Introduction to Programming

Week – *2*, Lecture – *4*

Introduction to C – Part 2

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Second, the output that the program produced looked a bit ugly

- The prompt started at the same point, where the output ended

The secondary problem we should mitigate is making the prompt appear on the next line

- Actually, it will be helpful if we know this, even for other messages that the program may show

The “generic” equation solver…

Let us create another version of our equation solver

- Let us call it `GenericQuadraticEquationWithRealRootsSolver.c`

We will make two changes here

- We will use another library function, `scanf()`, to take some inputs
- We will use a “special character” in our Strings the `\n` character, which means “new line”

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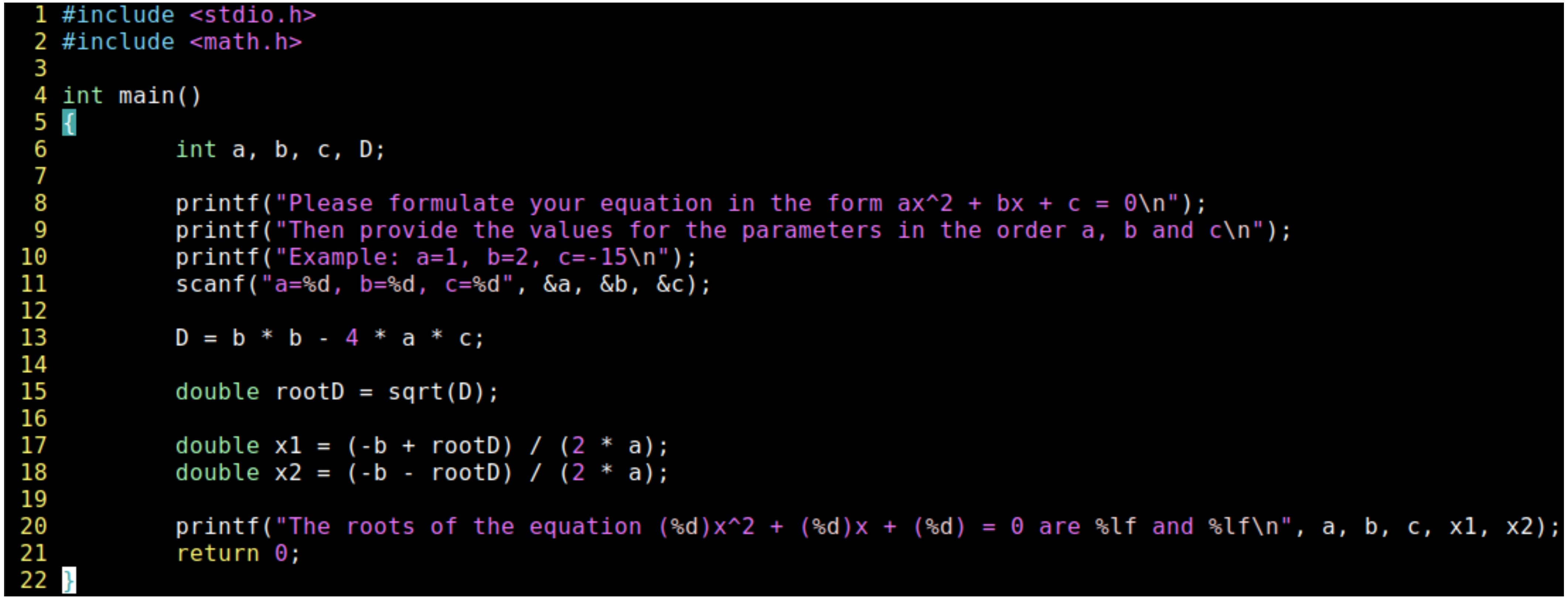

```c
#include <stdio.h>
#include <math.h>

int main()
{
        int a, b, c, D;

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        scanf("a=%d, b=%d, c=%d", &a, &b, &c);

        D = b * b - 4 * a * c;

        double rootD = sqrt(D);

        double x1 = (-b + rootD) / (2 * a);
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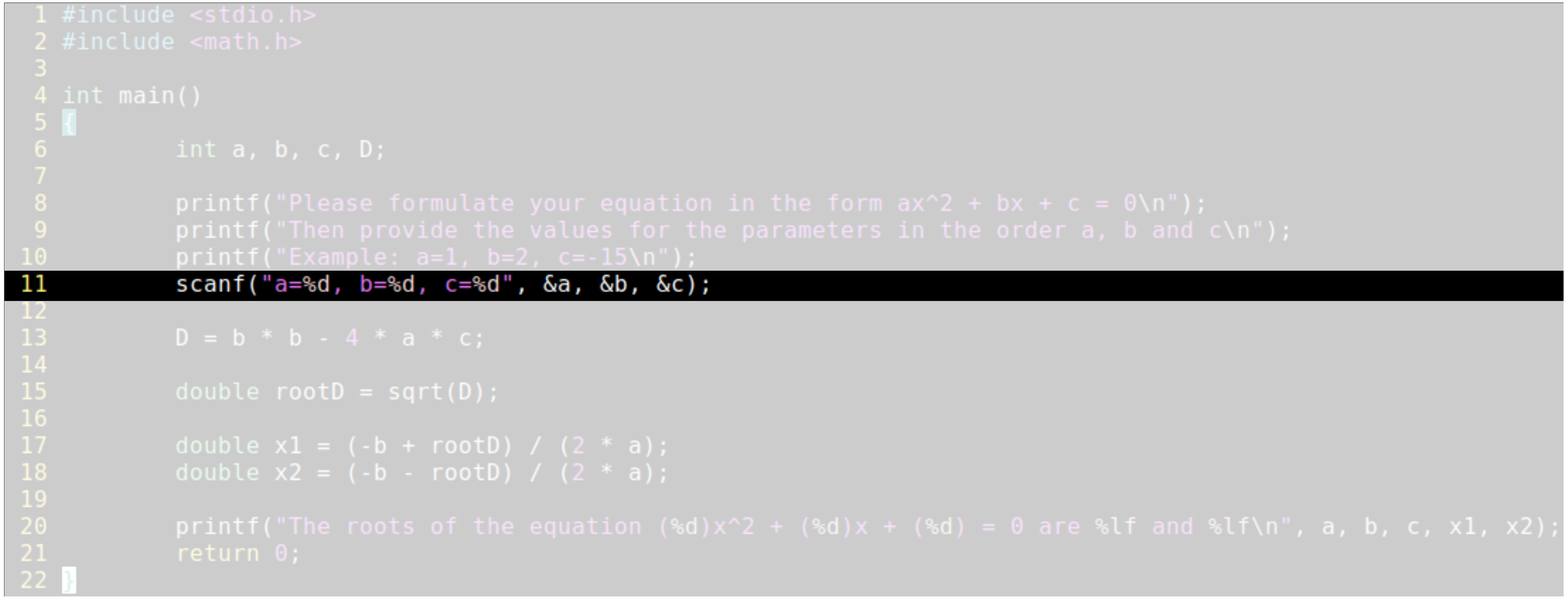

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The syntax for `scanf()` is almost similar to `printf()`

The `scanf()` Library Function

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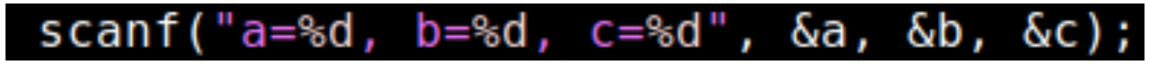

