

Embedded System Workshops

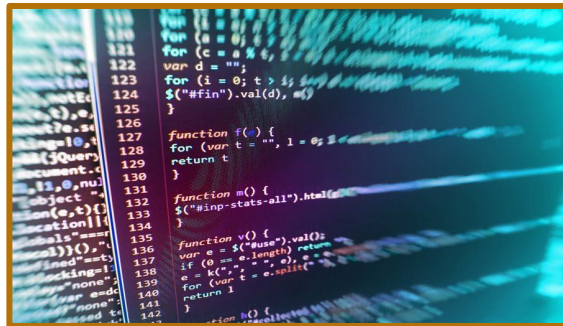
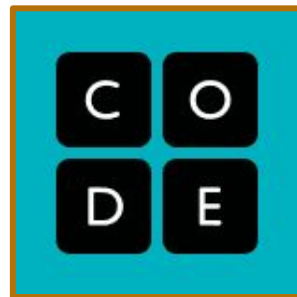
0B. Introduction to C
CCA Girls Who Code



What is C?

C is a popular programming language used for a variety of things, including

- Embedded systems
- Developing system and desktop applications
- Developing operating systems such as Apple's OS X and Microsoft's Windows
- Compiler production
- Open source software



Why C?

- Small runtime = very fast and very small memory footprint
- Middle level language
 - ◆ Can be used for low-level like scripting for drivers and kernels
 - ◆ Also can be used for high-level like developing software applications
- Direct access to machine level hardware APIs
- Portable and efficient
 - ◆ Close to the machine and almost universally available for existing processor architectures

What is GitHub?

GitHub is a cloud-based application for software development and version control.

- Used to store versions and revisions of projects
- Repositories used to organize files
- Access control and collaboration features
- Forking or “copying” repositories

Learn more about GitHub at github.com



What is the cloud, and why is it useful?

From Cloudbakers:

“The cloud enables users to access the same files and applications from almost any device, because the computing and storage takes place on servers in a data center, instead of locally on the user device.”

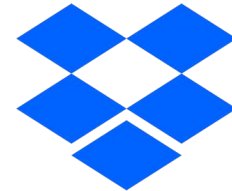
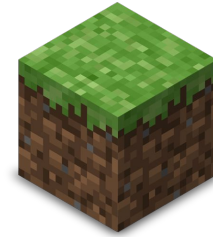
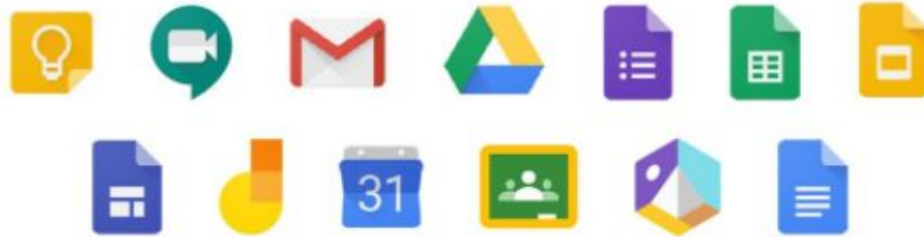
Types of cloud applications

- A local device runs a browser and uses a web solution
- A local device runs a browser but downloads a browser-based applications
- A local device runs a native application

Examples of Cloud-Based Applications

- Gmail and GSuite Applications
- Dropbox
- Facebook
- GitHub
- Instagram

- Minecraft
- Netflix
- Skype
- Twitter
- Zoom



Introduction to GitHub

Setting Up GitHub

→ Make a GitHub account (github.com)



Why GitHub? ▾ Team Enterprise Explore ▾ Marketplace Pricing ▾

Search GitHub



Sign in

Sign up

Where the world builds software

Millions of developers and companies build, ship, and maintain their software on GitHub—the largest and most advanced development platform in the world.

Email address

Sign up for GitHub



Setting Up GitHub

→ Download GitHub Desktop [here](https://desktop.github.com) (desktop.github.com)



Link to Program Repository

FTC9837 / [embedded-systems-course](#)

Watch 0

Star 0

Fork 7





[Code](#) [Issues](#) [Pull requests](#) [Actions](#) [Projects](#) [Wiki](#) [Security](#) [Insights](#) [Settings](#)

main 1 branch 0 tags

Go to file

Add file

Code

 SamP923	Pull practice #2	3362c8a 21 days ago	3 commits
	reference-materials	Initial commit	21 days ago
	.gitattributes	Initial commit	21 days ago
	README.md	Pull practice #2	21 days ago

README.md

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Purpose:

Due to COVID-19, in-person robotics meetings and thus competitions have become less feasible given social distancing restrictions. Personal embedded systems kits can be used to remotely connect with team members and gain relevant mechanical, electrical, and programming experience.

