C Programming

Class- BCA IInd Semester

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Outline

unit 5 : Preprocessors

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- Conditional Compilation
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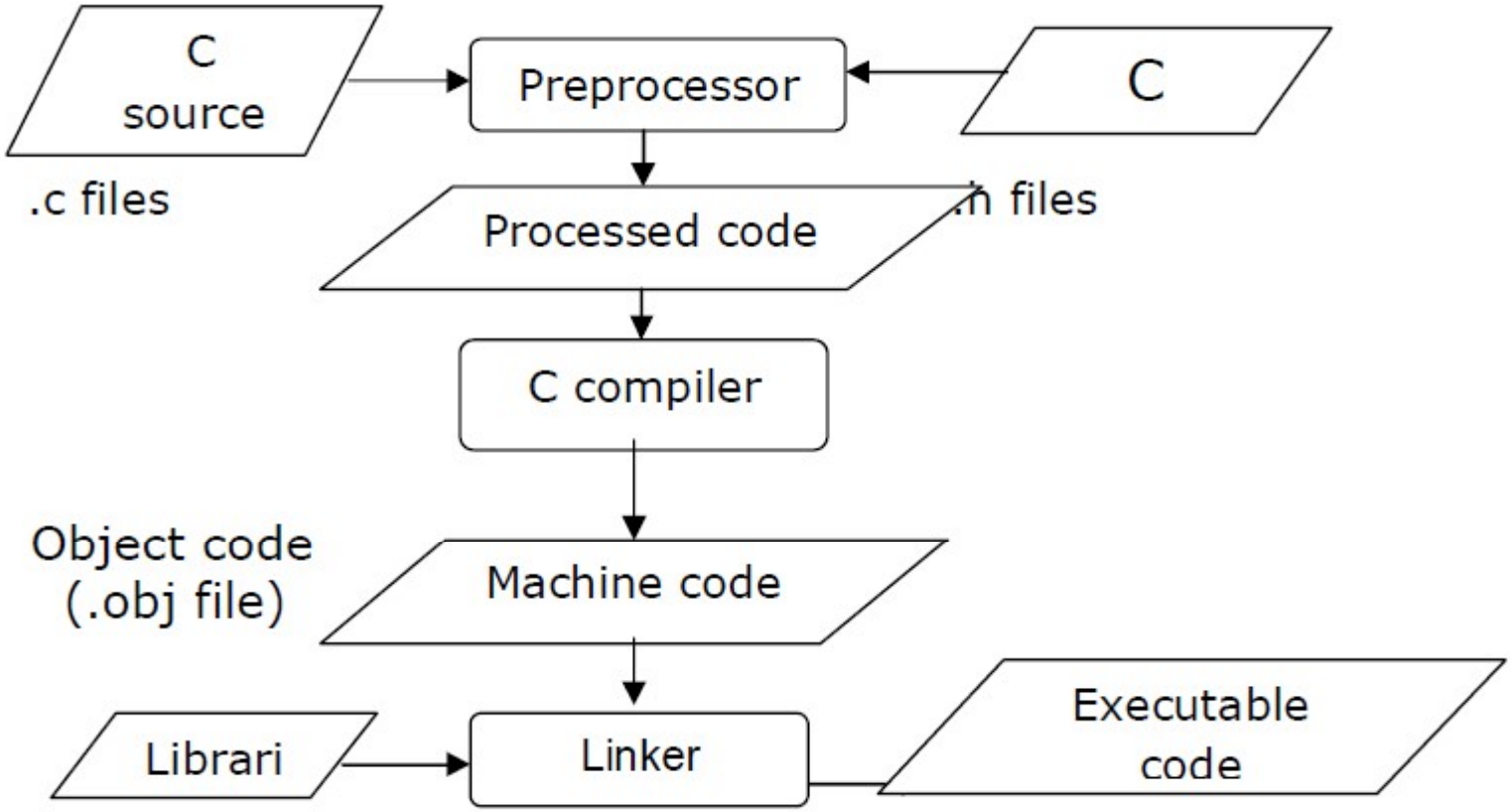
- Token Pasting

5.1 Preprocessors

- A unique feature of c language is the preprocessor. A program can use the tools provided by preprocessor to make his program easy to read, modify, portable and more efficient.
- The C preprocessor is a collection of special statements, called directives that are executed at the beginning of the compilation process.
- Preprocessor directives follow the special syntax rules that are listed below.
  - Executed by the pre-processor.
  - Occurs before a program is compiled.
  - Begin with #.
  - Would not end with semicolon.
  - Can be placed anywhere in the program.
  - Normally placed at the beginning of the program or before any particular function.

The compilation process can be diagrammatically given as below.



We would learn the following preprocessor directives here:

(a) Macro expansion

(b) File inclusion

(c) Conditional Compilation

(d) Miscellaneous directives

Macro Expansion

```
#define UPPER 25
main( )
{
int i ;
for ( i = 1 ; i <= UPPER ; i++ )
printf ( "\n%d", i ) ;
}
```

- In this program instead of writing 25 in the **for loop we are writing** it in the form of UPPER, which has already been defined before **main( ) through the statement,**
  #define UPPER 25
- This statement is called '**macro definition**' or more commonly, just a '**macro**'.

