe 345.67
? 300 White 0.00
? 400 Stone -42.16
? 500 Rich 224.62
? ^Z
```

11.4 Creating a Sequential Access File

- **C imposes no file structure**
  - No notion of records in a file
  - Programmer must provide file structure
- **Creating a File**
  - `FILE *cfPtr;  // Creates a FILE pointer called cfPtr`
  - `cfPtr = fopen("clients.dat", "w");`
    - Function `fopen` returns a `FILE` pointer to file specified
    - Takes two arguments – file to open and file open mode
    - If open fails, `NULL` returned

Computer system	Key combination
UNIX systems	*<return> <ctrl> d*
IBM PC and compatibles	*<ctrl> z*
Macintosh	*<ctrl> d*

Fig. 11.4 End-of-file key combinations for various popular computer systems.

11.4 Creating a Sequential Access File

- `fprintf`
  - Used to print to a file
  - Like `printf`, except first argument is a `FILE` pointer (pointer to the file you want to print in)
- `feof( FILE pointer )`
  - Returns true if end-of-file indicator (no more data to process) is set for the specified file
- `fclose( FILE pointer )`
  - Closes specified file
  - Performed automatically when program ends
  - Good practice to close files explicitly

- **Details**
  - Programs may process no files, one file, or many files
  - Each file must have a unique name and should have its own pointer

11.4 Creating a Sequential Access File

Mode	Description
`r`	Open a file for reading.
`w`	Create a file for writing. If the file already exists, discard the current contents.
`a`	Append; open or create a file for writing at end of file.
`r+`	Open a file for update (reading and writing).
`w+`	Create a file for update. If the file already exists, discard the current contents.
`a+`	Append; open or create a file for update; writing is done at the end of the file.
`rb`	Open a file for reading in binary mode.
`wb`	Create a file for writing in binary mode. If the file already exists, discard the current contents.
`ab`	Append; open or create a file for writing at end of file in binary mode.
`rb+`	Open a file for update (reading and writing) in binary mode.
`wb+`	Create a file for update in binary mode. If the file already exists, discard the current contents.
`ab+`	Append; open or create a file for update in binary mode; writing is done at the end of the file.

Fig. 11.6 File open modes.

Escola de Engenharia
Universidade do Minho

11.5 Reading Data from a Sequential Access File

- **Reading a sequential access file**
  - Create a `FILE` pointer, link it to the file to read
    ```
    cfPtr = fopen( "clients.dat", "r" );
    ```
  - Use `fscanf` to read from the file
    - Like `scanf`, except first argument is a `FILE` pointer
    ```
    fscanf( cfPtr, "%d%s%f", &accounnt, name, &balance );
    ```
  - Data read from beginning to end
  - File position pointer
    - Indicates number of next byte to be read / written
    - Not really a pointer, but an integer value (specifies byte location)
    - Also called byte offset
  - `rewind( cfPtr )`
    - Repositions file position pointer to beginning of file (byte 0)

```c
/* Fig. 11.7: fig11_07.c
   Reading and printing a sequential file */
#include <stdio.h>

int main()
{
   int account;     /* account number */
   char name[ 30 ]; /* account name */
   double balance;  /* account balance */

   FILE *cfPtr;     /* cfPtr = clients.dat file pointer */

   /* fopen opens file; exits program if file cannot be opened */
   if ( ( cfPtr = fopen( "clients.dat", "r" ) ) == NULL ) {
      printf( "File could not be opened\n" );
   } /* end if */
   else { /* read account, name and balance from file */
      printf( "%-10s%-13s%s\n", "Account", "Name", "Balance" );
      fscanf( cfPtr, "%d%s%lf", &account, name, &balance );

      /* while not end of file */
      while ( !feof( cfPtr ) ) {
         printf( "%-10d%-13s%7.2f\n", account, name, balance );
         fscanf( cfPtr, "%d%s%lf", &account, name, &balance );
      } /* end while */

```

