

Introduction to C Programming

The C Language, History, Writing Your First Program in C



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Technical Trainers
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<http://softuni.bg>



```
8 void loop()
9 {
10
    //MCU Task
    for(NUM_FN_TASK_CNT = 0; ((NUM_FN_TASK_CNT < NUM_FN_TASK_CNT_MAX) && (millis() - fn[NUM_FN_TASK_CNT].time_out) < fn[NUM_FN_TASK_CNT].in_sec); NUM_FN_TASK_CNT++)
    {
        if ((millis() - fn[NUM_FN_TASK_CNT].time_out) < fn[NUM_FN_TASK_CNT].in_sec)
        {
            fn[NUM_FN_TASK_CNT].time_out = millis();
            if (fn[NUM_FN_TASK_CNT].in_sec < 0)
            {
                fn[NUM_FN_TASK_CNT].in_sec = 0;
            }
        }
    }
}
```

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What is Computer Programming?



Computer Programming

Computer programming: creating a sequence of instructions to enable the computer to do something



Definition by Google

Software Development Phases

- Define a task / problem = **Specification**
- Plan your solution = **Architecture / Design**
 - Find suitable algorithm / data structures to use
 - Find suitable libraries / platforms / frameworks
- Write source code (step by step) = **Implementation**
- Fix program errors (bugs) = **Testing & Debugging**
- Install, configure and run the software = **Deployment**
- Fix / improve the software over time = **Maintenance**



```
int i = 0;
for(i = 0; i < NUM_TESTS; i++) {
    Stack_push(stack, tests[i]);
    mu_assert(Stack_peek(stack) == tests[i], "Wrong next value")
}

mu_assert(Stack_count(stack) == NUM_TESTS, "Wrong count on pop")

STACK_FOREACH(stack, cur) {
    debug("VAL: %s", (char *)cur->value);
}

for(i = NUM_TESTS - 1; i >= 0; i--) {
    char *val = Stack_pop(stack);
```

```
#include <stdio.h>
```

The C Programming Language

The C Language – History

- The C language was developed by Dennis Ritchie at Bell Labs
 - First released in 1972 (over 40 years ago)
 - Compiles directly to binary
 - Has very high performance
 - Can run on almost any hardware
 - Has a standard library with many built-in functions
 - Widely used to develop performance-demanding systems
 - E.g. operating systems, embedded systems, device drivers, etc.





Your First C Program

Your First C Program

Include the C standard
Input/Output Library

```
#include <stdio.h>
```

Define a function
called **main**

```
int main()  
{
```

```
    printf("Hello, C!\n");
```

