

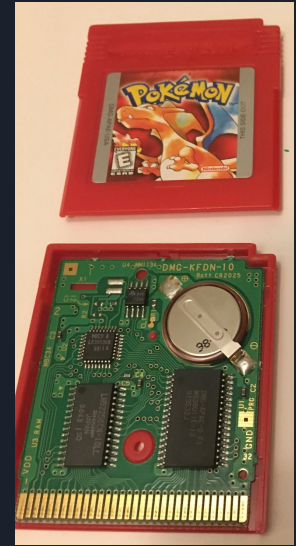


Game Boy Development

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The Nintendo Game Boy

- 8-bit handheld game console released in 1989
- Display
 - 160x144 dot matrix
 - 2-bit color (4 shades)
- CPU
 - Sharp LR35902 (GBZ80)
 - Based on 8080 and Z80 processors of the time
 - Used a version of Assembly
 - Based on Z80 assembler
- Memory
 - 8KiB RAM built in
 - More might be in carts
 - 8KiB RAM just for display
 - 32KiB ROM in cart for game code
- Misc
 - Graphical units called sprites



Programming

- Programmers of the time would have had to learn GBZ80 asm
- The Game Boy Development Kit (GBDK)
 - Rocky development
 - Development started late 90s
 - Abandoned early 2001
 - Rebooted in 2020
 - Compiles C into asm that the Small Device C Compiler (SDCC) can understand
 - In short, you can make Game Boy games with C!
- Your code
 - You'll write code in **main.c**
 - Everytime you make changes, run **make.bat**
 - This will turn your code into a .gb rom file
 - Make sure to run make in the same folder as the gbdk
 - Run the .gb file with VisualBoyAdvance



```
MEMORY
0000 d6 22 26 52 0f 0f 2f 6f ...f...f...
0008 e9 f5 a5 60 69 01 73 ff ...f...f...
0010 09 da 22 00 1b 00 44 dd ...f...f...
0018 7a b3 20 09 cd 31 00 e1 ...f...f...
0020 f1 e9 c3 10 00 1b c5 01 ...f...f...
0028 ac ff cd 51 00 c1 c3 18 ...f...f...
0030 00 04 10 22 79 d6 6f fe ...f...f...
0038 18 da 43 00 d6 18 fe 18 ...f...f...
0040 d2 3c 00 21 62 00 87 4f ...f...f...
0048 09 7c 23 56 6f e9 3e 0e ...f...f...

M Z H P E N C IFF=DI IW=0
AF=0xff\xff 65535 AF'=x00:x00 00000
BC=x00:x00 00000 BC'=x00:x00 00000
DE=x00:x00 00000 DE'=x00:x00 00000
HL=x00:x00 00000 HL'=x00:x00 00000
IX=0x0000 00000
IY=0x0000 00000
SP=0xffff 65535
PC=0x0000 00000

SUB 34 000b 26976 6960 1' A=255 (11111111) A'=000 (00000000)
LD H,146 0002 58869 e5f5 .. F=255 (11111111) F'=000 (00000000)
RRCA 0004 59759 e96f .. B=000 (00000000) B'=000 (00000000)
RRCA 0005 12047 2f0f .. C=000 (00000000) C'=000 (00000000)
CPL 0006 03986 0f32 .. D=000 (00000000) D'=000 (00000000)
LD L,A 0007 09762 2622 .. E=000 (00000000) E'=000 (00000000)
JP (HL) 0008 >ffff 54784 d600 .. H=000 (00000000) H'=000 (00000000)
PUSH AF 0009 ffff 0000 0000 .. L=000 (00000000) L'=000 (00000000)
PUSH HL 000a ffff 0000 0000 .. I=x00 (00000000) R=x00 (00000000)
LD H,B 000b ffff 0000 0000 ..
```

```
// UPDATE SWITCHES
void updateSwitches() {

    HIDE_WIN; // HIDE WINDOW LAYER
    SHOW_SPRITES; // SHOW SPRITES LAYER
    SHOW_BKG; // SHOW BACKGROUND LAYER
```



C Background

- C is a lower level programming language compared to the languages you may know like Python or Java
 - Python allows us to be more flexible, for example variable types can be determined at runtime by the data assigned to them
 - C code lacks this flexibility
- C must be compiled before it can be run
 - In this workshop we have given you the file **make.bat** it will compile your C code into .gb files for the emulator
- We are going to go over some syntax you'll need to know for your development





C Syntax - Semicolons and Variable Types

- For this workshop we will be using statements similar in nature to ones you know from other programming languages
- Syntax of those statements will be different
- For example:
 - Every non blocking statement must end with a semicolon ;
 - This would not include statements like if or while, the are followed by brackets {} containing the statements to be executed by them
 - Variables must be declared with a type
 - `int x;`
 - `int y = 4;`
 - `float i = 3.4;`
- Print using `printf("Text to be printed");`

```
void main(void)
{
    printf("Hello World");

    // Loop forever
    while(1) {

        // Game main loop processing goes

        // Done processing, yield CPU and
        wait_vbl_done();
    }
}
```

