Programming for Kids

Ruby and Mac Edition

Peter Armstrong

Programming for Kids

Learn Programming by Following Along in Ruby on a Mac

Peter Armstrong

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For Evan

Contents

Introduction

This book will teach you how to write computer programs!

You will need to use a Mac computer to follow along. The programs are short, so you can type them all in yourself. This is true even if you can't type well.

This book has a bunch of small chapters. Each chapter is about one idea.

At the end of every chapter, there will be exercises for you to do. It is really important that you do all of them! Doing the exercises ensures that you know the material in the chapter. The answers for all the exercises are in the back of the book, and there are links to the answers for all the exercises.

If your parents want to find out more about this book, they can read it with you. Or, they can just read the For Parents section at the back of the book.

If you're going to use their computer, they might want to sit with you. That's fine. They'll learn something too!

If you are following along on your Mac, you want to read the PDF file that your parents downloaded. If you double-click on the PDF file, it will open in a program called Preview. You will be switching back and forth between reading this book in Preview and typing stuff in Terminal. If you have clicked on the Preview to switch pages, you will need to click on the Terminal window to focus it **before** typing any commands.

If switching between Preview and Terminal gets annoying, there are a couple things you can do. If your parents have a printer, they can print the book. Or, if they have an iPad, they can download the EPUB file, add it to iTunes and then sync it to the iPad.

Let’s get started!

Chapter 1: Hello, Command Line!

This chapter is about the command line!

This book is for kids like you who use a Mac computer, either at home or at school.

Normally you use a Mac by clicking on stuff with a mouse. In this chapter you will learn a different way to use a Mac. It is called the command line, and you just use the keyboard.

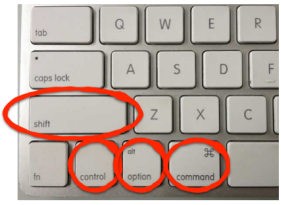
Once upon a time, about 30 years ago, all computers had was a command line.

Even though the command line is simple, it is also very powerful. If you know how to use it, you will be like a wizard who can type strange spells and make your computer do amazing things.

Relax, it's not scary. If you get something wrong, you won't break anything!

First we need to learn the basics.

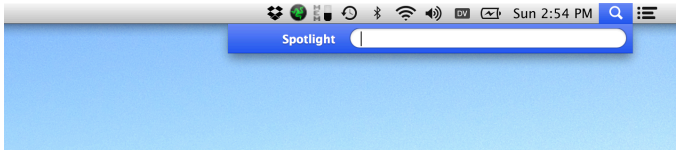
You already know what a keyboard is. But there may be some keys you may not have used before. These are the Command, Option, Control and Shift keys.



We are going to start a program called Terminal. Terminal is what lets you use the command line on your Mac.

To start Terminal, hold down the Command key and press the Space bar. (A shorter way of saying this is to say "type **`Command + Space`**". So, that's what I will say from now on.)

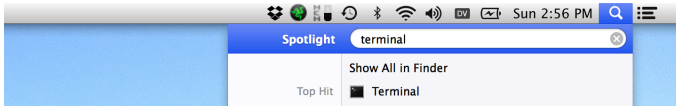
Typing **`Command + Space`** opens a program called Spotlight in the top right corner of your screen.



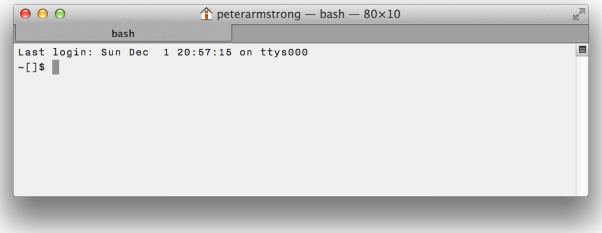
Spotlight lets you type the names of programs to run.

We are going to run Terminal. So, type **`terminal`** in Spotlight and hit the Enter key.

You might see it show up in a drop down list after you type **`term`**. If so, you can just click on that choice instead of finishing typing **`terminal`**.