Call **printf()** function
to print on the console

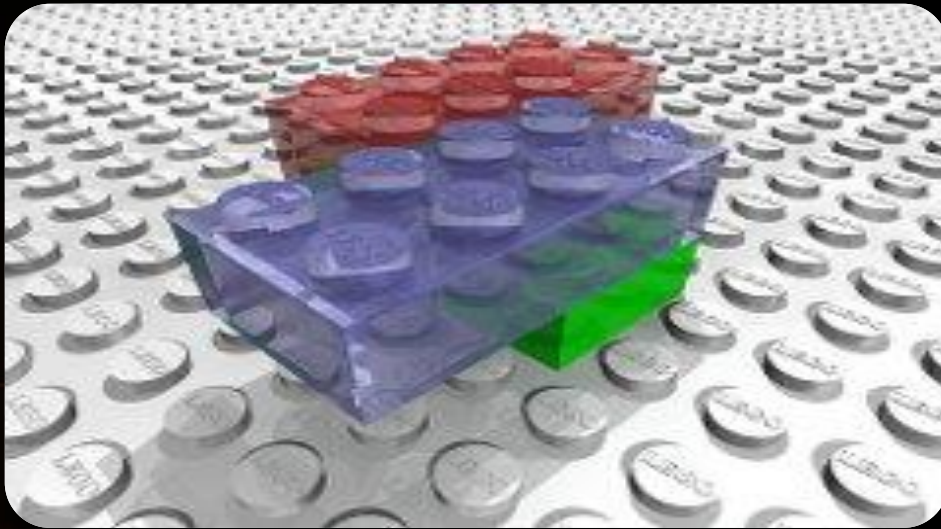
```
    return 0;
```

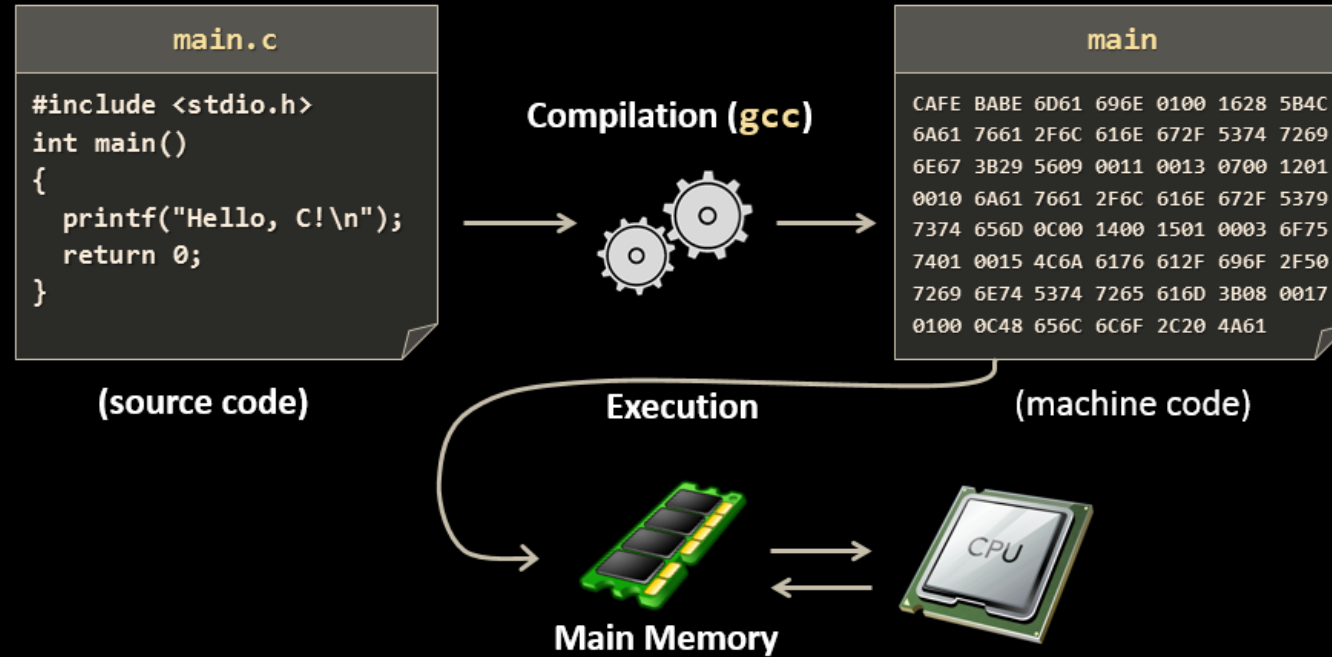
Exit program by
returning **0**

```
}
```