Materials:

About

No description, website, or topics provided.

Readme

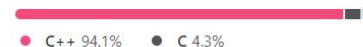
Releases

No releases published
[Create a new release](#)

Packages

No packages published
[Publish your first package](#)

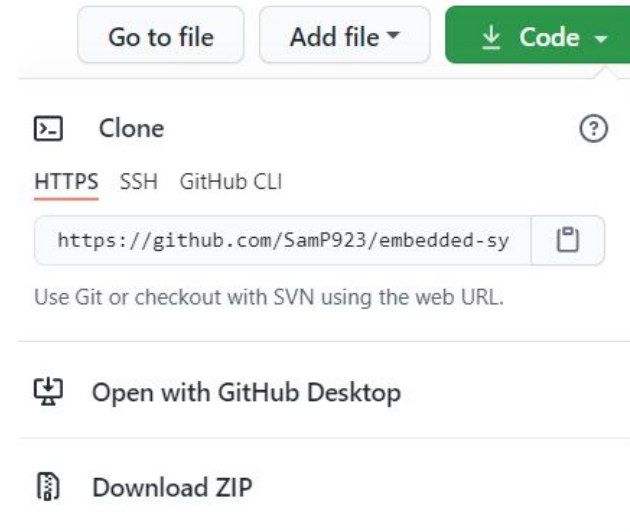
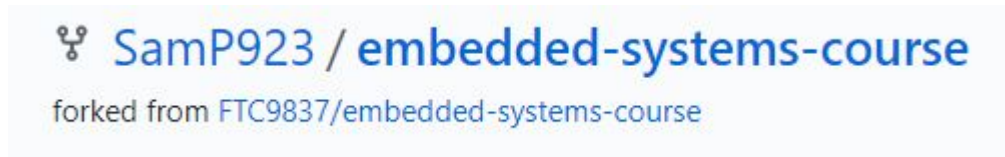
Languages



Clone and Download the Repository



- Click the fork button in the upper right hand corner to make your own copy of the repository
- Then, click the green Code button and click “Open with GitHub Desktop” to download the repository to your local system
- ◆ Make sure you download your repository, NOT the FTC9837 one!



Make your first commit!

- Let's edit the README of our project on GitHub browser
 - ◆ The README.md file is used to show documentation and information about the project in the repository
- Click the pencil to start editing the file
- Remove the To-Do line

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Purpose:

Due to COVID-19, in-person robotics meetings and thus competitions have become less feasible given social distancing restrictions. Personal embedded systems kits can be used to remotely connect with team members and gain relevant mechanical, electrical, and programming experience.

Materials:

- Computer with internet connection
- GitHub account
- Elegoo's Super Starter Kit Uno R3 Project (\$36.99 on Amazon)

[TO-DO 1]

Practice pulling new code to your fork that has been uploaded to the main repository! Delete this line.

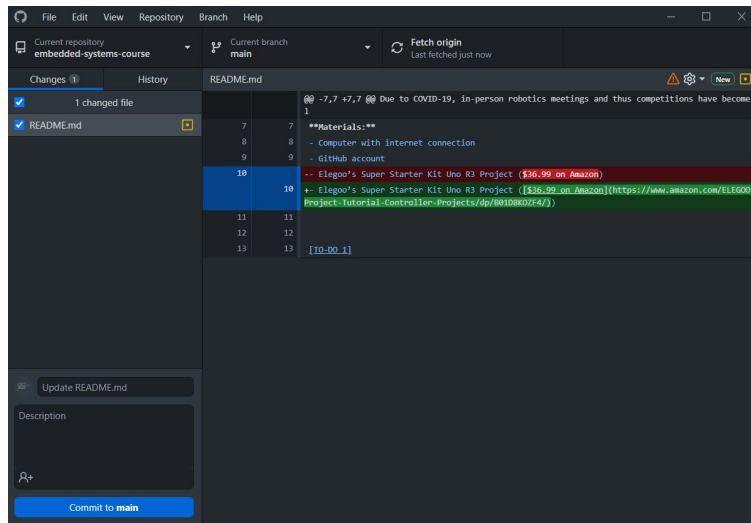
Make your second commit!