You will see Terminal, which will look something like this.

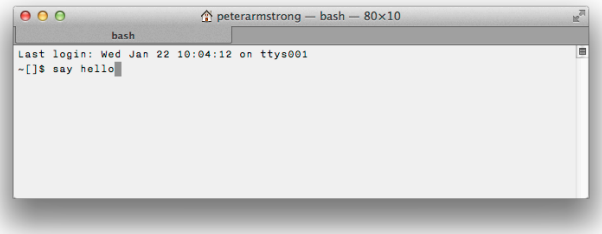


Terminal is the command line of the Mac.

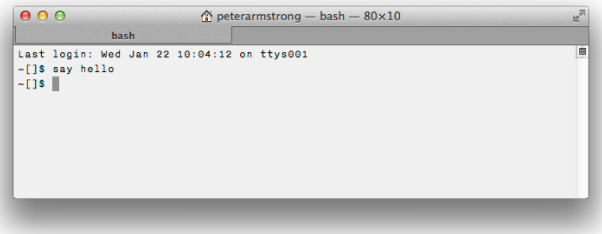
(Don't worry about the ~[]$ stuff at the beginning of the line. That's just what the "prompt" looks like on my computer, and it is possible to customize your prompt. Your prompt might look like > or ~.)

Before we get started, let's have the command line say hello to us. To do this, we're going to run the **`say`** program.

Type **`say hello`** in Terminal.



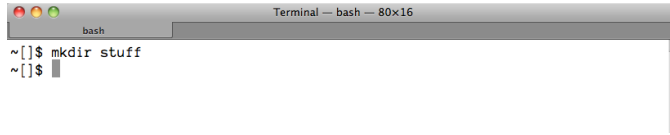
Then, press the `Enter` key to run the command.



Hopefully your Mac said hello to you! If not, make sure the volume is on and try that again.

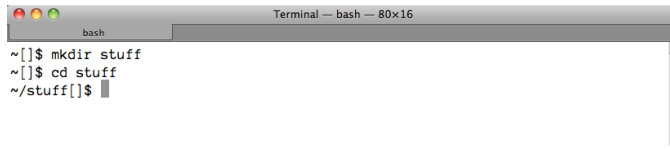
By the way, after entering any command in Terminal you need to hit Enter to run it.

Now, let's start by making a folder for all the stuff we are going to do in this book. Type **`mkdir stuff`** in Terminal and hit Enter.



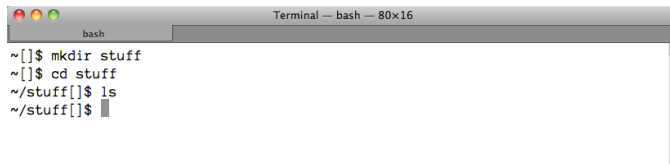
The command **`mkdir`** is said "make dir" and stands for "make directory". Directory is another word for folder. So, you just made a folder called **`stuff`**.

Next, we are going to go into that folder. Type **`cd stuff`** in Terminal and hit Enter.



The **`cd`** command stands for "change directory". So, you are changing into the directory called stuff that you just made.

Let's look inside this directory. In Terminal, type **`ls`** (a lowercase L and a lowercase S) and hit Enter.



Typing **`ls`** shows nothing!

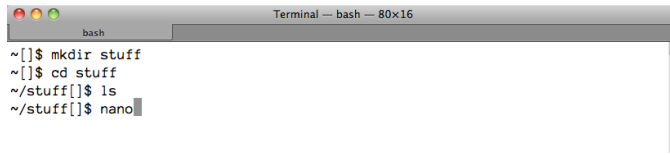
The **`ls`** command means "list", which means to show the files and folders inside this folder. There is nothing in this folder, since we just made it. So, this is why typing **`ls`** shows nothing.

Now, let's change that by creating a file.

