

Header files

Adapted from materials by Dr. Carrier



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void PrintArray(int* arr, int len){  
    printf("[");  
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        if(i != 0) printf(" ");  
        printf("%d", *(arr + i));  
        if(i != len-1) printf(",");  
    }  
    printf("]\n");  
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How can we reuse this code in different files?

Introducing: header files

Header files contain C code, filenames end in .h

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The files we've been including, example:

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#include <stdio.h>
```

For system headers, we use

```
#include <file.h>
```

For local headers that we write:

```
#include "file.h"
```

What goes in a header file

Traditionally, header files contain structs, variables, and function *prototypes*

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(You can put function definitions in headers, there are tradeoffs)

Example header file (print.h)

```
#include <stdio.h>

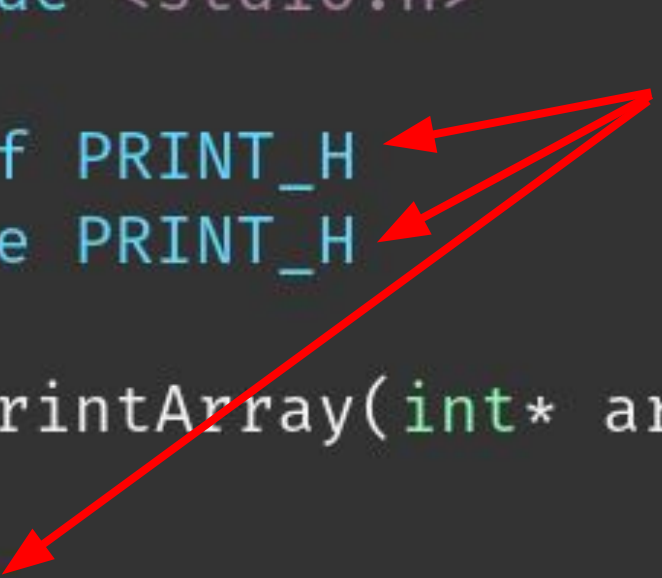
#ifndef PRINT_H
#define PRINT_H

void PrintArray(int* arr, int len);

#endif
```

Example header file (print.h)

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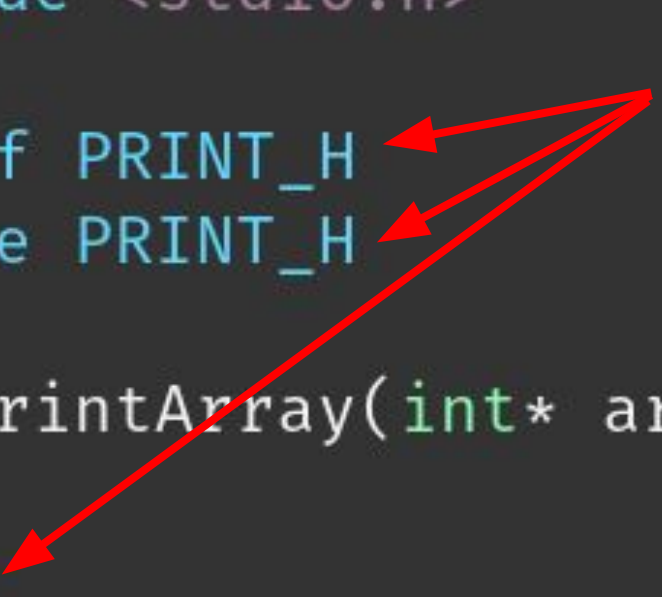
The image shows a code snippet for a header file named `print.h`. The code is as follows:

```
#include <stdio.h>
???
#ifndef PRINT_H
#define PRINT_H
void PrintArray(int* arr, int len);
#endif
```

Three red arrows originate from the red text `???` and point to the preprocessor directives `#ifndef PRINT_H`, `#define PRINT_H`, and `#endif`, indicating that the `???` represents the missing implementation of the `PrintArray` function.

Example header file (print.h)

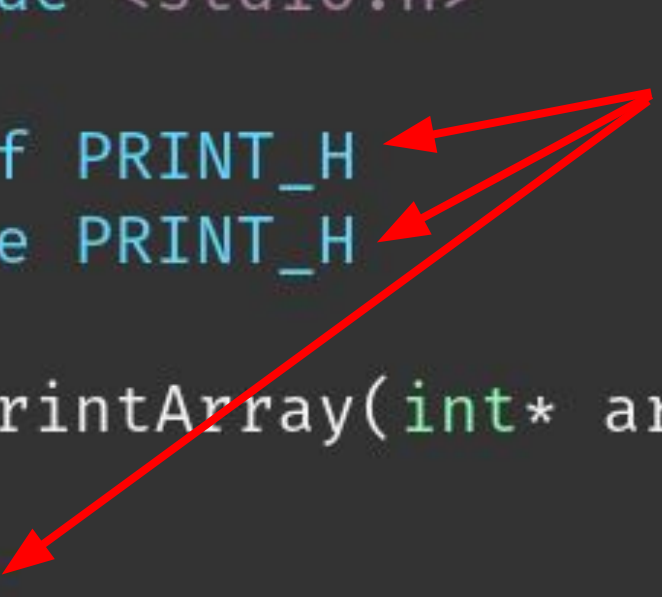
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This extra stuff is a header guard

Example header file (print.h)

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#ifndef PRINT_H
#define PRINT_H
void PrintArray(int* arr, int len);
#endif
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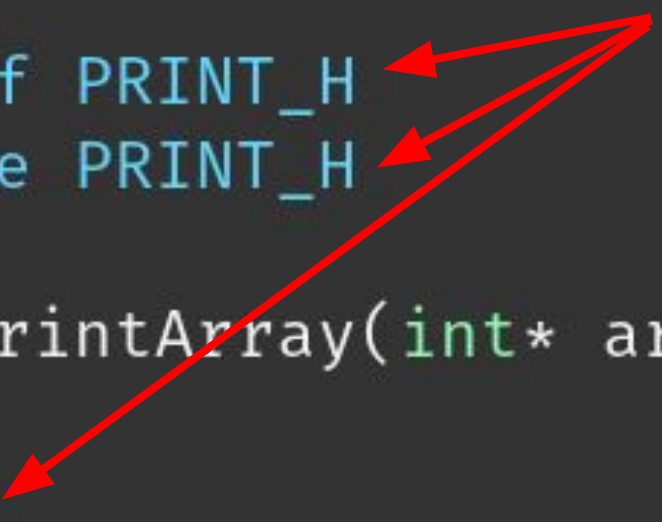
A diagram with three red arrows pointing from the '???' text to the preprocessor directives. One arrow points to '#ifndef PRINT_H', another points to '#define PRINT_H', and a third points to '#endif'.

This extra stuff is a header guard

`#ifndef` checks to see if macro (`PRINT_H` here) is defined, if so, it cuts out all code between it and `#endif`

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#include <stdio.h>
                                ???
#ifndef PRINT_H
#define PRINT_H
void PrintArray(int* arr, int len);
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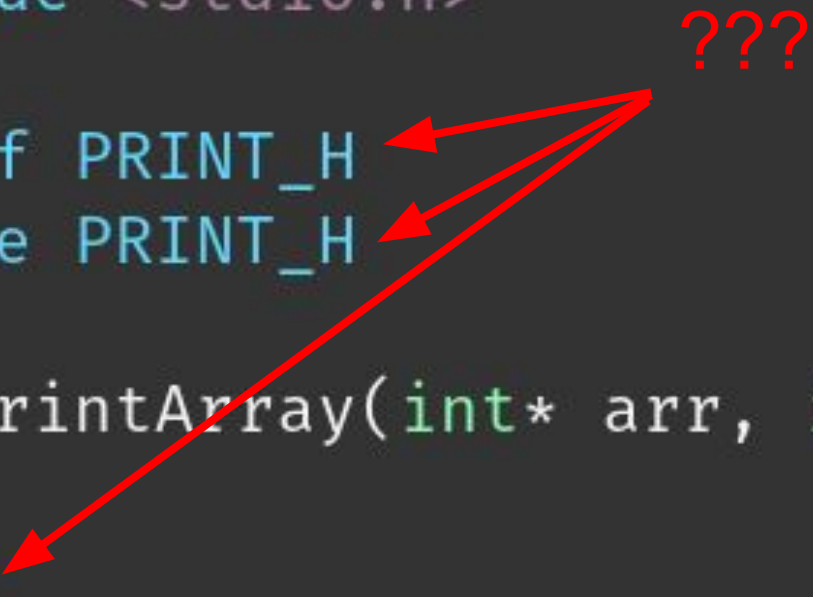
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Because we define the macro inside this if, we ensure we have, at most, one copy of this code!

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`#ifndef` checks to see if macro (`PRINT_H` here) is defined, if so, it cuts out all code between it and `#endif`

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`#pragma once` is a modern alternative

Where does the function definition go?

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```
#include "print.h"

void PrintArray(int* arr, int len){
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    for(int i = 0; i < len; i++){
        if(i != 0) printf(" ");
        printf("%d", *(arr + i));
        if(i != len-1) printf(",");
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    printf("]\n");
}
```