- Pull the changes made in the browser
- Add a file from your local system
 - ◆ Make a file called helloworld.c
 - ◆ Copy into it the following code

```
#include <stdio.h>

int main(void) {
    printf("Hello World\n");
    return 0;
}
```

- Push your changes to your repository



Introduction to Coding

Setting up repl.it



- Search up “Repl.it”
- Click “Sign up” if you do not have an account
- Click the Google logo
- Sign in with your Google account



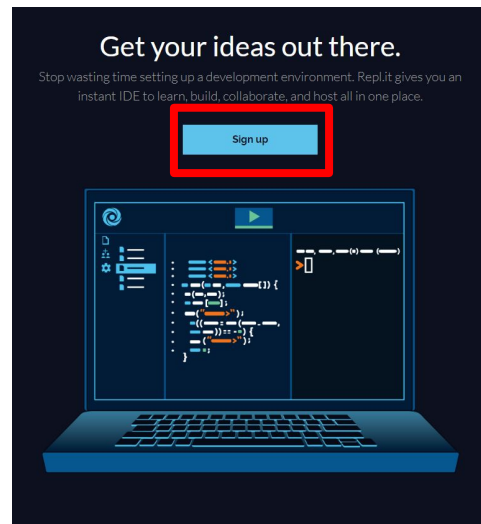
You must use a personal email!



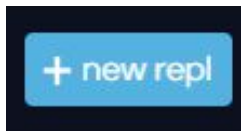
Signup form with fields for:

- username
- email
- password

Below the fields are checkboxes for "I'm a teacher" and a link for "or log in". At the bottom is a red "Sign up" button.



First coding exercise!

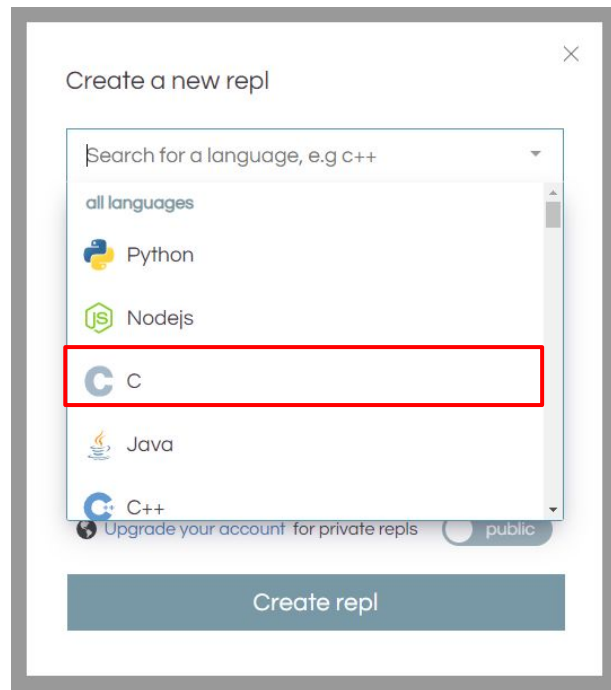


- Click “new repl” in the top right corner
- A window (shown to the right) should pop up
- Search for “C” (not C++ or C#)
- Name your repl “c_introduction”
- Click “Run” and see what happens!



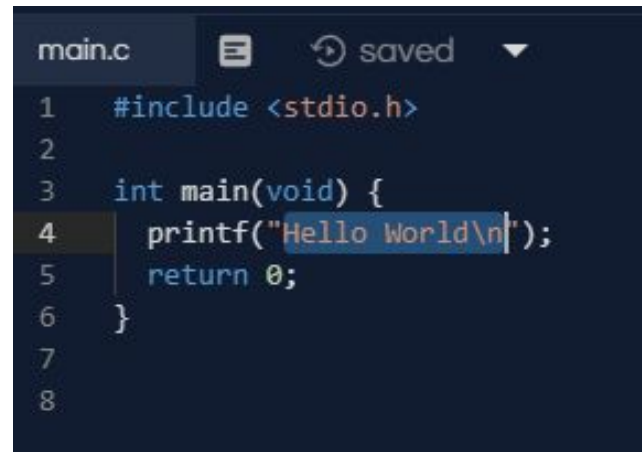
It may take a while to run.

```
main.c  saving...  
1  #include <stdio.h>  
2  
3  int main(void) {  
4      printf("Hello World\n");  
5      return 0;  
6  }  
7
```

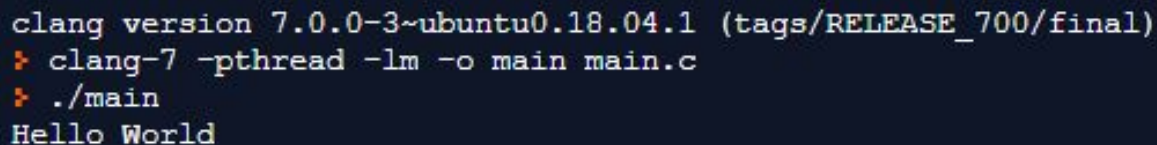


Print Statements

- What was the result?
- When you click “Run,” whatever is written in the highlighted region will be printed out
- Only the words, characters, or numbers **inside** the quotation marks to be printed



```
main.c  saved
1  #include <stdio.h>
2
3  int main(void) {
4  printf("Hello World\n");
5  return 0;
6  }
7
8
```



```
clang version 7.0.0-3~ubuntu0.18.04.1 (tags/RELEASE_700/final)
❯ clang-7 -pthread -lm -o main main.c
❯ ./main
Hello World
```