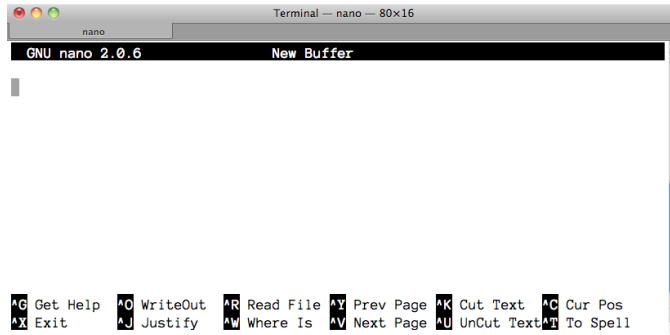
We are going to use a program called a text editor to edit the file. A text editor lets you type words in a file, and save the file just like you would save a game. We are just going to use a small text editor

called **nano**. Nano means really small, and it's a good name since **nano** is a really small, simple text editor.

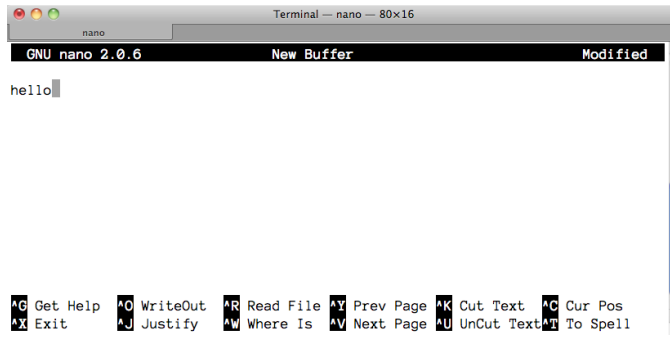
So, in Terminal, type **nano** and hit the Enter key.



This starts nano. The screen will look like this.

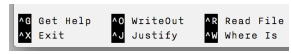


In nano, type **hello**. You don't need to hit the Enter key.



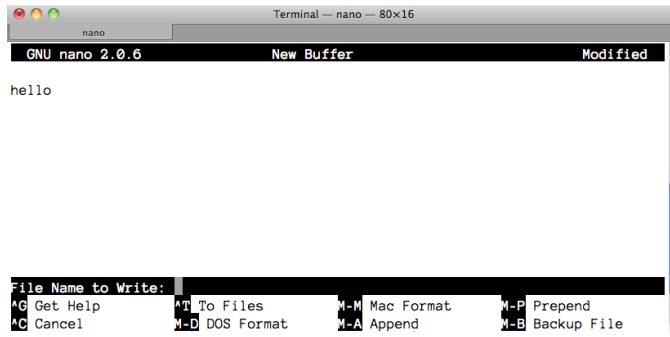
You can see that nano is being helpful, by showing you the list of commands you can type by holding down the `control` key and typing a letter. (Nano is showing the `control` key like the caret (^),

but it is not `shift + 6`, it is the `control` key.)

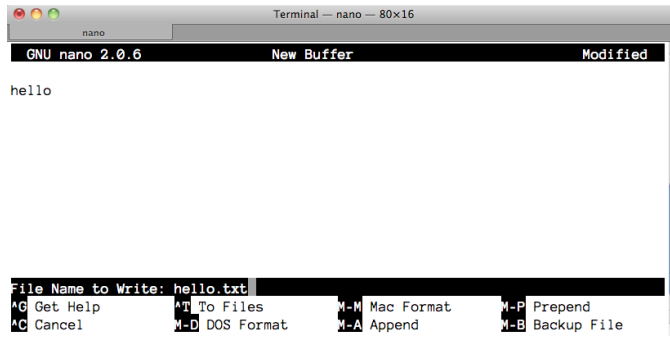


So, to save the file, hold the **`Control`** key down and type the **`o`** key.

