COMsW 1003-1

Introduction to Computer Programming in C

Lecture 9

Spring 2011

Instructor: Michele Merler

http://www1.cs.columbia.edu/~mmerler/comsw1003-1.html

Are Computers Smarter than Humans?

IBM's Watson on 'Jeopardy': Computer takes big lead over humans in Round 2

February 15, 2011 | 9:20 pm (0) (0) Comments (0)

On Tuesday night's "Jeopardy" episode, Watson, the IBM supercomputer, steamrollered to a commanding lead over his human competitors.

Link

http://latimesblogs.latimes.com/technology/2011/02/ibms-watson-on-jeopardy-computer-takes-big-lead-over-humans-in-round-2.html

Today

- Homework 1 Correction
- Debugging (from Lecture 8)
- C Preprocessor

Conditional Assignment

- Another way of embedding `if` - `else` in a single statement
- Uses the ? : operators

```
variable = ( condition ) ? val1 : val2 ;
```

If condition is true, we assign val1 to variable

If condition is false, we assign val2 to variable

```
int x = 7, y;

y =  ( x > 5 ) ? x : 5;
```

y= 7

```
int x = 7, y;

if( x > 5 ) {
    y = x;
}
else{
    y = 5;
}
```

The comma operator

- In C statements can also be separated by , not only ;

```
int x = 2;
int y;

x++, y = x/3, y += 2;
```

```
int x = 2;
int y;

x++;
y = x/3;
y = y+2;
```

Be careful with declarations!

```
int x = 2, char c = 'm';
```

Different types, NO

```
int x = 2, y;
```

Same type, OK

The comma operator

Special case, the `for` loop statement

Example: the palindrome word checking. Check if a word is the same when read right to left

```
int i, flag = 1;

char word[100] = "radar";

for( i=0 , j=strlen(word)-1 ;  i < strlen(word)/2 ;  i++ , j-- ) {

    if( word[i] != word[j] ) {
            flag = 0;
            break;
    }
}
```

The comma operator

Special case, the `for` loop statement

Example: the palindrome word checking

Initial conditions

change conditions

```
for( i=0 , j=strlen(word)-1 ;  i < strlen(word)/2 ;  i++ , j-- ) {

    if( word[i] != word[j] ) {
            flag = 0;
            break;
    }
}
```

Advanced Types - Const

`const` defines a variable whose value cannot be changed

```
const double PI = 3.14;

double r = 5, circ;

circ = 2 * PI * r;

PI = 7;
```

Advanced Types - Const

`const` defines a variable whose value cannot be changed

```
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double r = 5, circ;

circ = 2 * PI * r;

PI = 7;
```

Once it's initialized, a const variable cannot change value

C Preprocessor

C Preprocessor

Preprocessor is a facility to handle

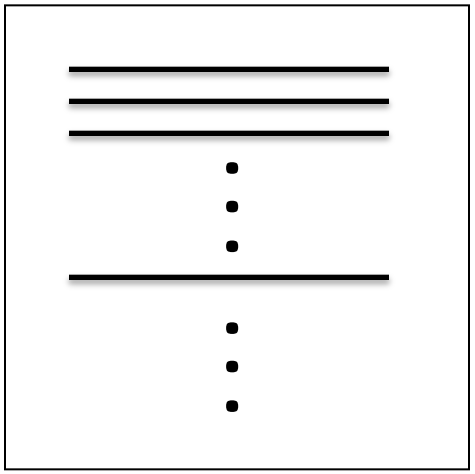
- **Header files**
- **Macros**

Independent from C itself, it's basically a text editor that modifies your code before compiling

Preprocessor statements begin with **#** and do **not** end with ;

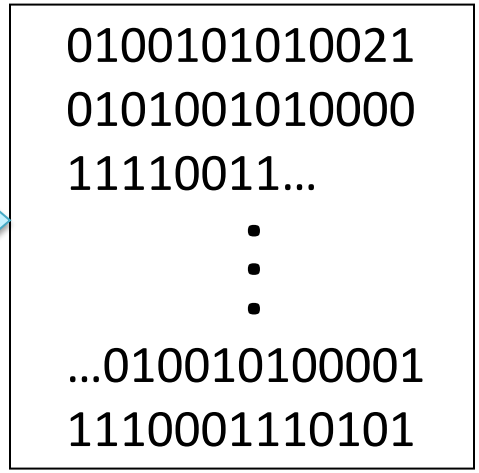
C Preprocessor

myFile .c (program)



