Computer Programming 143 – Lecture 27
File Processing III

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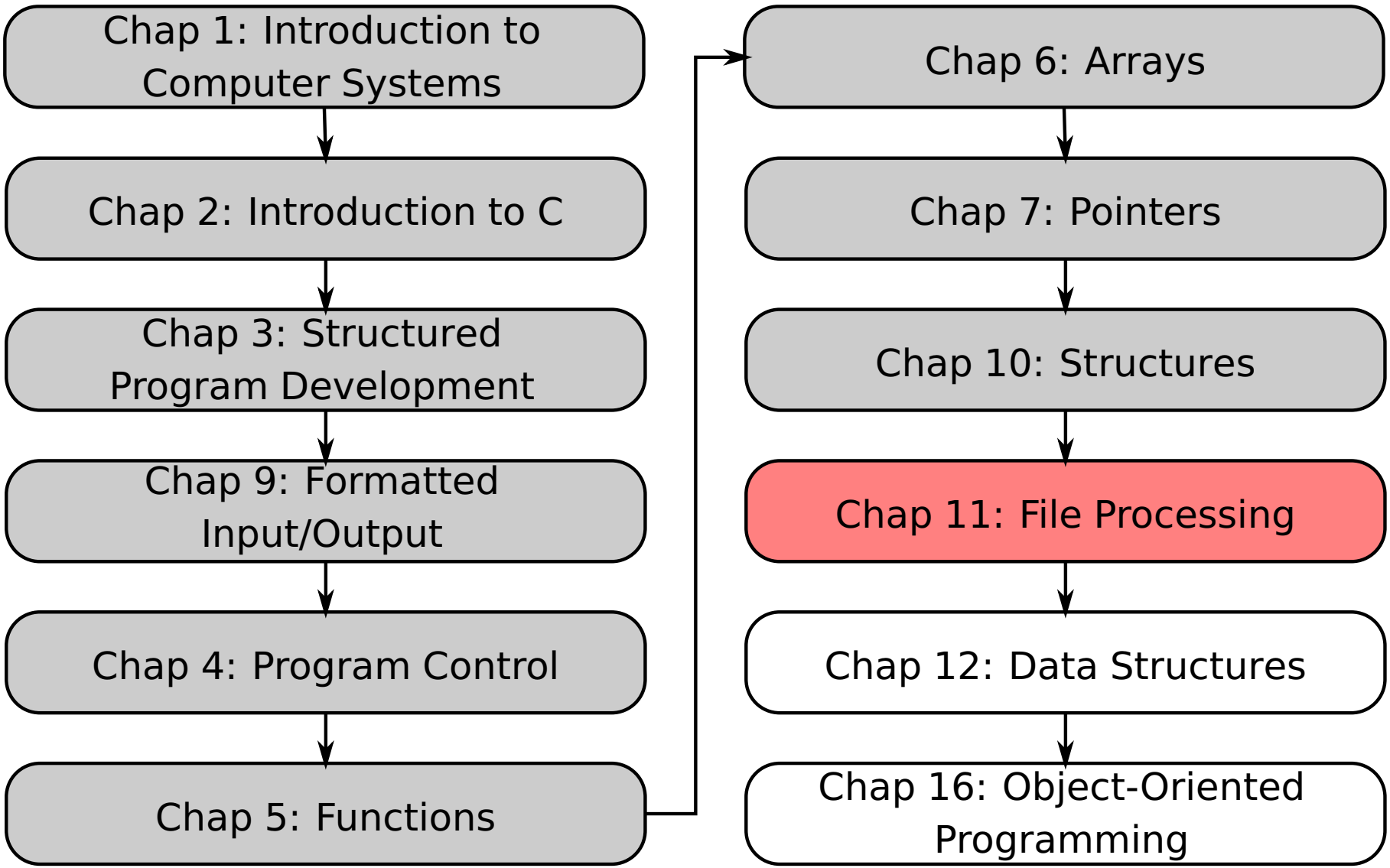
Module Overview