Your First C# Program

Live Demo





C Code Compilation and Execution

The Make Utility

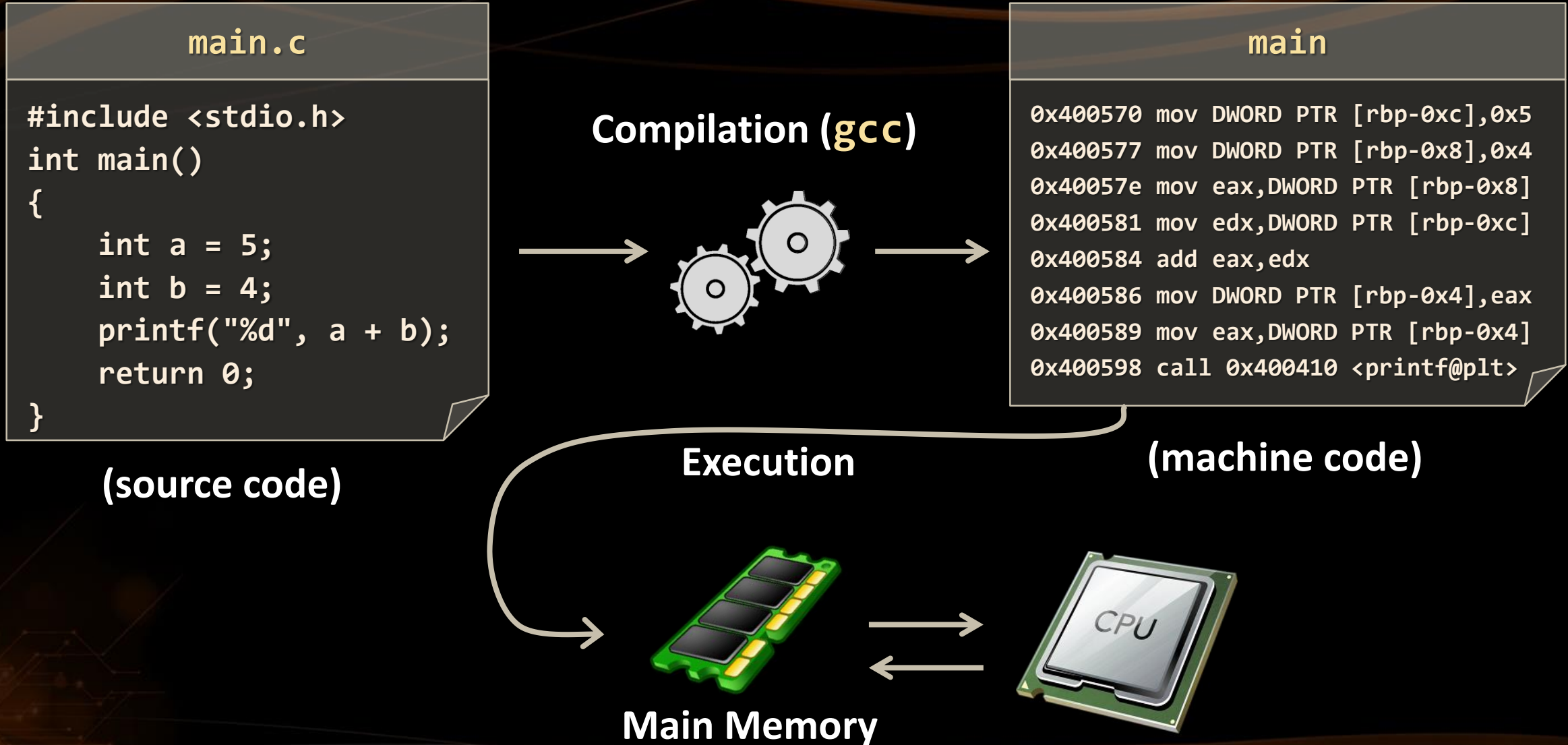
- Under Linux C source code can be compiled with **make**:

```
make main
```

- Produces executable called "main" with no extension
- Can be run by executing `./{executable-name}`

```
File Edit View Terminal Tabs Help
nasko@nasko-VirtualBox:~/Documents/C-Course/MakePlayground/Simple$ make main
cc      main.c      -o main
nasko@nasko-VirtualBox:~/Documents/C-Course/MakePlayground/Simple$ ./main
Hello, C!
nasko@nasko-VirtualBox:~/Documents/C-Course/MakePlayground/Simple$
```

C Compilation and Execution



Compiling and Running a C Program – Stages



1. Preprocessing – include-files, conditional compilation instructions and macros are processed by the **preprocessor**
2. Compilation – the **compiler** takes the source code and generates **assembler** (machine code)
3. Assembly – **.o** (object) files are generated
4. Linking – combines the **.o** files with external libraries to produce an executable file
5. Loading – the executable is loaded into **main memory** (RAM) and is granted a **process** to run on

Makefile

- A **Makefile** is a file that describes how to organize, compile and link several C source code files
- E.g. we have the following two files:

main.c

```
#include <stdio.h>
#include "functions.c"
int main()
{
    int area = rect_area(4, 5);
    printf("%d\n", area);

    return 0;
}
```

functions.c

```
int rect_area(int a, int b)
{
    return a * b;
}
```

Calls function from
other file

Makefile – Example

Tab (not space) indent
is required

Makefile

```
program: main.o functions.o
```

```
    gcc main.o functions.o -o program
```