(print.c)

Using our header file

```
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#include "print.h"

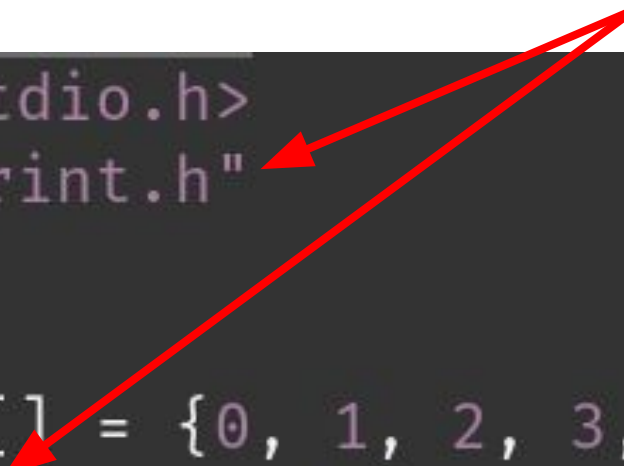
int main(){
    int arr_1[] = {0, 1, 2, 3, 4, 5};
    PrintArray(arr_1, 6);
    int arr_2[3];
    arr_2[0] = 1000000;
    arr_2[1] = -57;
    arr_2[2] = 0;
    PrintArray(arr_2, 3);
    return 0;
}
```

(main.c or whatever)

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#include "print.h"

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Our program needs to know about both .c files

To compile:

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gcc program.c print.c
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What if we don't want to compile all files each time?
E.g., maybe print.c rarely changes, no reason to recompile.

We can compile them separately using object files:

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We are linking files together!
(ever had a linker error?)

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Example:

```
gcc -Iother_proj/headers
```

More on preprocessor directives

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List (part 1):

`#include <header.h>` -> paste contents of header.h

`#define NAME X` -> Replace instances of NAME with X

`#define NAME(a) printf("a");` -> Can also take arguments

`#undef NAME` -> Undefines NAME

More on preprocessor directives

Remember: these operate on **text**, they do not consider code context

List (part 2):

`#if X` -> Includes following code if X is not 0

`#elseif` and `#else` -> Go with if

`#endif` -> Ends if / elseif / else blocks

`#ifdef X` -> Like if; includes code if X is defined

`#ifndef X` -> Includes if X is NOT defined