Lecture Overview

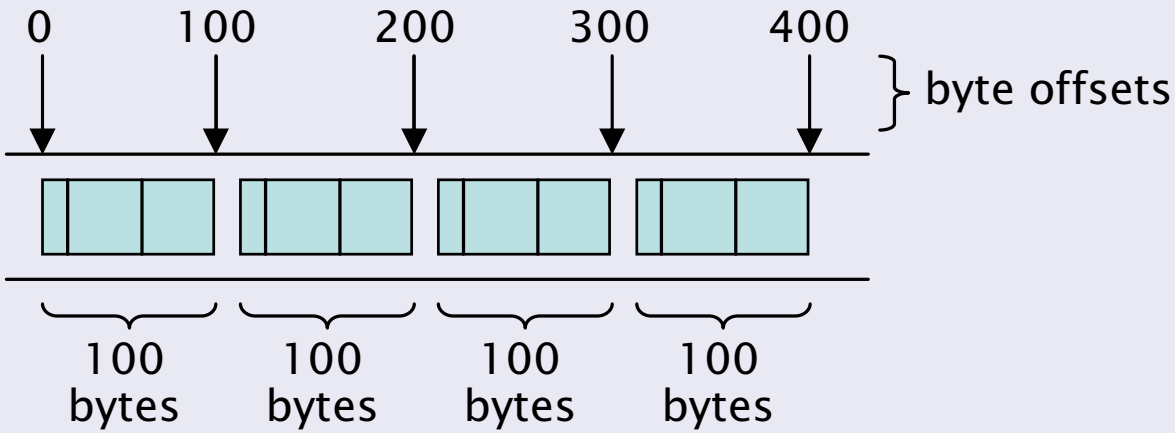
1. Random-Access Files (11.5-11.6)
2. Writing Data to a Random-Access File (11.7)
3. Reading Data from a Random-Access File (11.8)

11.5 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



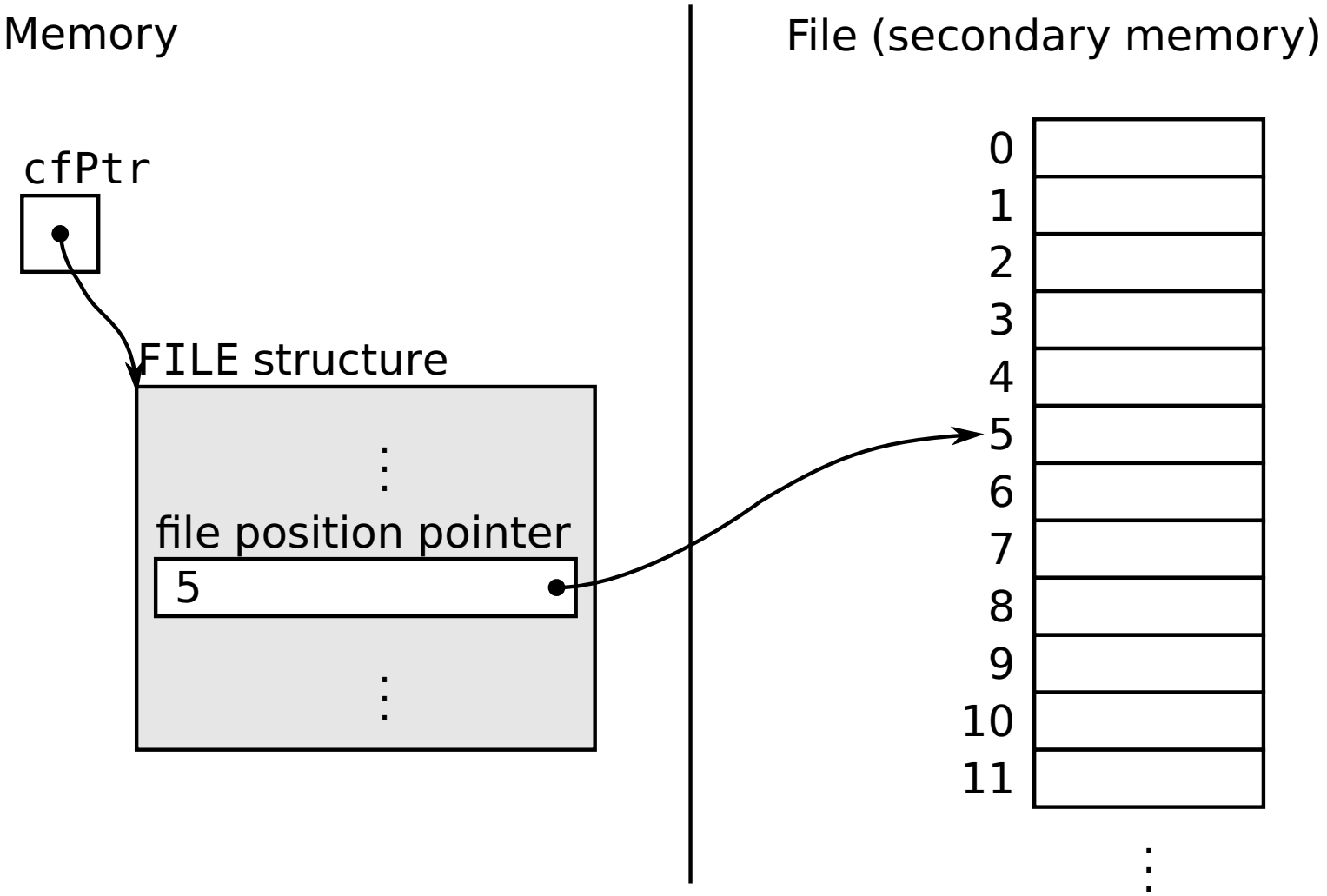
- Text files usually do not have fixed-length records and are therefore handled sequentially