```
27         fclose( cfPtr ); /* fclose closes the file */
28      } /* end else */
29
30      return 0; /* indicates successful termination */
31
32   } /* end main */
```

```
Account  Name      Balance
100      Jones       24.98
200      Doe        345.67
300      White        0.00
400      Stone      -42.16
500      Rich       224.62
```

```c
/* Fig. 11.8: fig11_08.c
   Credit inquiry program */
#include <stdio.h>

/* function main begins program execution */
int main()
{
   int request;     /* request number */
   int account;     /* account number */
   double balance;  /* account balance */
   char name[ 30 ]; /* account name */
   FILE *cfPtr;     /* clients.dat file pointer */

   /* fopen opens the file; exits program if file cannot be opened */
   if ( ( cfPtr = fopen( "clients.dat", "r" ) ) == NULL ) {
      printf( "File could not be opened\n" );
   } /* end if */
   else {

      /* display request options */
      printf( "Enter request\n"
              " 1 - List accounts with zero balances\n"
              " 2 - List accounts with credit balances\n"
              " 3 - List accounts with debit balances\n"
              " 4 - End of run\n? " );
```

```
26          scanf( "%d", &request );
27
28          /* process user's request */
29          while ( request != 4 ) {
30
31             /* read account, name and balance from file */
32             fscanf( cfPtr, "%d%s%lf", &account, name, &balance );
33
34             switch ( request ) {
35
36                case 1:
37                   printf( "\nAccounts with zero balances:\n" );
38
39                   /* read file contents (until eof) */
40                   while ( !feof( cfPtr ) ) {
41
42                      if ( balance == 0 ) {
43                         printf( "%-10d%-13s%7.2f\n",
44                                 account, name, balance );
45                      } /* end if */
46
47                      /* read account, name and balance from file */
48                      fscanf( cfPtr, "%d%s%lf",
49                              &account, name, &balance );
50                   } /* end while */
51
```

```
52                break;
53
54             case 2:
55                printf( "\nAccounts with credit balances:\n" );
56
57                /* read file contents (until eof) */
58                while ( !feof( cfPtr ) ) {
59
60                   if ( balance < 0 ) {
61                      printf( "%-10d%-13s%7.2f\n",
62                              account, name, balance );
63                   } /* end if */
64
65                   /* read account, name and balance from file */
66                   fscanf( cfPtr, "%d%s%lf",
67                           &account, name, &balance );
68                } /* end while */
69
70                break;
71
72             case 3:
73                printf( "\nAccounts with debit balances:\n" );
74
```

```
75                /* read file contents (until eof) */
76                while ( !feof( cfPtr ) ) {
77
78                   if ( balance > 0 ) {
79                      printf( "%-10d%-13s%7.2f\n",
80                              account, name, balance );
81                   } /* end if */
82
83                   /* read account, name and balance from file */
84                   fscanf( cfPtr, "%d%s%lf",
85                           &account, name, &balance );
86                } /* end while */
87
88                break;
89
90             } /* end switch */
91
92             rewind( cfPtr ); /* return cfPtr to beginning of file */
93
94             printf( "\n? " );
95             scanf( "%d", &request );
96          } /* end while */
97
```

```
98          printf( "End of run.\n" );
99          fclose( cfPtr ); /* fclose closes the file */
100      } /* end else */
101
102      return 0; /* indicates successful termination */
103
104 } /* end main */
```

```
Enter request
 1 - List accounts with zero balances
 2 - List accounts with credit balances
 3 - List accounts with debit balances
 4 - End of run
? 1