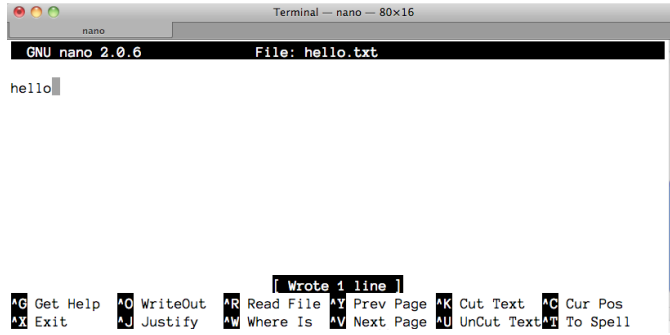
Nano will ask you what you want to call the file you are saving, by showing text saying "File Name to Write".



Type **`hello.txt`** and press the Enter key.



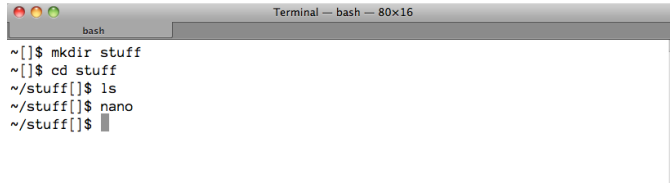
Nano will save the file and tell you it was one line long, by saying "Wrote 1 line".



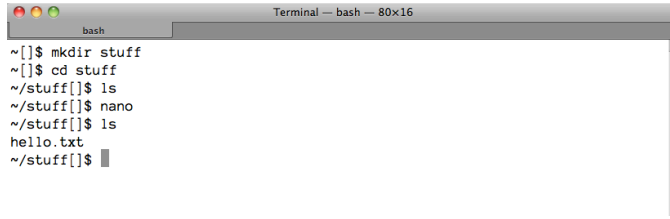
(If you had hit Enter after typing "hello" earlier, it will say "Wrote 2 lines". That's fine, don't worry.)

Now that we've saved our file, let's quit nano by holding down the Control key and typing **x**. (A shorter way of saying this is to say "type **Control + x**". So, that's what I will say from now on.)

You will be back at the command line inside Terminal.

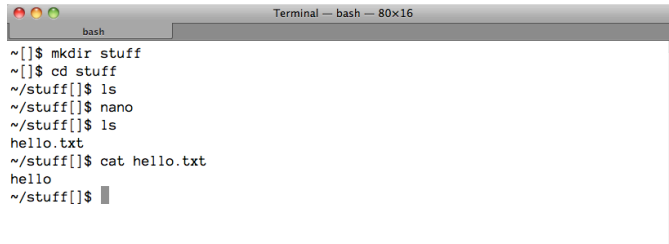


Let's look inside our **stuff** folder again. Remember last time we typed **ls** we saw it was empty. Type **ls** in Terminal again. You will see the hello.txt file you created.



Let's look inside this file. Type **cat hello.txt** in Terminal and hit Enter.

Here, **`cat`** is not an animal. Instead, it is a command that shows you what is in your file. Since we typed the word hello, this is what you will see.

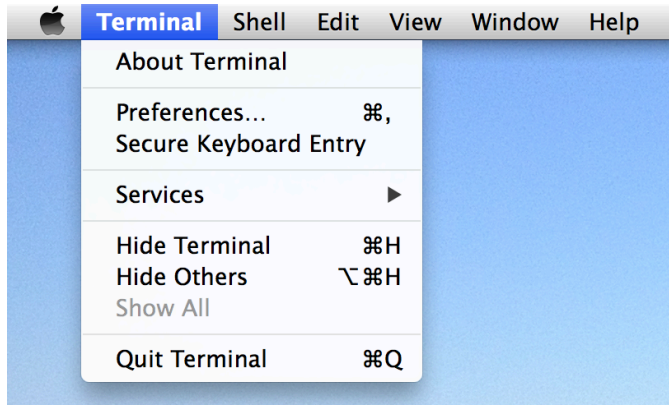


So, the hello.txt file had "hello" inside it, so when you typed **`cat hello.txt`** you saw "hello".

You now know how to use some of the basic commands of the command line! You learned a bunch of strange commands, things like **`mkdir`**, **`cd`**, **`ls`** and **`cat`**. The neat thing is that these commands are actually just programs that were written by other people!

In the next chapter, **you** will create **your** first program, which **you** will also be able to run from the command line!