```
scanf("a=%d, b=%d, c=%d", &a, &b, &c);
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Here, `scanf()` expects the values of `a`, `b` and `c`, in exactly the way it is mentioned, e.g.

- `a=1, b=2, c=-15`

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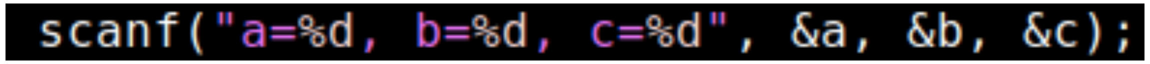

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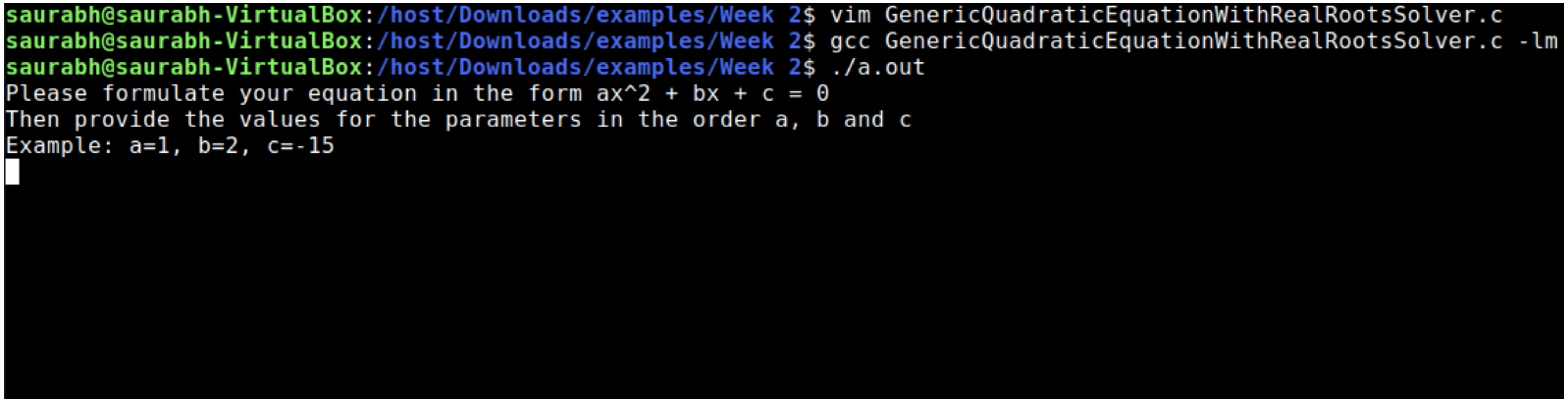
- `a=1, b=2, c=-15`
- You must add a & before all the variables – something that is different from `printf()`
- We will know what this & means in later weeks; for now, just assume this is a part of the syntax