Accounts with zero balances:
300        White                0.00

? 2

Accounts with credit balances:
400        Stone              -42.16
```

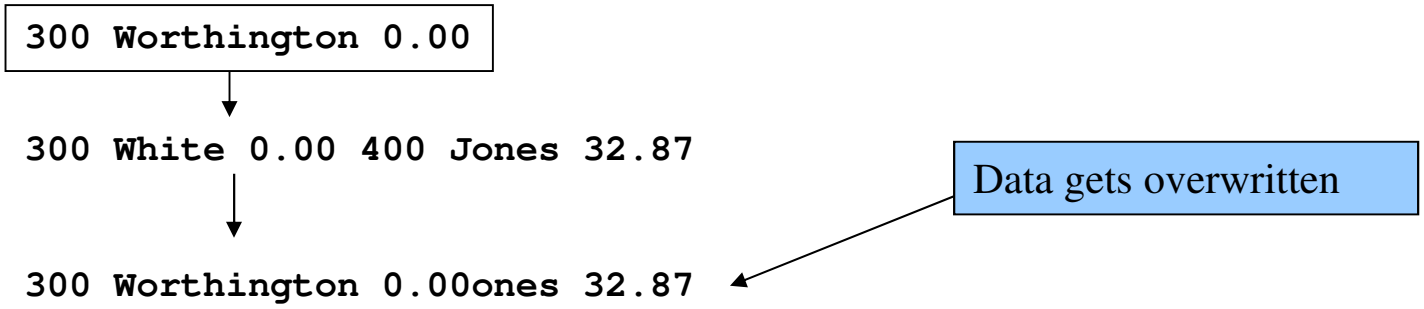
```
? 3

Accounts with debit balances:
100        Jones               24.98
200        Doe                345.67
500        Rich               224.62

? 4
End of run.
```

11.5 Reading Data from a Sequential Access File

- **Sequential access file**
  - Cannot be modified without the risk of destroying other data
  - Fields can vary in size
    - Different representation in files and screen than internal representation
    - 1, 34, -890 are all `int`s, but have different sizes on disk

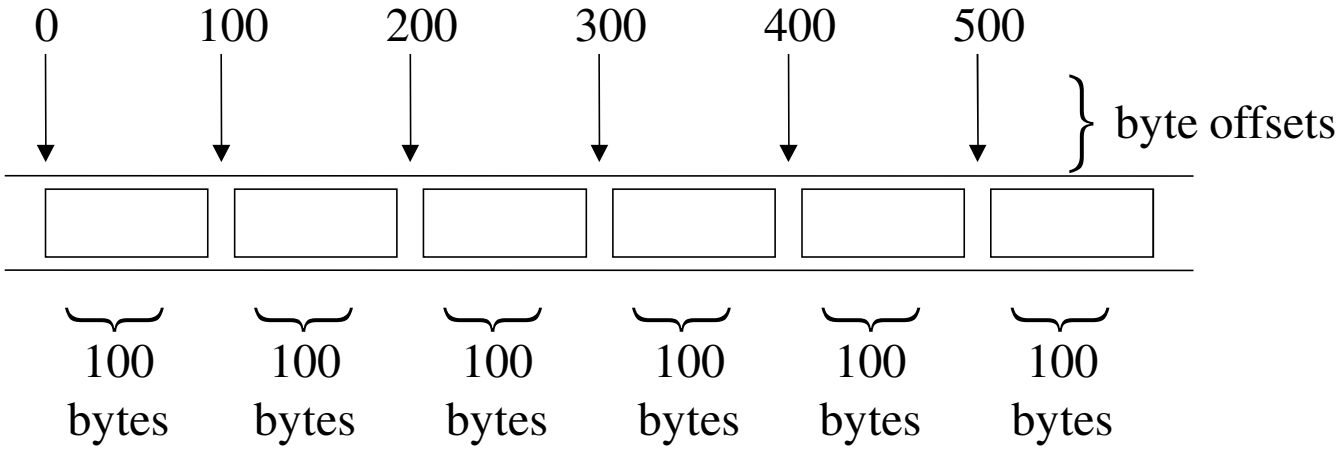
300 White 0.00 400 Jones 32.87 (old data in file)

If we want to change White's name to Worthington,



11.6 Random-Access Files

- **Random access files**
  - Access individual records without searching through other records
  - Instant access to records in a file
  - Data can be inserted without destroying other data
  - Data previously stored can be updated or deleted without overwriting
- **Implemented using fixed length records**
  - Sequential files do not have fixed length records



11.7 Creating a Randomly Accessed File

- **Data in random access files**
  - Unformatted (stored as "raw bytes")
    - All data of the same type (`int`s, for example) uses the same amount of memory
    - All records of the same type have a fixed length
    - Data not human readable

11.7 Creating a Randomly Accessed File

- **Unformatted I/O functions**
  - `fwrite`
    - Transfer bytes from a location in memory to a file
  - `fread`
    - Transfer bytes from a file to a location in memory
  - Example:

    ```
    fwrite( &number, sizeof( int ), 1, myPtr );
    ```

    - `&number` – Location to transfer bytes from
    - `sizeof( int )` – Number of bytes to transfer
    - `1` – For arrays, number of elements to transfer
      - In this case, "one element" of an array is being transferred
    - `myPtr` – File to transfer to or from

11.7 Creating a Randomly Accessed File

- **Writing `structs`**