Finally, we are going to quit Terminal. Type **`Command + Q`** or choosing Quit Terminal from the Terminal menu.



By the way, if you ever get something on the commmand line really wrong and you don't know what to do next, you can always just quit Terminal and open it up again.

Make sure you do the Exercises on the next page before continuing!

Exercises

1. Start Terminal and `cd` into the `stuff` directory.
2. Use nano to make a file named `hooray.txt` that contains the text "hooray". Quit nano when you're done.
3. Use the `cat` program to see the contents of your `hooray.txt` file.
4. Quit Terminal.

You can see the answers to the exercises, or just continue to the next chapter.

Chapter 2: Hello World!

Let's write our first computer program!

Start Terminal, `cd` into the `stuff` directory and run `nano` (If that did not make sense, see the Chapter 1 Exercises.)

We're going to create a really simple program. Type **`puts "Hello World!"`** in nano.

There's no need to hit the Enter key. I'll talk more about what **`puts`** means later.

To type a quote mark like `"` hold the shift key and type the `'` key. There's no difference between the start and end quote marks.

That's it!

Type **`Control + o`** to save the file.

Nano will ask you what you want to call the file you are saving, by showing text saying "File Name to Write:"

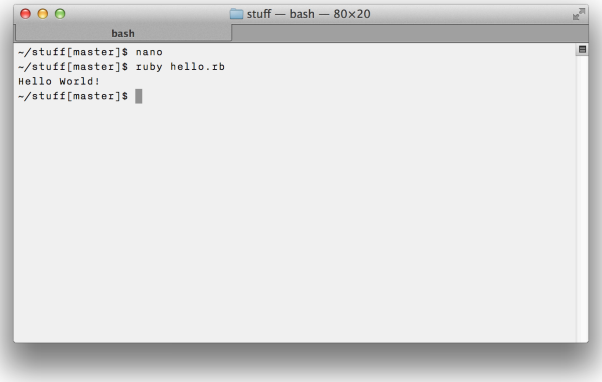
Type **`hello.rb`** and press the **`Enter`** key. As you type the file name, you will see it shown in "File Name to Write" area near the bottom of Terminal.

Nano will save the file and tell you it was one line long, by saying "Wrote 1 line". (If you hit the Enter key, it will say Wrote 2 lines. That's fine too.)

Now that we've saved our file, type **`Control + x`** to quit nano.

Let's run our program!

In Terminal, type **`ruby hello.rb`** and hit **`Enter`**. You need a space between **`ruby`** and **`hello.rb`**.



Congratulations, you've written your first computer program! As you just saw, **`puts`** printed something to the screen.

But, what was that strange word "ruby"?

Ruby is a programming language. You speak English, but there are lots of other languages that people speak. Similarly, there are lots of different languages you can use to tell a computer what to do. Ruby is one of the easier ones to use, and your Mac comes with Ruby already installed.

The program you wrote was a Ruby program! The file extension (the stuff after the . in the filename) for Ruby programs is `rb` so we named the file `hello.rb`.

In the next chapter, we will play with Ruby on its own command line!

Exercises

1. Write and run a Ruby program named hi.rb that prints `Hi!`

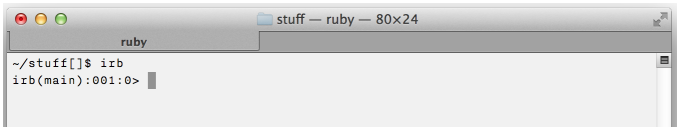
You can see the answers to the exercises, or just continue to the next chapter.

Chapter 3: Hello, `irb`!

Ensure that Terminal is running, and that you are in the `stuff` directory. (If that did not make sense, see the Chapter 1 Exercises.)

Ruby is a programming language. It also has its own command line called **`irb`**, which stands for Interactive Ruby Shell.