Data Types for Variables

Much like a variable in math, a variable in C acts as a way to store information. They specify the type of data (size and value) that can be stored in a variable. For example, instead of typing `printf(6);` you can type `int num = 6; printf(num);`

Types of Data Types

- **Int** - stores integer values (Ex: 4)
- **Float/Double** - stores decimal values (Ex: 2.6)
- **Boolean** - stores either “true” or “false”
- **Char** - stores a single character (Ex: “a”)



How to Print Strings

- Unlike Java, a String is not a variable type in C
- We can print strings of characters using an array
- Try printing your name!

```
main.c  [icon]  saved  ▼  
1  #include <stdio.h>  
2  
3  int main(void) {  
4  
5      char str[] = "Put your name here!";  
6  
7      printf("%s", str);  
8      return 0;  
9  }
```

Format Specifiers

%c	Character
%d	Signed integer
%f	Float values
%l or %ld or %li	Long
%lf	Double
%s	String
%x or %X	Hexadecimal representation
%n	Prints nothing
%%	Prints % character

Find a full list from [tutorialspoint!](https://www.tutorialspoint.com/cprogramming/c_format_specifiers.htm)

Variables Practice

- Create a variable called **num** that stores a float and print out the value

```
float myFloat = 6.02;
```

- Create a two variables called **n1** and **n2** that store integers. Print out the sum

```
int myInt = 4;
```

- Create a variable that stores boolean values, one true and one false

```
#include <stdbool.h> ← Add this to the start of your file under the first #include
```

```
bool x = false; ← Put this with the rest of your variables
```

Variables Practice KEY

main.c

```
1  #include <stdio.h>
2  #include <stdbool.h>
3
4  int main(void) {
5      float num = 2.0;
6      printf("%f\n", num);
7
8      int n1 = 2;
9      int n2 = 8;
10     printf("%d\n", n1+n2);
11
12     bool x = false;
13     bool y = true;
14     return 0;
15 }
16
17
```

Console

Shell

```
> clang-7 -pthread -lm -o main main.c
> ./main
2.000000
10
> 
```

How to Get User Input (scanf() and printf())

- The printf function writes output to the standard output stream **stdout**
- The scanf function reads input from the standard input stream **stdin** according to the format provided
- Try this exercise!

main.c

```
1  #include <stdio.h>
2  int main(void) {
3
4      char str[100];
5      int i;
6
7      printf( "Enter a string and an integer:");
8      scanf("%s %d", str, &i);
9
10     printf( "\nYou entered: %s %d ", str, i);
11
12     return 0;
13 }
```

Computing Practice

- Write a C program that asks the user for two integer inputs. Then, calculate the sum of the two inputs.
- Ask the user for a height and width value, then compute the perimeter and area of a rectangle with those dimensions
- BONUS: Ask the user for a radius value, then compute the perimeter and area of a circle with that dimension

Computing Practice KEY

- Write a C program that asks the user for two integer inputs. Then, calculate the sum of the two inputs.

```
main.c
1  #include <stdio.h>
2  int main() {
3      int number1, number2, sum;
4
5      printf("Enter two integers: ");
6      scanf("%d %d", &number1, &number2);
7
8      // calculating sum
9      sum = number1 + number2;
10
11     printf("%d + %d = %d", number1, number2, sum);
12     return 0;
13 }
```

Computing Practice KEY

- Ask the user for a height and width value, then compute the perimeter and area of a rectangle with those dimensions

```
1  #include <stdio.h>
2  int main() {
3      int width;
4      int height;
5
6      int area;
7      int perimeter;
8
9      printf("Enter a height and width: ");
10     scanf("%d %d", &height, &width);
11
12     perimeter = 2*(height + width);
13     area = height * width;
14
15     printf("area = %d \n", area);
16     printf("perimeter = %d", perimeter);
17     return 0;
18 }
```

Computing Practice KEY

- Ask the user for a radius value, then compute the perimeter and area of a circle with that dimension

```
1  #include <stdio.h>
2  int main() {
3      int radius;
4      int perimeter;
5      int area;
6
7      printf("Enter a radius: ");
8      scanf("%d", &radius);
9
10     area = 3.14*radius*radius;
11     perimeter = 3.14*2*radius;
12
13     printf("area = %d \n", area);
14     printf("perimeter = %d", perimeter);
15     return 0;
16 }
```

Getting Code from GitHub Practice

- The GitHub repository has just been updated!
- Pull the new files into your local repository
- Copy the code from `months.c` into your Repl.it file. What does it do?

Thank you!

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