```
fwrite( &myObject, sizeof (struct myStruct), 1, myPtr );
```

  - `sizeof` – returns size in bytes of object in parentheses
- **To write several array elements**
  - Pointer to array as first argument
  - Number of elements to write as third argument

```c
/* Fig. 11.11: fig11_11.c
   Creating a randomly accessed file sequentially */
#include <stdio.h>

/* clientData structure definition */
struct clientData {
   int acctNum;           /* account number */
   char lastName[ 15 ];  /* account last name */
   char firstName[ 10 ]; /* account first name */
   double balance;        /* account balance */
}; /* end structure clientData */

int main()
{
   int i; /* counter */

   /* create clientData with no information */
   struct clientData blankClient = { 0, "", "", 0.0 };

   FILE *cfPtr; /* credit.dat file pointer */

   /* fopen opens the file; exits if file cannot be opened */
   if ( ( cfPtr = fopen( "credit.dat", "wb" ) ) == NULL ) {
      printf( "File could not be opened.\n" );
   } /* end if */
```

```
26    else {
27
28       /* output 100 blank records to file */
29       for ( i = 1; i <= 100; i++ ) {
30          fwrite( &blankClient, sizeof( struct clientData ), 1, cfPtr );
31       } /* end for */
32
33       fclose ( cfPtr ); /* fclose closes the file */
34    } /* end else */
35
36    return 0; /* indicates successful termination */
37
38 } /* end main */
```

11.8 Writing Data Randomly to a Randomly Accessed File

- `fseek`
  - Sets file position pointer to a specific position
  - `fseek( pointer, offset, symbolic_constant );`
    - *pointer* – pointer to file
    - *offset* – file position pointer (0 is first location)
    - *symbolic_constant* – specifies where in file we are reading from
    - SEEK_SET – seek starts at beginning of file
    - SEEK_CUR – seek starts at current location in file
    - SEEK_END – seek starts at end of file

```c
/* Fig. 11.12: fig11_12.c
   Writing to a random access file */
#include <stdio.h>

/* clientData structure definition */
struct clientData {
   int acctNum;           /* account number */
   char lastName[ 15 ];   /* account last name */
   char firstName[ 10 ]; /* account first name */
    double balance;       /* account balance */
}; /* end structure clientData */

int main()
{
   FILE *cfPtr; /* credit.dat file pointer */

   /* create clientData with no information */
   struct clientData client = { 0, "", "", 0.0 };

   /* fopen opens the file; exits if file cannot be opened */
   if ( ( cfPtr = fopen( "credit.dat", "rb+" ) ) == NULL ) {
      printf( "File could not be opened.\n" );
   } /* end if */
   else {

```