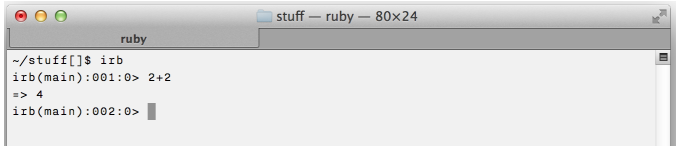
To start **`irb`**, just type **`irb`** in Terminal.



Note that irb has its own prompt. On my Mac, it looks like `irb(main):001:0>` If you have an older version of Ruby on an older Mac, your irb prompt might just look like `>>`. The irb prompt just lets you know that irb is waiting for you to type a command. We'll ignore the other details that it shows.

Anyway, let's get irb to do your math homework!

Type **`2+2`** in irb and hit Enter.



For your parents' sake: you should just use **`irb`** to check your answers when **you** do your math homework! :)

To do multiplication, you use **`*`** (**`shift`** + **`8`**) not **`x`**.

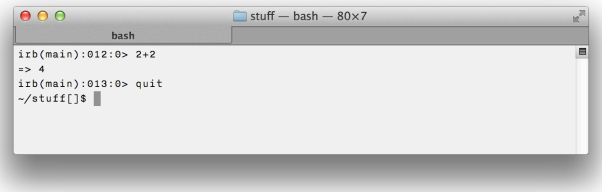
Try **`3*2`** in irb.

```
irb> 3*2
=> 6
```

To do division, you use `/` (which is beside the right `shift` key).

```
irb> 6/2
=> 3
```

To quit irb, type **`quit`**.



One of the reasons that Ruby is an easy programming language to learn is that it has irb, so you can experiment interactively really quickly.

In the next chapter, we're going to learn what functions are!

Exercises

1. Have irb do **`3-2`**. The minus key, `-`, is beside the `0`.
2. Have irb do **`3.0/2`**. What do you think the answer is?

You can see the answers to the exercises, or just continue to the next chapter.

Chapter 4: Functions

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Exercises

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Chapter 5: Programs

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Chapter 6: Functions, Part 2

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Chapter 7: Characters and Strings

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Chapter 9: Command Line Input

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Question 1

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Question 2

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Chapter 10: Arrays and Looping

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Exercises

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Chapter 11: Files

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Exercises

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Chapter 12: Booleans, If and While

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Exercises

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Chapter 13: The Spelt Project

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Section 1: Spelling a Word

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Section 2: Finishing Spelt

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Section 3: Enhancing Spelt

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Question 1

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Question 2

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Question 3

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Hint #1 for Question 3

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Hint #2 for Question 3

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Hint #3 for Question 3

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For Parents

This is a book for you to read with your child, or for your child to read by himself or herself.

I wrote it to teach my 9 year old son the basics of programming. He has been playing video games for years, and he wants to learn programming since he wants to make his own video games someday. This book is intended to be the first step. (No, it doesn't teach you how to create the kinds of video games a 9 year old can dream up; that takes a lot more knowledge!)

The reason this book exists is to be the best book in the world for a kid who is wanting to learn to program computers to read first. Computer programming is a good skill to have, regardless of what occupation your child eventually does as an adult. (I'd argue it's much more important than lots of the math than you learn in high school, for example.) But more importantly, learning how to program computers teaches a rigor and discipline of thinking which is useful in any field. This book exists to show kids that they can program computers, and to help them get started.

With the exception of this appendix, this book is written like a book for kids in elementary school. My goal is that this book should be accessible for kids between ages 9 and 14. In North America, that's grades 3-8. My son is working through it as I write it. (I don't think it's a good book for kids aged 7 and 8: I started writing this book when my son was 7, but he wasn't ready for it. So, I paused writing it—for 2 years. If your child is 7 or 8, I think that something like Scratch is a better choice for kids of that age.)

No knowledge of programming is assumed. The examples are as short as possible, since I assume the reader can't type well. (My son can't touch type, so if I make long examples I'll hear about it!)

My goal is for this book to be the best programming book for kids to read first. After this book, they can follow what interests them.

This book is written assuming you are using a Mac. I think that a Mac is the best computer for kids to learn to program on. Since this is a beginner book for kids, I can't write it generically to cover Mac, Windows and Linux. I have to pick one operating system, and have the child follow along verbatim.