Using the “generic” equation solver…



```
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saurabh@saurabh-VirtualBox:/host/Downloads/examples/Week 2$ gcc GenericQuadraticEquationWithRealRootsSolver.c -lm
saurabh@saurabh-VirtualBox:/host/Downloads/examples/Week 2$ ./a.out
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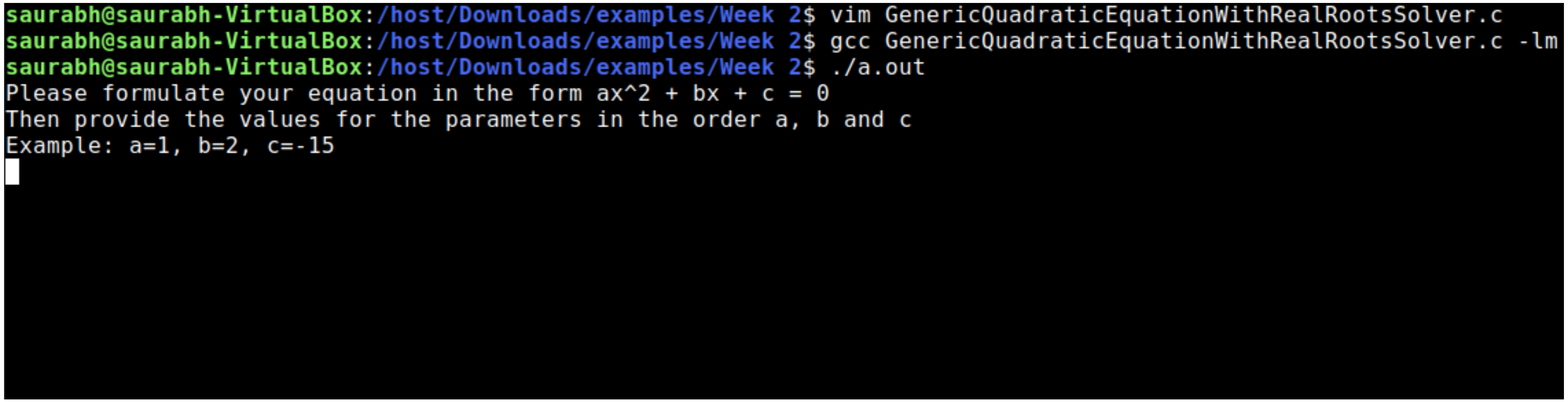
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When you run this program, your cursor will simply blink at this point – this is an indication that your program wants “inputs” from you

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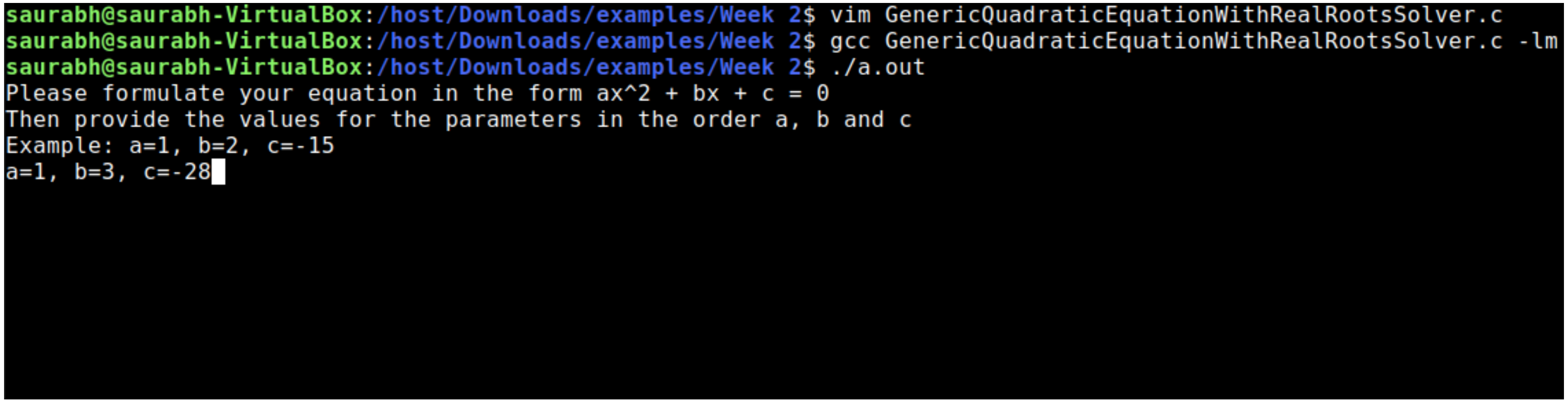

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Please formulate your equation in the form ax^2 + bx + c = 0
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Example: a=1, b=2, c=-15
a=1, b=3, c=-28
```
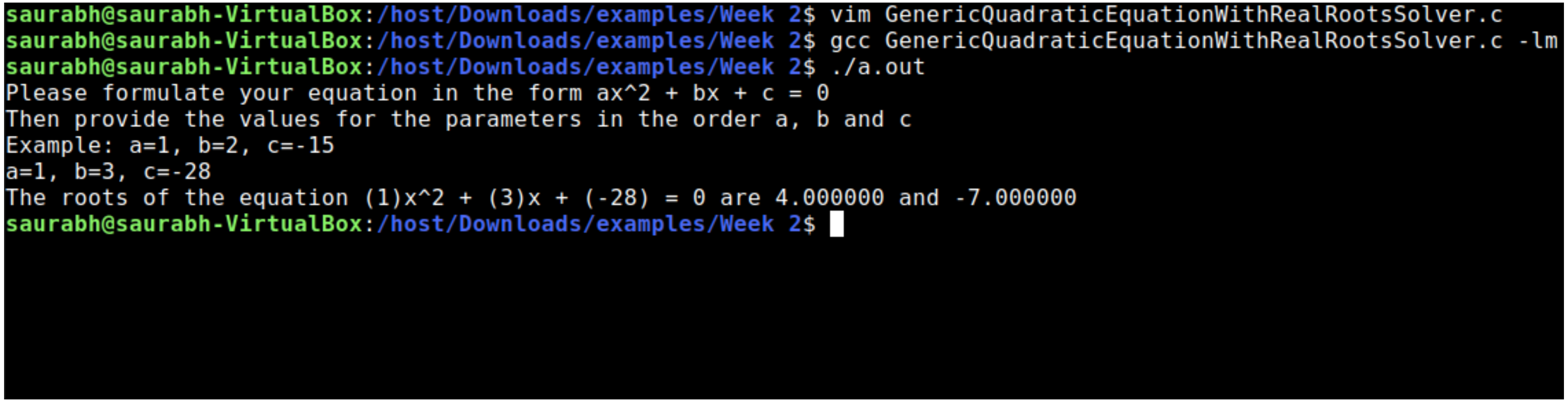