```
26        /* require user to specify account number */
27        printf( "Enter account number"
28                " ( 1 to 100, 0 to end input )\n? " );
29        scanf( "%d", &client.acctNum );
30
31        /* user enters information, which is copied into file */
32        while ( client.acctNum != 0 ) {
33
34           /* user enters last name, first name and balance */
35           printf( "Enter lastname, firstname, balance\n? " );
36
37           /* set record lastName, firstName and balance value */
38           fscanf( stdin, "%s%s%lf", client.lastName,
39                   client.firstName, &client.balance );
40
41           /* seek position in file of user-specified record */
42           fseek( cfPtr, ( client.acctNum - 1 ) *
43                  sizeof( struct clientData ), SEEK_SET );
44
45           /* write user-specified information in file */
46           fwrite( &client, sizeof( struct clientData ), 1, cfPtr );
47
48           /* enable user to specify another account number */
49           printf( "Enter account number\n? " );
50           scanf( "%d", &client.acctNum );
```

```
51         } /* end while */
52
53         fclose( cfPtr ); /* fclose closes the file */
54      } /* end else */
55
56      return 0; /* indicates successful termination */
57
58   } /* end main */
```

```
Enter account number ( 1 to 100, 0 to
end input )
? 37
Enter lastname, firstname, balance
? Barker Doug 0.00
Enter account number
? 29
Enter lastname, firstname, balance
? Brown Nancy -24.54
Enter account number
? 96
Enter lastname, firstname, balance
? Stone Sam 34.98
Enter account number
? 88
Enter lastname, firstname, balance
? Smith Dave 258.34
Enter account number
? 33
Enter lastname, firstname, balance
? Dunn Stacey 314.33
Enter account number
? 0
```

11.8 Writing Data Randomly to a Randomly Accessed File

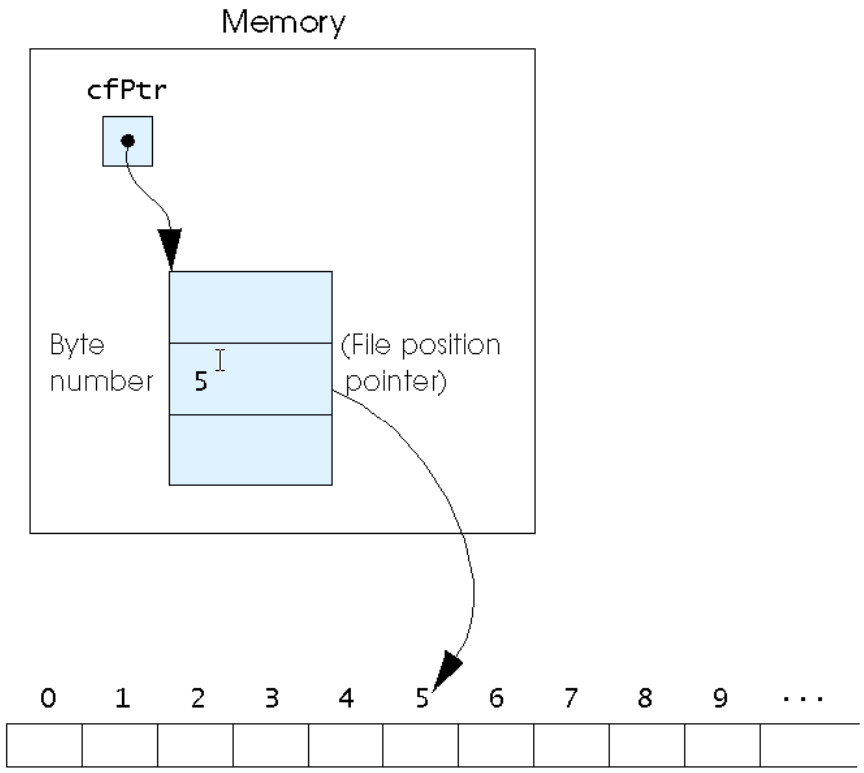


Fig. 11.14 The file position pointer indicating an offset of 5 bytes from the beginning of the file.

Escola de Engenharia
Universidade do Minho

11.9 Reading Data Randomly from a Randomly Accessed File

- `fread`
  - Reads a specified number of bytes from a file into memory

