Computer Programming 143 – Lecture 25
File Processing I

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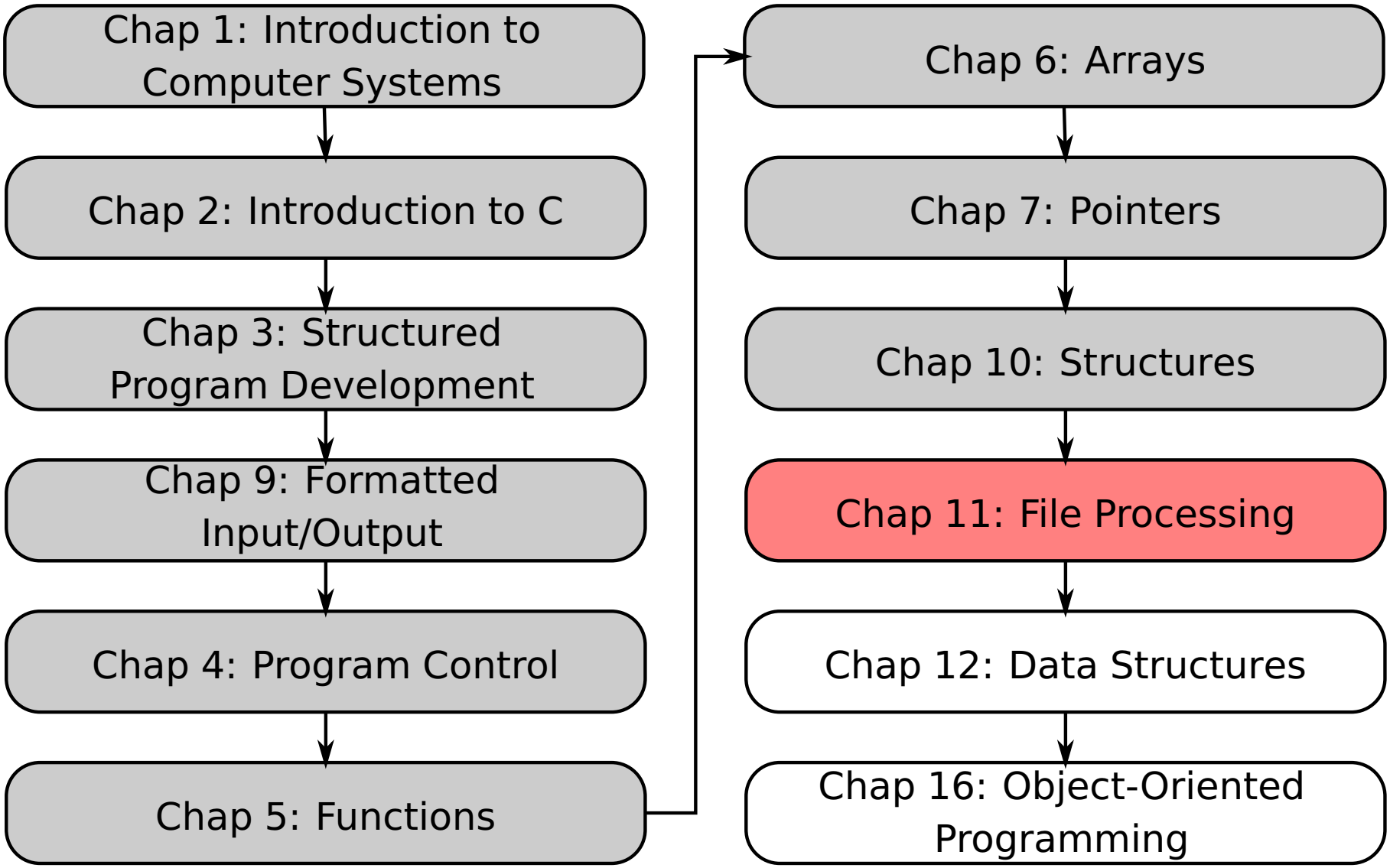
Module Overview



Lecture Overview

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.