Type the values of `a`, `b` and `c`, in exactly the same fashion as `scanf()` expects

Using the "generic" equation solver…



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a=1, b=3, c=-28
The roots of the equation (1)x^2 + (3)x + (-28) = 0 are 4.000000 and -7.000000
saurabh@saurabh-VirtualBox:/host/Downloads/examples/Week 2$
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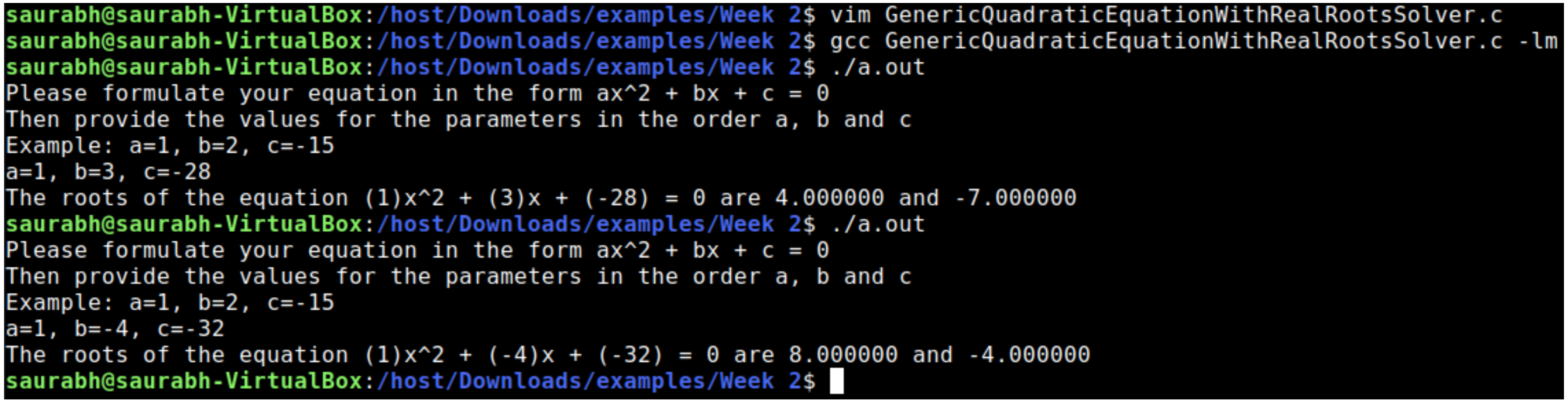
… and here are your roots

Using the “generic” equation solver…



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Example: a=1, b=2, c=-15
a=1, b=-4, c=-32
The roots of the equation (1)x^2 + (-4)x + (-32) = 0 are 8.000000 and -4.000000
saurabh@saurabh-VirtualBox:/host/Downloads/examples/Week 2$
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You can try it out for other combinations too !!