```
fread( &client, sizeof (struct clientData), 1, myPtr
  );
```

  - Can read several fixed-size array elements
    - Provide pointer to array
    - Indicate number of elements to read
  - To read multiple elements, specify in third argument

```c
/* Fig. 11.15: fig11_15.c
   Reading a random access file sequentially */
#include <stdio.h>

/* clientData structure definition */
struct clientData {
   int acctNum;           /* account number */
   char lastName[ 15 ];  /* account last name */
   char firstName[ 10 ]; /* account first name */
    double balance;        /* account balance */
}; /* end structure clientData */

int main()
{
   FILE *cfPtr; /* credit.dat file pointer */

   /* create clientData with no information */
   struct clientData client = { 0, "", "", 0.0 };

   /* fopen opens the file; exits if file cannot be opened */
   if ( ( cfPtr = fopen( "credit.dat", "rb" ) ) == NULL ) {
      printf( "File could not be opened.\n" );
   } /* end if */
```

```
24    else {
25       printf( "%-6s%-16s%-11s%10s\n", "Acct", "Last Name",
26               "First Name", "Balance" );
27
28       /* read all records from file (until eof) */
29       while ( !feof( cfPtr ) ) {
30          fread( &client, sizeof( struct clientData ), 1, cfPtr );
31
32          /* display record */
33          if ( client.acctNum != 0 ) {
34             printf( "%-6d%-16s%-11s%10.2f\n",
35                     client.acctNum, client.lastName,
36                     client.firstName, client.balance );
37          } /* end if */
38
39       } /* end while */
40
41       fclose( cfPtr ); //closes the file
42    } /* end else */
43
44    return 0;
45
46 } /* end main */
```

```
Acct  Last Name      First Name   Balance
29    Brown          Nancy         -24.54
33    Dunn           Stacey        314.33
37    Barker         Doug            0.00
88    Smith          Dave          258.34
96    Stone          Sam            34.98
```

11.10 Case Study: A Transaction Processing Program

- **This program**
  - Demonstrates using random access files to achieve instant access processing of a bank's account information
- **We will**
  - Update existing accounts
  - Add new accounts
  - Delete accounts
  - Store a formatted listing of all accounts in a text file

```c
/* Fig. 11.16: fig11_16.c
   This program reads a random access file sequentially, updates data
   already written to the file, creates new data to be placed in the
   file, and deletes data previously in the file. */
#include <stdio.h>

/* clientData structure definition */
struct clientData {
   int acctNum;          /* account number */
   char lastName[ 15 ];  /* account last name */
   char firstName[ 10 ]; /* account first name */
   double balance;       /* account balance */
}; /* end structure clientData */

/* prototypes */
int enterChoice( void );
void textFile( FILE *readPtr );
void updateRecord( FILE *fPtr );
void newRecord( FILE *fPtr );
void deleteRecord( FILE *fPtr );

int main()
{
   FILE *cfPtr; /* credit.dat file pointer */
   int choice;  /* user's choice */

```

```
27    /* fopen opens the file; exits if file cannot be opened */
28    if ( ( cfPtr = fopen( "credit.dat", "rb+" ) ) == NULL ) {
29       printf( "File could not be opened.\n" );
30    } /* end if */
31    else {
32
33       /* enable user to specify action */
34       while ( ( choice = enterChoice() ) != 5 ) {
35
36          switch ( choice ) {
37
38             /* create text file from record file */
39             case 1:
40                textFile( cfPtr );
41                break;
42
43             /* update record */
44             case 2:
45                updateRecord( cfPtr );
46                break;
47
```