File Types in C

Binary files

- Unformatted (stored as “raw bytes”)
  - Data not human readable
- Written and read sequentially or randomly

Text files

- Data is stored as characters (`char`)
- Usually only written and read sequentially

Opening and Closing Files

Opening files

```
FILE *cfPtr;
cfPtr = fopen( someFilename.xyz", "r" );
```

- Declares pointer **cfPtr** that may point to a file
- Opens `someFilename.xyz` and let **cfPtr** point to its beginning
  - **"r"**: File is opened to read and as text file

Closing files

```
fclose( cfPtr );
```

- Closes file to which **cfPtr** points
- Files should always be closed after use

File open modes

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.

11.2 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

- Communication channel between files and programs
- Opening a file returns a pointer to a `FILE` structure
- Three files with associated streams are automatically opened with program execution:
  - `stdin` – standard input (keyboard)
  - `stdout` – standard output (screen)
  - `stderr` – standard error (screen)

FILE structure

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

11.2 Files and Streams

Read/Write functions in standard library

A few useful functions from the standard C library.

- `int fgetc( FILE *stream );`
  - Reads one character from a file
  - Takes a `FILE` pointer as an argument
  - `fgetc( stdin )` equivalent to `getchar()`
- `char *fgets( char *str, int count, FILE *stream );`
  - Reads a line from a file
- `int fscanf( FILE *stream, const char *format, ... );`
  - File processing equivalents of `scanf()`
- `int fprintf( FILE *stream, const char *format, ... );`
  - File processing equivalent of `printf()`

11.3 Creating a Text File for Sequential Access

Additional functions for text files

- `int feof( FILE *stream );`
  - Returns true if *end-of-file* indicator (no more data to process) is set for the specified file
- `void rewind( FILE *stream );`
  - Resets the file position pointer to the beginning of the file

```c
#include <stdio.h>
#include <stdlib.h>
int main( void )
{
   FILE *fPtr; // file pointer
   char fileName[ 30 ]; // string to store file name
   char lineOfText[ 50 ] = "A single line of text";
   int myInt = 5;
   float myFloat = 1.345;
   // Next 2 lines illustrate a point - please do not use!
   fprintf( stdout, "Please enter filename: " );
   fscanf( stdin, "%29s", fileName );
   fPtr = fopen( fileName, "w" ); // opens file for writing
   if ( fPtr == NULL ) {
      printf( "ERROR - File could not be opened!\n" );
   }
   else { // what would the following write to the file?
      fprintf( fPtr, "*");
      fprintf( fPtr, "%s", lineOfText);
      fprintf( fPtr, "*");
      fprintf( fPtr, "\nmyInt = %d\nmyFloat = %.3f\n", myInt, myFloat );
      fclose( fPtr ); // closes file
   }
   return 0; // indicates successful termination
} // end function main
```

```c
#include <stdio.h>
#include <stdlib.h>
int main( void )
{
   FILE *fPtr; // file pointer
   char fileName[ 30 ]; // string to store file name
   char lineOfText[ 30 ], string1[ 20 ], string2[ 20 ];
   float myFloat;
   printf( "Please enter filename: " );
   scanf( "%29s", fileName ); // reads file name from user
   fPtr = fopen( fileName, "r" ); // opens file for reading
   if ( fPtr == NULL ) {
      printf( "ERROR - file could not be opened!\n" );
   }
   else { // what would the following code display?
      fgets( lineOfText, 29, fPtr );
      while ( !feof( fPtr ) ) {
         printf( "%s", lineOfText );
         fgets( lineOfText, 29, fPtr );
      }
      rewind( fPtr );
      printf( "%c\n", fgetc( fPtr ) );
      fgets( lineOfText, 29, fPtr );
      printf( " %s", lineOfText );
      fgets( lineOfText, 29, fPtr );
      printf( "%s", lineOfText );
      fscanf( fPtr, "%19s%19s%f", string1, string2, &myFloat );
      printf( "Value of myFloat = %.3f\n", myFloat );
      fclose( fPtr ); // closes file
   }
   return 0; // indicates successful termination
} // end main
```

Perspective

Today

File Processing I

- File types in C
- Opening and closing files
- Writing and reading from a text file

Next lecture

File Processing II

- Data hierarchy
- Binary files

Homework

1. Study Sections 11.1-11.4 in Deitel & Deitel