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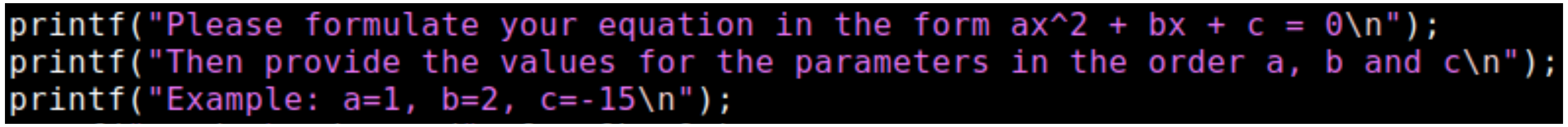

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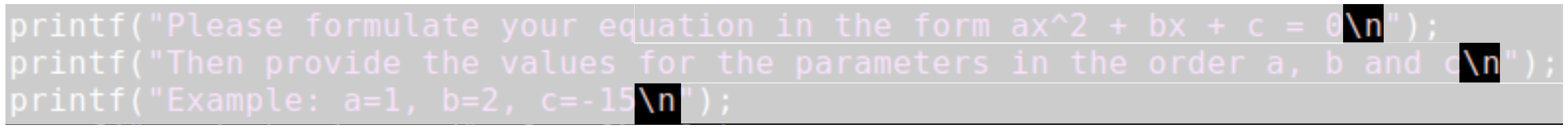

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So this is how we were able to change lines in the messages we printed

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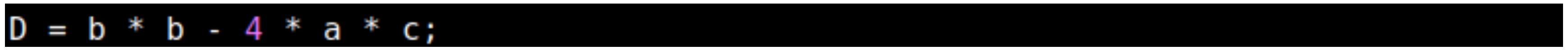

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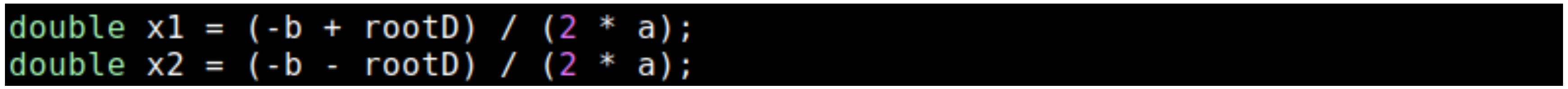

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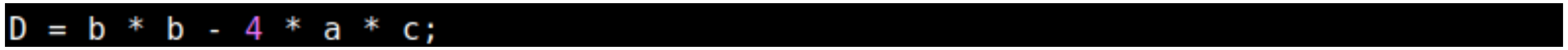

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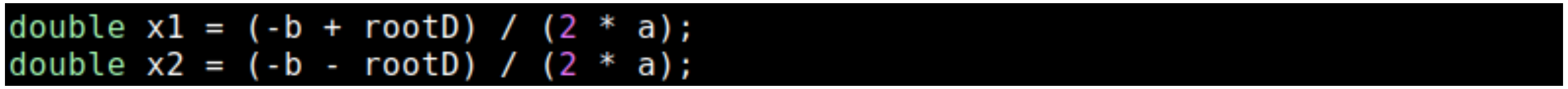

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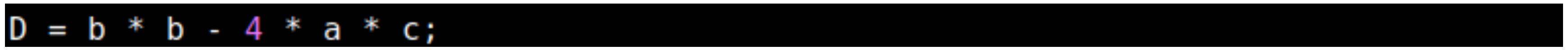

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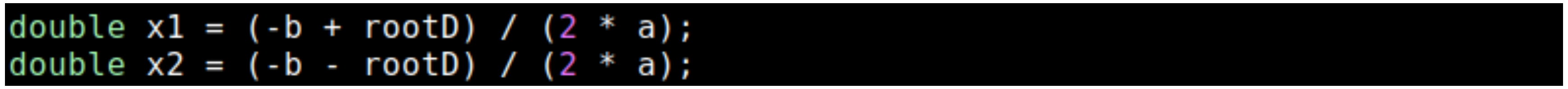

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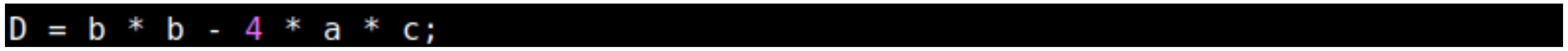