```
48             /* create record */
49             case 3:
50                newRecord( cfPtr );
51                break;
52
53             /* delete existing record */
54             case 4:
55                deleteRecord( cfPtr );
56                break;
57
58             /* display message if user does not select valid choice */
59             default:
60                printf( "Incorrect choice\n" );
61                break;
62
63          } /* end switch */
64
65       } /* end while */
66
67       fclose( cfPtr ); /* fclose closes the file */
68    } /* end else */
69
70    return 0; /* indicates successful termination */
71
72 } /* end main */
73
```

```c
/* create formatted text file for printing */
void textFile( FILE *readPtr )
{
   FILE *writePtr; /* accounts.txt file pointer */

   /* create clientData with no information */
   struct clientData client = { 0, "", "", 0.0 };

   /* fopen opens the file; exits if file cannot be opened */
   if ( ( writePtr = fopen( "accounts.txt", "w" ) ) == NULL ) {
      printf( "File could not be opened.\n" );
   } /* end if */
   else {
      rewind( readPtr ); /* sets pointer to beginning of record file */
      fprintf( writePtr, "%-6s%-16s%-11s%10s\n",
               "Acct", "Last Name", "First Name","Balance" );

      /* copy all records from record file into text file */
      while ( !feof( readPtr ) ) {
         fread( &client, sizeof( struct clientData ), 1, readPtr );

```

```
95          /* write single record to text file */
96          if ( client.acctNum != 0 ) {
97             fprintf( writePtr, "%-6d%-16s%-11s%10.2f\n",
98                      client.acctNum, client.lastName,
99                      client.firstName, client.balance );
100         } /* end if */
101
102      } /* end while */
103
104      fclose( writePtr ); /* fclose closes the file */
105   } /* end else */
106
107 } /* end function textFile */
108
109 /* update balance in record */
110 void updateRecord( FILE *fPtr )
111 {
112    int account;         /* account number */
113    double transaction; /* account transaction */
114
115    /* create clientData with no information */
116    struct clientData client = { 0, "", "", 0.0 };
117
```

```
118    /* obtain number of account to update */
119    printf( "Enter account to update ( 1 - 100 ): " );
120    scanf( "%d", &account );
121
122    /* move file pointer to correct record in file */
123    fseek( fPtr, ( account - 1 ) * sizeof( struct clientData ),
124           SEEK_SET );
125
126    /* read record from file */
127    fread( &client, sizeof( struct clientData ), 1, fPtr );
128
129    /* display error if account does not exist */
130    if ( client.acctNum == 0 ) {
131       printf( "Acount #%d has no information.\n", account );
132    } /* end if */
133    else { /* update record */
134       printf( "%-6d%-16s%-11s%10.2f\n\n",
135               client.acctNum, client.lastName,
136               client.firstName, client.balance );
137
138       /* request user to specify transaction */
139       printf( "Enter charge ( + ) or payment ( - ): " );
140       scanf( "%lf", &transaction );
141       client.balance += transaction; /* update record balance */
142
```

```
143         printf( "%-6d%-16s%-11s%10.2f\n",
144                 client.acctNum, client.lastName,
145                 client.firstName, client.balance );
146
147         /* move file pointer to correct record in file */
148         fseek( fPtr, ( account - 1 ) * sizeof( struct clientData ),
149                 SEEK_SET );
150
151         /* write updated record over old record in file */
152         fwrite( &client, sizeof( struct clientData ), 1, fPtr );
153      } /* end else */
154
155   } /* end function updateRecord */
156
157   /* delete an existing record */
158   void deleteRecord( FILE *fPtr )
159   {
160      /* create two clientDatas and initialize blankClient */
161      struct clientData client;
162      struct clientData blankClient = { 0, "", "", 0 };
163
164      int accountNum; /* account number */
165
```