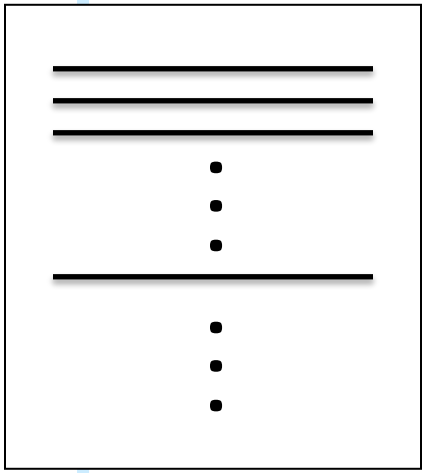
Compiler

myFile (executable)



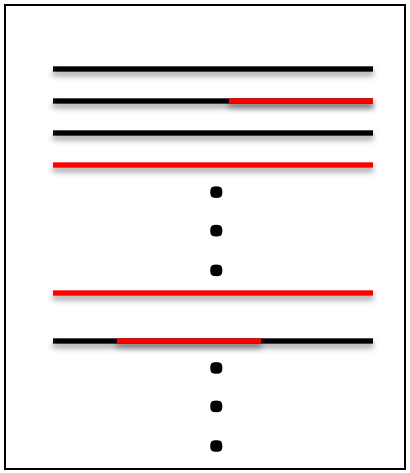
C Preprocessor

myFile.c (program)



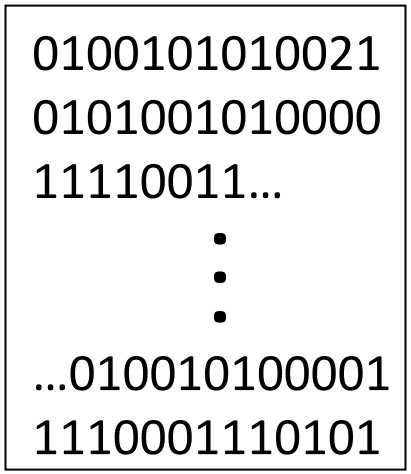
Preprocessor

myFile.c
(preprocessor code)



Compiler

myFile (executable)



View Preprocessor Code

gcc has a special option that allows to run only the preprocessor

gcc -E myFile.c

We can send output to a file using the UNIX > operator

gcc -E myFile.c > outFile.txt

Saves gcc's output to outFile.txt

Header files

- Header files are fundamentally libraries
- Their extension is .h
- They contain function definitions, variables declarations, macros
- In order to use them, the preprocessor uses the following code

```
#include <nameOfHeader.h>
```