11.5 Random-Access Files

Data in random-access files

- Random-access files are usually binary/unformatted (stored as “raw bytes”)
  - All data of the same type (ints, for example) uses the same amount of space as in memory
  - All records of the same type have a fixed length
  - Data not human readable

11.7 Writing Data to a Random-Access File I



11.7 Writing Data to a Random-Access File II

fseek()

- Sets file position pointer to a specific position

```
int fseek( FILE *stream, long int offset, int whence );
```

  - `stream` – pointer to file
  - `offset` – file position to seek (relative to the position specified in `whence`)
  - `whence` – specifies reference point in file for `offset`
    - `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

Writing data with `fseek()`

```
struct coord xPnt = { 1.0, 5.0 };
fseek( fPtr, 4 * sizeof( struct coord ), SEEK_SET );
fwrite( &xPnt, sizeof( struct coord ), 1, fPtr );
```

- Positions the file position pointer at the 5th element from the beginning of the file and writes structure `xPnt`.

11.8 Reading Data from a Random-Access File

Reading data with `fseek()`

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

```
struct coord xPnt;
fseek( fPtr, 4 * sizeof( struct coord ), SEEK_SET );
fread( &xPnt, sizeof( struct coord ), 1, fPtr );
```

- 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

11.6 Creation of Binary File for Random Access I

```
#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( void )
{
    int i; // counter used to count from 1-100

    // create clientData with default information
    struct clientData blankClient = { 0, "", "", 0.0 };

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

11.6 Creation of Binary File for Random Access II

```
    // 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
    else {
        // output 100 blank records to file
        for ( i = 1; i <= 100; i++ ) {
            fwrite( &blankClient, sizeof( struct clientData ), 1,
                    cfPtr );
        } // end for

        fclose( cfPtr ); // fclose closes the file
    } // end else

    return 0; // indicates successful termination
} // end main
```

11.7 Writing Data in Random-Access File I

```c
#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( void )
{
    FILE *cfPtr; // credit.dat file pointer

    // create clientData with default information
    struct clientData client = { 0, "", "", 0.0 };
```

11.7 Writing Data in Random-Access File II

```
// 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 {
    // require user to specify account number
    printf( "Enter account number"
        " ( 1 to 100, 0 to end input )\n? " );
    scanf( "%d", &client.acctNum );

    // user enters information, which is copied into file
    while ( client.acctNum != 0 ) {
        // user enters last name, first name and balance
        printf( "Enter lastname, firstname, balance\n? " );

        // set record lastName, firstName and balance value
        scanf( "%s%s%lf", client.lastName,
        client.firstName, &client.balance );
```

11.7 Writing Data in Random-Access File III

```
            // seek position in file to user-specified record
            fseek( cfPtr, ( client.acctNum - 1 ) *
            sizeof( struct clientData ), SEEK_SET );

            // write user-specified information in file
            fwrite( &client, sizeof( struct clientData ), 1, cfPtr );

            // enable user to input another account number
            printf( "Enter account number\n? " );
            scanf( "%d", &client.acctNum );
        } // end while

        fclose( cfPtr ); // fclose closes the file
    } // end main

    return 0; // indicates successful termination
} // end main
```

11.8 Reading Data from a Random-Access File I

```c
#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( void )
{
    FILE *cfPtr; // file pointer
    struct clientData client = {0, "", "", 0.0};
```

11.8 Reading Data from a Random-Access File II

```
// fopen opens the file
if((cfPtr = fopen("credit.dat", "rb")) == NULL)
{
        printf("File could not be opened.");
}
else
{
    // print headings
    printf(" %-6s%-16s%-11s%10s\n", "Acct", "Last Name",
    "First Name", "Balance");
```

11.8 Reading Data from a Random-Access File III

```
        // read all records from file
        while(!feof(cfPtr)){
        // read an entry out of file
            int result = fread(
                &client, sizeof(struct clientData), 1, cfPtr);

            // display record
            if(result != 0 && client.accNum != 0){
                printf(" %-6d%-16s%-11s%10.2f\n",
                client.accNum, client.lastName,
                client.firstName, client.balance);
            }
        }
        fclose(cfPtr);
    }
    return 0; // indicates successful termination
} // end main
```

Perspective

Today

File Processing III

- Random-access files
- Write randomly to a binary file
- Read randomly from a binary file

Next lecture

Dynamic Structures I

- Self-referential structures
- Dinamic data allocation
- Linked lists

Homework

1. Study Sections 11.6-11.9 in Deitel & Deitel
2. Do Self Review Exercises 11.1, 11.3 in Deitel & Deitel
3. Do Exercise 11.11 in Deitel & Deitel