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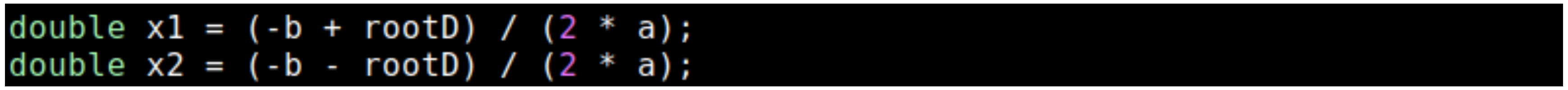

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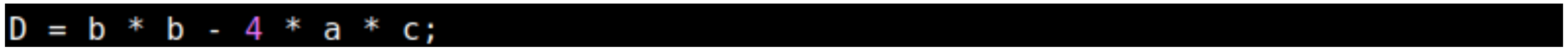

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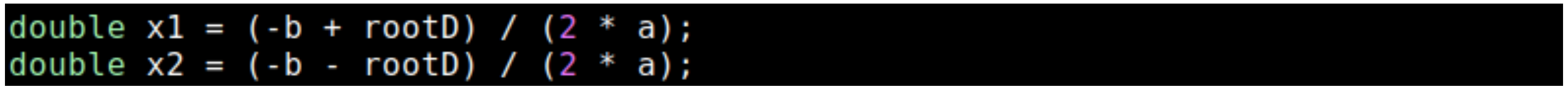

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But in C, things are a bit different

Operator Precedence

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Parentheses has the highest precedence among operators

- It has a few peers, but for now, it suffices to know that parentheses have highest precedence
- This is why parentheses can be used to finely control the evaluation sequence in an expression

Example: Evaluation of a C statement

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To make it easier to explain, let us represent the `*`s in this statement as following

- `D = b` $*_1$ `b - 4` $*_2$ `a` $*_3$ `c;`
- There are a total of 5 operators in this statement: `=`, $*_1$, `-`, $*_2$, $*_3$

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Also, since all the $*$s have the same precedence, they are evaluated from left to right

- … this means $*_1$ is evaluated first, then $*_2$, and then $*_3$

Example: Evaluation of a C statement

`D = b * b - 4 * a * c;`

- Let us see how it is evaluated in C

To make it easier to explain, let us represent the *s in this statement as following

- D = b $*_1$ b − 4 $*_2$ a $*_3$ c;
- There are a total of 5 operators in this statement: =, $*_1$, −, $*_2$, $*_3$

* has higher precedence than −, and − has higher precedence than = in C

Also, since all the *s have the same precedence, they are evaluated from left to right

- … this means $*_1$ is evaluated first, then $*_2$, and then $*_3$

Then, the − is evaluated, followed by the = at the end

Example: Evaluation of a C statement

`D = b * b - 4 * a * c;`

- Let us see how it is evaluated in C

To make it easier to explain, let us represent the `*`s in this statement as following

- `D = b` $*_1$ `b - 4` $*_2$ `a` $*_3$ `c;`
- There are a total of 5 operators in this statement: $=$, $*_1$, $-$, $*_2$, $*_3$

$*$ has higher precedence than $-$, and $-$ has higher precedence than $=$ in C

Also, since all the $*$s have the same precedence, they are evaluated from left to right

- … this means $*_1$ is evaluated first, then $*_2$, and then $*_3$

Then, the $-$ is evaluated, followed by the $=$ at the end

So the expression essentially becomes

- `D = ((b` $*_1$ `b) - ((4 * a) * c));`

Homework !!

There are a fixed set of escape characters that you can use in C; `\n` is just one of them

- Read about others
- This link gives a brief overview of `printf()`, with a short introduction to escape characters as well http://web.mit.edu/10.001/Web/Course_Notes/c_Notes/tips_printf.html

Other than the arithmetic operators, C has many others, we will explore them implicitly

- … i.e. we will use them in Programs, as and when required
- However, it may not be a bad idea to have a look at them today as well
- This link explains them in brief: https://www.geeksforgeeks.org/operator-precedence-and-associativity-in-c/
- **Don't worry much if you don't understand the concept of associativity** – we'll keep discussing it in later weeks