Computer Science I

File Input/Output

Dr. Chris Bourke
cbourke@cse.unl.edu

Outline

1. Introduction & File Output
2. File Input
3. Binary Files
4. Exercises

Part I: Introduction & File Output

Overview

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- CSV, XML, JSON, base-64 encoding

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- Also called a *handle*

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- First argument: path and name of the file to open
- Second argument: *mode* to open it up in
- File input: `"r"` for *reading*
- File output: `"w"` for *writing*
- Demonstration

Demonstration


```c
//open a file data.txt in the current directory for reading:
FILE *f = fopen("data.txt", "r");

//open a file data.txt for writing:
FILE *f = fopen("data.txt", "w");

//you can also use relative paths
FILE *f = fopen("../../data.txt", "r");

//absolute path:
FILE *f = fopen("/etc/shadow", "r");

//error checking:
if(f == NULL) {
  printf("Unable to open file!\n");
}
```

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- Opening a file for writing will create it if it does not already exist
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- Failure to *close* a file *may* lead to data corruption
- Closing a file:

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fclose(f);
```

Paths

- Current Working Directory: `.`

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- One directory "up" the hierarchy `..`

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File Output


```c
int a = 42;

FILE *f = fopen("data.txt", "w");

fprintf(f, "Hello World!\n");
fprintf(f, "a = %d\n");
fprintf(f, "pi is %.4f\n", M_PI);

fclose(f);
```

Part II: File Input

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- `fgetc()` gets a single character from a file
- `fgets()` gets (up to) an entire line from a file

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- Returns a special flag, `EOF` when it gets to the end-of-file

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fgetc


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

int main(int argc, char **argv) {

  FILE *f = fopen("./data/students.csv", "r");
  char c = fgetc(f);
  while(c != EOF) {
    printf("c = %c\n", c);
    c = fgetc(f);
  }
  fclose(f);

  return 0;
}
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fgets

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#include <stdio.h>
#include <string.h>

int main(int argc, char **argv) {

  FILE *f = fopen("./data/students.csv", "r");

  char buffer[100];
  char *line = fgets(buffer, 100, f);
  while(line != NULL) {
    //chomp out the endline character:
    int n = strlen(buffer);
    if(buffer[n-1] == '\n') {
      buffer[n-1] = '\0';
    }
    printf("line = %s\n", line);
    line = fgets(buffer, 100, f);
  }
  fclose(f);
  return 0;
}
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Part III: Binary Files

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- C: `fread` (reading) and `fwrite` (writing) binary data
- Reads/writes multiple pieces of data at once

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Part IV: Exercises

File I/O
Exercise

Write a program to process a CSV file with student information including last name, first name, NUID, and GPA to prepare a Dean's list. Output to a separate file all student names whose GPA is greater than 3.5, but only include their first name and last name (one to a line).

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- Exercise: dictionary attack a SHA-256 hashed password: `0xaa97302150fce811425cd84537028a5afbe37e3f1362ad45a51d467e17afdc9c`