```
166    /* obtain number of account to delete */
167    printf( "Enter account number to delete ( 1 - 100 ): " );
168    scanf( "%d", &accountNum );
169
170    /* move file pointer to correct record in file */
171    fseek( fPtr, ( accountNum - 1 ) * sizeof( struct clientData ),
172           SEEK_SET );
173
174    /* read record from file */
175    fread( &client, sizeof( struct clientData ), 1, fPtr );
176
177    /* display error if record does not exist */
178    if ( client.acctNum == 0 ) {
179       printf( "Account %d does not exist.\n", accountNum );
180    } /* end if */
181    else { /* delete record */
182
183       /* move file pointer to correct record in file */
184       fseek( fPtr, ( accountNum - 1 ) * sizeof( struct clientData ),
185          SEEK_SET );
186
187       /* replace existing record with blank record */
188       fwrite( &blankClient,
189               sizeof( struct clientData ), 1, fPtr );
190    } /* end else */
191
```

```
192 } /* end function deleteRecord */
193
194 /* create and insert record */
195 void newRecord( FILE *fPtr )
196 {
197    /* create clientData with no information */
198    struct clientData client = { 0, "", "", 0.0 };
199
200    int accountNum; /* account number */
201
202    /* obtain number of account to create */
203    printf( "Enter new account number ( 1 - 100 ): " );
204    scanf( "%d", &accountNum );
205
206    /* move file pointer to correct record in file */
207    fseek( fPtr, ( accountNum - 1 ) * sizeof( struct clientData ),
208           SEEK_SET );
209
210    /* read record from file */
211    fread( &client, sizeof( struct clientData ), 1, fPtr );
212
```

```
213    /* display error if account previously exists */
214    if ( client.acctNum != 0 ) {
215       printf( "Account #%d already contains information.\n",
216               client.acctNum );
217    } /* end if */
218    else { /* create record */
219
220       /* user enters last name, first name and balance */
221       printf( "Enter lastname, firstname, balance\n? " );
222       scanf( "%s%s%lf", &client.lastName, &client.firstName,
223              &client.balance );
224
225       client.acctNum = accountNum;
226
227       /* move file pointer to correct record in file */
228       fseek( fPtr, ( client.acctNum - 1 ) *
229              sizeof( struct clientData ), SEEK_SET );
230
231       /* insert record in file */
232       fwrite( &client,
233               sizeof( struct clientData ), 1, fPtr );
234    } /* end else */
235
236 } /* end function newRecord */
237
```

```c
/* enable user to input menu choice */
int enterChoice( void )
{
   int menuChoice; /* variable to store user's choice */

   /* display available options */
   printf( "\nEnter your choice\n"
           "1 - store a formatted text file of acounts called\n"
           "    \"accounts.txt\" for printing\n"
           "2 - update an account\n"
           "3 - add a new account\n"
           "4 - delete an account\n"
           "5 - end program\n? " );

   scanf( "%d", &menuChoice ); /* receive choice from user */

   return menuChoice;

} /* end function enterChoice */
```

```
After choosing option 1 accounts.txt contains:

Acct  Last Name       First Name    Balance
29    Brown           Nancy          -24.54
33    Dunn            Stacey         314.33
37    Barker          Doug             0.00
88    Smith           Dave           258.34
96    Stone           Sam             34.98
```

```
After choosing option 2 accounts.txt contains:

Enter account to update ( 1 - 100 ): 37
37    Barker          Doug             0.00

Enter charge ( + ) or payment ( - ): +87.99
37    Barker          Doug            87.99
```

```
After choosing option 3 accounts.txt contains:

Enter new account number ( 1 - 100 ): 22
Enter lastname, firstname, balance
? Johnston Sarah 247.45
```

Escola de Engenharia
Universidade do Minho

Questões?

Programação – Aula Teórica 11

Processamento de Ficheiros em C

Luís Paulo Reis

lpreis@dsi.uminho.pt

Professor Associado do Departamento de Sistemas de Informação, Escola de Engenharia, Universidade do Minho, Portugal

(Slides Baseados em Deitel e Deitel 2010 e L.P.Reis et al., 2006)