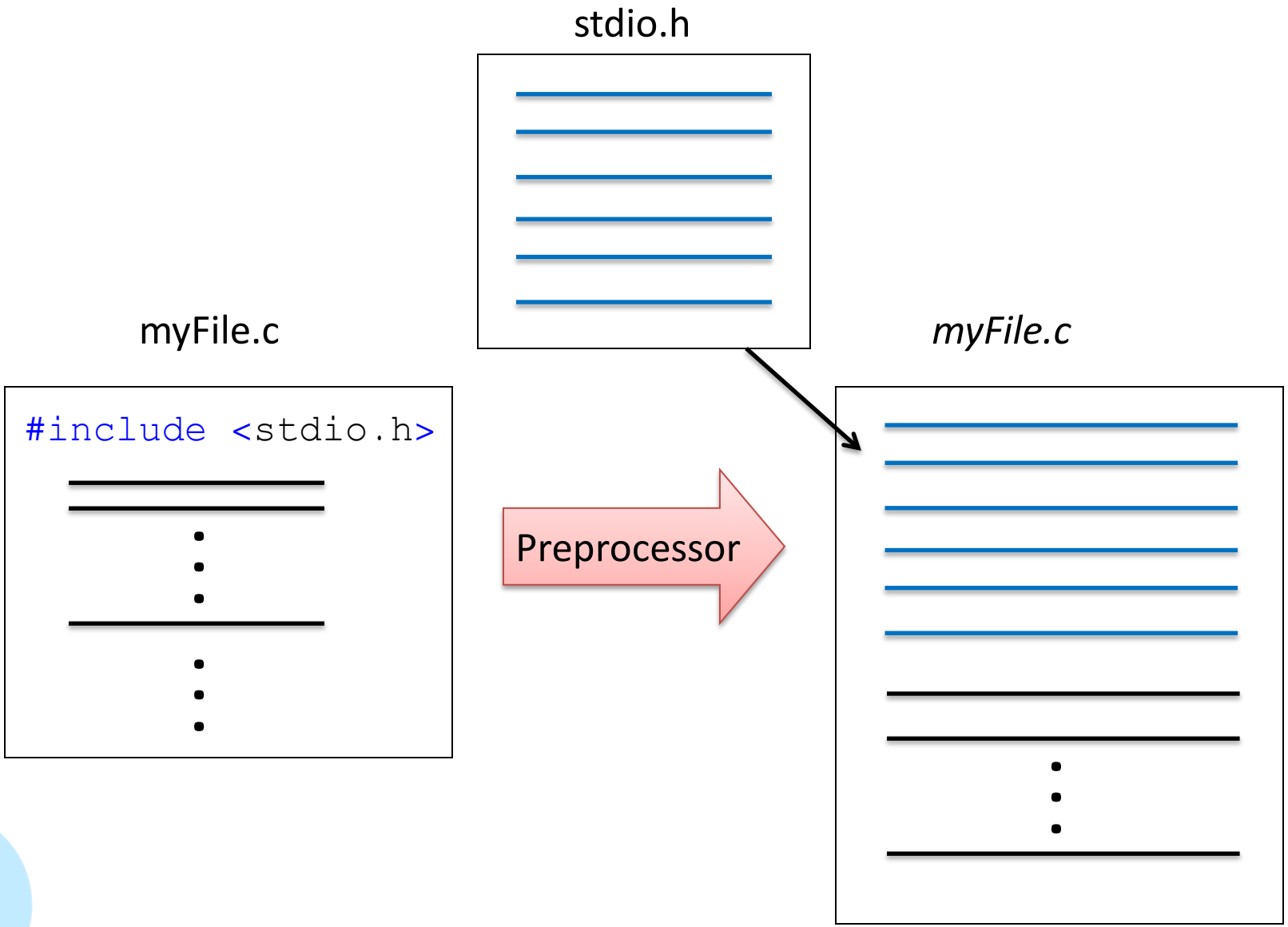
→ For standard C libraries

```
#include "nameOfHeader.h"
```

→ For user defined headers

- So far, we have used predefined C header files, but we can create our own! (more on this in upcoming Lectures)

Header files



Macros

- A **macro** is a piece of code ***c*** which has been given a name ***n***
- Every time we use that ***n*** in our program, it gets replaced with ***c***
- The preprocessor allows you to declare them with `#define`
- Two types:
  - Object-like macros
  - Function-like macros

macros.c

Object like macros

- Constants, usually defined on top of programs

```
#define name text_to_substitute
```

```
#define SIZE 10

#define FOR_ALL for( i=0; i< SIZE; i++ )
```

macros.c

Object like macros

```
#define SIZE 10

/* main function */
int main(){

  int arr[SIZE];

  return(0);
}
```

From now on, every time we write SIZE inside our program it is going to be replaced by 10

Object like macros

macros.c

- Some compilers do not allow you to declare arrays with a variable as size

```
int size1 = 10;
int arr1[size1]; /* should always cause error */

const int size2=10;
int arr2[size2]; /* causes errors in many compilers */

#define SIZE 10
int arr3[SIZE]; /* OK in any C compiler */
```

macros.c

Function-like macros

- Macros that can take parameters like functions

```
#define SQR(x) ((x) * (x))

#define MAX(x,y) ((x) > (y) ? (x) : (y))
```

- Parameters MUST be included in parentheses in the macro name, without spaces
- It is a good habit to include parameters in parentheses also in the text to be substituted

condComp.c

Conditional Compilation

- Allows to use or not certain parts of a program based on definitions of macros

`#ifdef var`	if `var` is defined, consider the following code
`#ifndef var`	if `var` is not defined, consider the following code
`#else`	
`#endif`	close `if(n)def`
`#undef var`	undefine `var` (opposite of `#define`)

condComp.c

Conditional Compilation

```
#define DEBUG
        .
        .
        .
#ifdef DEBUG

printf("The value of x is %d\n", x);

#endif
```

If `DEBUG` was defined earlier in the program, then the statement `printf(…);` is considered, otherwise the preprocessor does not copy it to the file to be compiled