C Syntax - Main Function and Other Functions

- Similar to Java, C runs code that is inside the main function
 - From here you can call other functions
 - They may be in the same .c file or other .c files
- In C it is customary to have header files that outline functions used in the program
 - Implement functions in a .c file of the same name
- Include these header files and other files in main.c with include statements at the top of the program like **#include "block.h"**

Instantiates functions

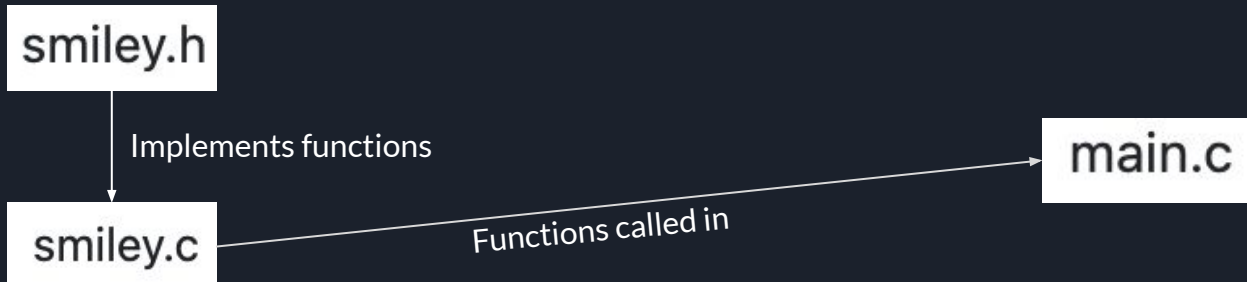
smiley.h

Implements functions

smiley.c

Functions called in

main.c





C Syntax - If-else Statements

- For this workshop need to know if statements
 - Similar syntax to Java
- Possible conditional operators used in this workshop include
 - == equals
 - != not equal
 - && and
 - || or
 - > greater than
 - < less than

```
if (test expression) {  
    // run code if test expression is true  
}  
else {  
    // run code if test expression is false  
}
```



C Syntax - Calling Functions

- Calling functions is similar to Java
 - Functions for this workshop are created by GBTD
- We will need to call them in main
- Also, we will need to supply them with arguments if the function requires them
- For example a function with two arguments
 - `function_name(argument1, argument2);`
- Calling a function with no arguments leaves the parentheses blank
 - `function_name();`

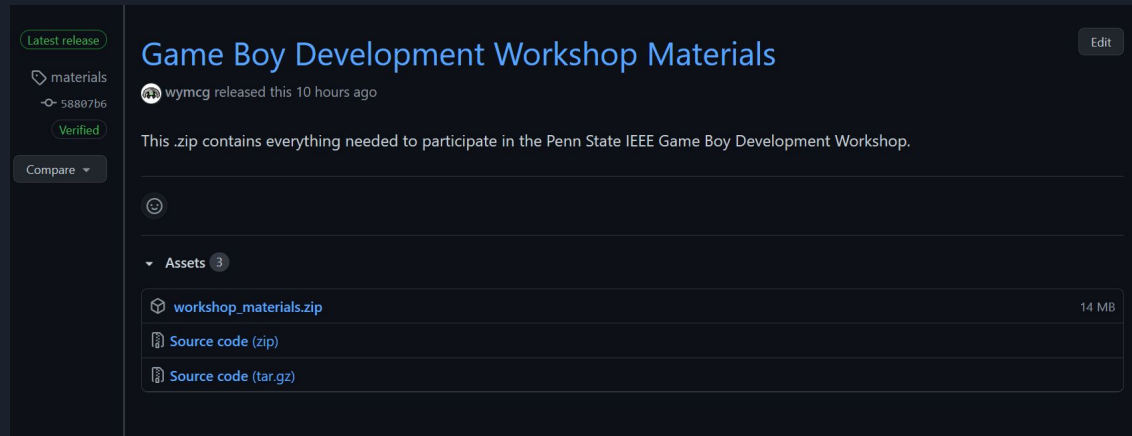
```
int sum(int a, int b)
{
    int c=a+b;
    return c;
}

int main(
{
    int var1 =10;
    int var2 = 20;
    int var3 = sum(var1, var2);
    printf("%d", var3);

    return 0;
}
```


Download workshop materials

1. Navigate to <https://github.com/psuieee/projects2021/releases>
2. Download workshop_materials.zip
3. Extract the contents to an easy-to-find place



The screenshot shows the GitHub release page for 'Game Boy Development Workshop Materials'. On the left sidebar, there is a 'Latest release' badge, a repository icon for 'materials' with commit hash '58807b6', a 'Verified' badge, and a 'Compare' dropdown. The main content area has the title 'Game Boy Development Workshop Materials' with an 'Edit' button. Below the title, it says 'wymcg released this 10 hours ago'. A description states: 'This .zip contains everything needed to participate in the Penn State IEEE Game Boy Development Workshop.' There is a placeholder for a description image. Under the 'Assets' section (3 items), there are three items: 'workshop_materials.zip' (14 MB), 'Source code (zip)', and 'Source code (tar.gz)'.