- Usually named **Makefile**
- Tells the compiler to:
 - Compile **main.c** and **functions.c** into object files
 - Link **main.o** and **functions.o** into a single executable – **program**
- Executed with the **make** command (no additional arguments)



Compiling a C Program Manually

Live Demo

C Standards

- The C language has been standardized several times throughout its history
 - Official standards: ANSI C (1989), C99 (1999), C11 (2011)
 - Each new standard improves C and adds new functionality, e.g.:

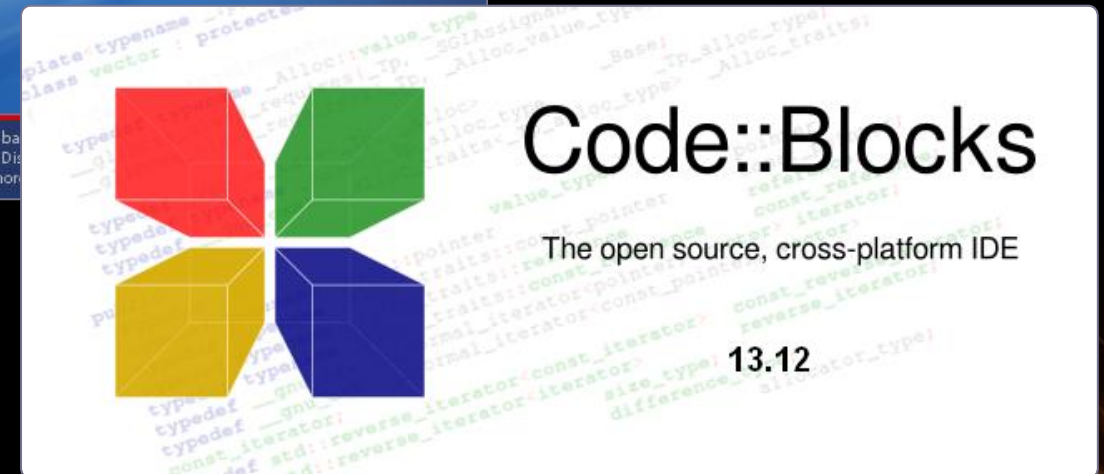
ANSI C for-loop declaration

```
int i;  
for (i = 0; i < 10; i++)
```

C99 for-loop declaration

```
for (int i = 0; i < 10; i++)
```

- Almost all modern compilers support C99 and C11
- No reason to conform to ANSI C unless using MSVS compiler



C IDEs

Code::Blocks, Eclipse, Visual Studio

Eclipse CDT – IDE for C/C++ Developers

- Eclipse is popular IDE (Integrated Development Environment)
 - Written in Java
 - Supports Java, PHP, Python, JavaScript, C/C++, ...
 - Features a code editor with inline documentation, syntax highlighting, auto-complete
 - Flexible debugger with lot's of options
 - Customizable UI with lot's of available plugins



<https://eclipse.org/cdt/>

Code::Blocks

- **Code::Blocks** is a free and open-source IDE oriented towards C/C++:
 - Supports a wide range of compilers (GCC, MinGW, Clang, Visual C++)
 - Features a code editor with syntax highlighting, code folding, debugger, etc.
 - Custom build configuration (not makefiles)
 - Has 3rd party plugins for pretty much anything



<http://www.codeblocks.org/>

NetBeans

- NetBeans is an open-source IDE
 - Supports Java, C++, PHP, HTML5
 - Developed by Oracle
 - Integrated features: code editor, debugger, profiler, GUI editor, source control tools, etc.
 - Supports inline documentation (Linux man pages)
 - Displays runtime errors on the console (unlike Eclipse CDT)



www.netbeans.org



Creating, Compiling, Running and Debugging C Programs

NetBeans Live Demo



C Documentation

C References

- CppReference
 - <http://en.cppreference.com/w/>
 - C/C++ reference with detailed explanations + code examples
- Linux man (manual) pages
 - Come with any Linux distribution
 - Displayed in the terminal via the command `man {function-name}`
 - Built into NetBeans and Eclipse code completion (opened with Ctrl + Space)

Introduction to C Programming



Questions?



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