- using **#define can produce more efficient and more easily** understandable programs**.**
- A **#define** directive is many a times used to define operators as shown below.

```
#define AND &&
#define OR ||
main( )
{
int f = 1, x = 4, y = 90 ;
if ( ( f < 5 ) AND ( x <= 20 OR y <= 45 ) )
printf ( "\nYour PC will always work fine..." ) ;
else
printf ( "\nIn front of the maintenance man" ) ;
}
```

- A **#define directive could be used even to replace a condition, as** shown below.

```
#define AND &&
#define ARANGE ( a > 25 AND a < 50 )
main( )
{
int a = 30 ;
if ( ARANGE )
printf ( "within range" ) ;
else
printf ( "out of range" ) ;
}
```

Macros with Arguments

- The macros that we have used so far are called simple macros. Macros can have arguments, just as functions can. Here is an example that illustrates this fact.

```
#define AREA(x) ( 3.14 * x * x )
main( )
{
float r1 = 6.25, r2 = 2.5, a ;
a = AREA ( r1 ) ;
printf ( "\nArea of circle = %f ", a ) ;
a = AREA ( r2 ) ;
printf ( "\nArea of circle = %f ", a ) ;
}
```

Here's the output of the program...

```
Area of circle = 122.656250
Area of circle = 19.625000
```

Macros versus Functions

- In a macro call the preprocessor replaces the macro template with

  its macro expansion, in a stupid, unthinking, literal way.
- As against this, in a function call the control is passed to a function along with certain arguments, some calculations are performed in the function and a useful value is returned back from the function.
- This brings us to a question: when is it best to use macros with arguments and when is it better to use a function?
- Usually macros make the program run faster but increase the program size, whereas functions make the program smaller and compact.

File Inclusion

- This directive causes one file to be included in another. The preprocessor command for file inclusion looks like this:

  #include "filename "

- If we have a very large program, the code is best divided into several different files, each containing a set of related functions. It is a good programming practice to keep different sections of a large program separate. These files are **#included** at the beginning of main program file.
- Actually there exist two ways to write **#include statement. These**

are:

#include "filename"

#include <filename>

- The meaning of each of these forms is given below:

#include "goto.c "

- This command would look for the file **goto.c** in the current directory as well as the specified list of directories as mentioned in the include search path that might have been set up.

#include <goto.c>

- This command would look for the file **goto.c** in the specified list of directories only.

Conditional Compilation

- if we want, have the compiler skip over part of a source code by inserting the preprocessing commands **#if and #endif,** which have the general form:

```
#if  macroname
statement 1 ;
statement 2 ;
#endif
```

If **macroname has been #defined, the block of code will be** executed as usual; otherwise not.

```
#include <stdio.h>
#include <conio.h>
 #define NUMBER  0
void main()
{
#if NUMBER==0
printf("Value of Number is: %d", NUMBER);
#endif
getch();
}
```

#else

- The #else preprocessor directive evaluates the expression or condition if condition of #if is false. It can be used with #if, #elif, #ifdef and #ifndef directives.

- **Syntax:**

```
#if expression
Staement 1
 #else
 Staement 2
 #endif
```

Syntax with #elif

```
#if expression
    Staement 1
#elif expression
        Staement 2
#else
        Staement 2
#endif
```

Example

```
#include <stdio.h>
#include <conio.h>
#define NUMBER 1
void main()
{
 #if NUMBER==0
printf("Value of Number is: %d",NUMBER);
#else
print("Value of Number is non-zero");
#endif
getch();
}
```

Miscellaneous Directives

- There are two more preprocessor directives available, though they are not very commonly used. They are:

(a) #undef

(b) #pragma

#undef

- To undefine a macro means to cancel its definition. This is done with the **#undef** directive.

Syntax: **#undef token**

```
#include <stdio.h>
 #define PI 3.1415
#undef PI
main()
{ printf("%f", PI);
}
```

Output: Compile Time Error: 'PI' undeclared

#pragma

#pragma startup and #pragma exit: These directives allow us to specify functions that are called upon program startup (before **main( )) or program exit (just before the program** terminates). Their usage is as follows:

- **Syntax: #pragma token**

```
#include<stdio.h>
#include<conio.h>
void func() ;
#pragma startup func
 #pragma exit func
void main(){
printf("\nI am in main");
 getch(); }
void func() {
printf("\nI am in func");
getch(); }
Output:  I am in func
                I am in main
                I am in func
```

Stringize (#)

- The stringize or number-sign operator ('#'), when used within a macro definition, converts a macro parameter into a string constant. This operator may be used only in a macro that has a specified argument or parameter list. For example:

```
#include <stdio.h>

#define  message_for(a, b)  \
    printf(#a " and " #b ": We love you!\n")

int main(void)
{
   message_for(Carole, Debra);
   return 0;
}
```

- it produces the following result:

Carole and Debra: We love you!

Token Pasting (##)

- The token-pasting operator (##) within a macro definition combines two arguments. It permits two separate tokens in the macro definition to be joined into a single token. For example:

```
#include <stdio.h>

#define tokenpaster(n) printf ("token" #n " = %d", token##n)

int main(void)
{
   int token34 = 40;

   tokenpaster(34);
   return 0;
}
```

- it produces the following result: token34 = 40

Exercise

1. Write a program to find out the area of circle with a micro substitution.
2. Write a program to find largest input any two numbers using a micro.
3. Write a program to declare the member of structure using a bit field data type and to display the contents of the structure.
4. Write a program to illustrate the bitwise operator.

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Thanks