Latest release

materials
58807b6
Verified
Compare

Game Boy Development Workshop Materials

Edit

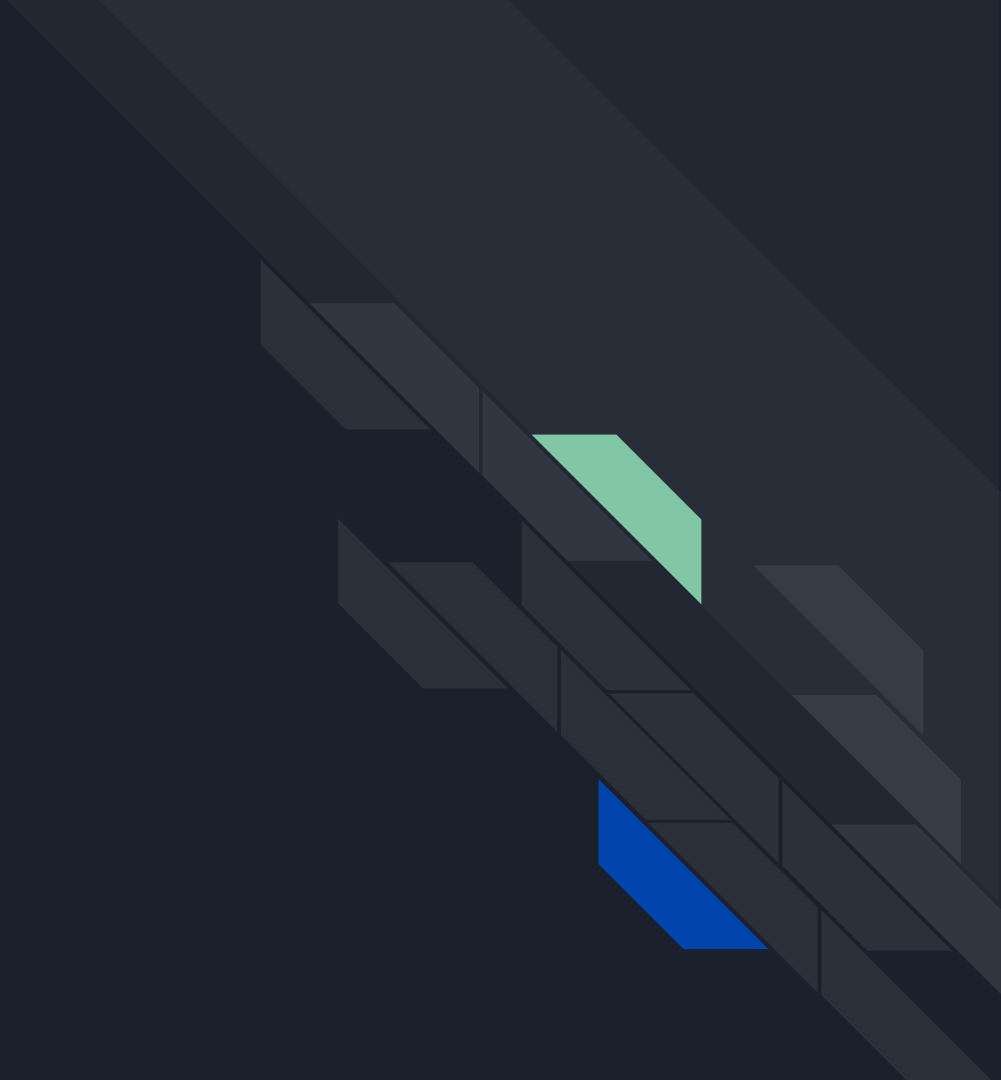
wymcg released this 10 hours ago

This .zip contains everything needed to participate in the Penn State IEEE Game Boy Development Workshop.

Assets 3

- workshop_materials.zip 14 MB
- Source code (zip)
- Source code (tar.gz)

Hello, World!



A word on GBTD



Getting your sprite on screen



Getting that sprite to move



Final changes



Next Steps

- Background tiles
- Multiple Sprites
- Larger sprites
- Sprite groups
- Sound

See GBDK documentation!

