

C Programming: I/O, files, selection sort

Yipeng Huang

Rutgers University

January 25, 2022

Table of contents

Announcements

- Recitations and office hours

- Programming assignments

`oddEven`: A program that prints if a number is even or odd

- Program structure

- Printing to command line

- Compiling and running your program

`collatz`: A program that prints a $3x+1$ number sequence

- Opening a file

- Reading characters from a file

- Control flow

`sortJobs`: A program that sorts jobs by an index

Recitations and office hours

- ▶ TAs now fully appointed.
- ▶ Recitations start this week, virtual this week.
- ▶ Attend any or all of the recitations that you need and work for you.
- ▶ Since Section 6 and Section 7 originally at the same time, the Section 6 option has been moved to Fridays 10:20 at CoRE 301.
- ▶ Lecture and recitations will be in-person starting January 31.
- ▶ TAs might offer livestreaming or recording.
- ▶ If recitation room is overcrowded prohibiting social distancing, you will have to find somewhere else to watch virtually or watch the recording.
- ▶ Some type of class resource (recitation/office hour) offered every day of the week.

<https://rutgers.instructure.com/courses/160141/pages/recitation-and-office-hour-information>

Programming assignments

- ▶ PA0 has been out, due Tuesday February 1. Objective is to get your programming environment set up.
- ▶ PA1 now out, due Tuesday February 8. A bit more tricky. Review of some sorting algorithms and recursion from CS 112. Learn about C arrays and pointers and how to use functions in C.

Table of contents

Announcements

- Recitations and office hours

- Programming assignments

`oddEven`: A program that prints if a number is even or odd

- Program structure

- Printing to command line

- Compiling and running your program

`collatz`: A program that prints a $3x+1$ number sequence

- Opening a file

- Reading characters from a file

- Control flow

`sortJobs`: A program that sorts jobs by an index

oddEven: A program that prints if a number is even or odd

- ▶ Headers
- ▶ Command line arguments
- ▶ printf and format specifiers
- ▶ EXIT_SUCCESS

Including headers

- ▶ `#include <stdio.h>`
- ▶ `#include <stdlib.h>`
- ▶ `#include <stdbool.h>`

Printing to command line

The format string in `printf(char* format, args)`

- ▶ `%d`: integer
- ▶ `%ld`: long integer
- ▶ `%s`: string
- ▶ `%c`: character
- ▶ `%f`: float

Compiling and running your program

How does a program end up on your computer?

How a Makefile works

- ▶ $\$@$: target file name
- ▶ $\$<$: first prerequisite
- ▶ $\$^$: all prerequisites

First encounter with pointers

What is `char* argv[]`

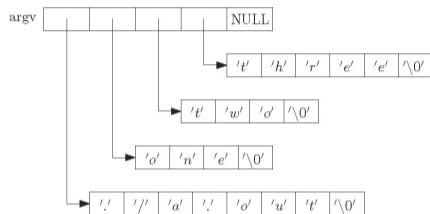


Figure: Image credit: <http://www.csc.villanova.edu/~mdamian>

In C, Strings, `char*`, and `char[]` are all the same

- ▶ `char greeting[6] = {'H', 'e', 'l', 'l', 'o', '\0'};`
- ▶ `char greeting[] = "Hello";`

Table of contents

Announcements

- Recitations and office hours

- Programming assignments

`oddEven`: A program that prints if a number is even or odd

- Program structure

- Printing to command line

- Compiling and running your program

`collatz`: A program that prints a $3x+1$ number sequence

- Opening a file

- Reading characters from a file

- Control flow

`sortJobs`: A program that sorts jobs by an index

collatz: A program that prints a $3x+1$ number sequence

Opening a file

The mode in `FILE *fopen(const char *filename, const char *mode)`

- ▶ "r": read from the file
- ▶ "w": write, starting at the beginning of the file
- ▶ "a": write, starting at the end of the file (append)

Reading characters from a file

- ▶ `int fgetc(FILE *stream)`
- ▶ `char *fgets(char *str, int n, FILE *stream)`
- ▶ `int fscanf(FILE *stream, const char *format, ...)`

Control flow

- ▶ Conditionals
- ▶ Loops
 - ▶ for loops
 - ▶ while loops
 - ▶ do-while loops
 - ▶ break;
 - ▶ continue;

Table of contents

Announcements

- Recitations and office hours

- Programming assignments

`oddEven`: A program that prints if a number is even or odd

- Program structure

- Printing to command line

- Compiling and running your program

`collatz`: A program that prints a $3x+1$ number sequence

- Opening a file

- Reading characters from a file

- Control flow

`sortJobs`: A program that sorts jobs by an index

sortJobs: A program that sorts jobs by an index

Recall as a class: what types of sorting algorithms are there?

To tackle the `sortJobs` example we will show three approaches:

1. Selection sort by multiple passes through the input.
2. Insertion sort using a linked list to keep track of sorted results.
3. Bucket sort using an array to keep track of sorted results.

First we walk through the selection sort example.

We will detour to the pointers lab before coming back to insertion and bucket sort examples.