Besides teaching programming, the book also teaches basic use of the command line on a Mac. This is accessed via the Terminal program. The reason for this is that I feel that the best way to learn is to follow along, and the simplest way to follow along is to type everything. Real programmers use the command line every day. If you want to learn programming, you should use Terminal and files. Yes, you can play with stuff in a web browser at places like Codecademy, and while this is very friendly and instructive, it is fundamentally a different activity from what real programmers do. And, besides being easier, it's somehow less rewarding.

If you are letting your child use **your** Mac computer to follow along, I **strongly** recommend you sit beside them and follow along! For example, I'm not planning to teach the command to delete files, but it's fairly short!

The examples are in Ruby. Ruby is a fairly simple programming language. If you've ever heard of websites built on "Ruby on Rails", you've heard of Ruby: it's the programming language that Rails is written in. This is not a book about how to learn Ruby, however. The examples could have easily been written in JavaScript, CoffeeScript or Python.

Finally, I really want your feedback! Did your child get stuck anywhere? If you have anything to say about the book, I want to hear it! Please email me at peter@leanpub.com and let me know!

About the Author

I'm the founder of Ruboss, a software consulting company based in Vancouver, BC, Canada. We're the creators of Leanpub, a website that anyone can use to self-publish in-progress ebooks like this one. I'm also a programmer, an author and a father. I've written two books for programmers (*Flexible Rails* and *Hello! Flex 4*), so I know how to explain things to fellow programmers. And my son is a very intelligent 9 year old, so I have a lot of experience explaining things to a smart child. This is probably the most challenging book I will ever write, as I honestly want this to be the best introduction to programming for all kids.

About the Cover

The cover photo is by Gareth Newstead and is from Unsplash.

About Leanpub

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Answers to Exercises

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Chapter 1

Question 1

You start Terminal and `cd` into the **`stuff`** directory by doing this:

1. In Finder, type **`Command + Space`** to start Spotlight
2. Type **`terminal`**
3. Hit the Enter key
4. Type **`cd stuff`** in Terminal and hit `Enter`

You will now be in Terminal in the **`stuff`** directory.

Question 2

To start nano, just type **`nano`** in the Terminal window, and hit Enter.

You will now be in nano.

Type `hooray`

Hold down the `Control` key and typo `o` Type `hooray.txt` and press Enter. Nano will say "Wrote `1` line" (or "Wrote `2` lines", if you hit Enter after typing `hooray`).

Hold down the `Control` key and type `x` to quit nano.

Question 3

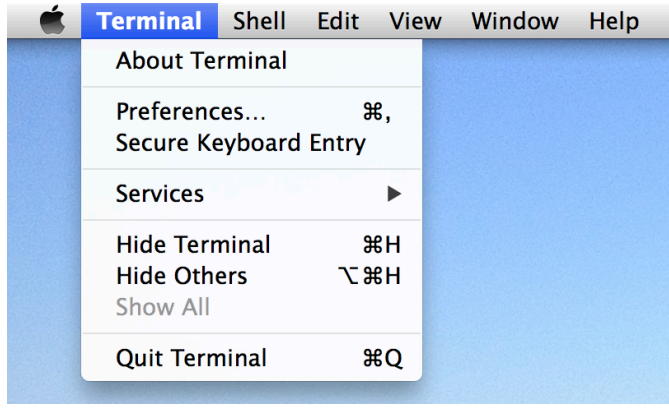
Type **`cat hooray.txt`** to see the contents of hooray.txt.

You will see something like this:

```
~/stuff[]$ cat hooray.txt
hooray
```

Question 4

To quit Terminal, type **`Command + Q`** or choosing Quit Terminal from the Terminal menu.



Continue Reading

If this was confusing, please read chapter 1 again.

If this made sense, please continue to chapter 2.

Chapter 2

Question 1

To start nano, type **`nano`** in a Terminal window, and hit Enter. You will now be in nano. Type **`puts "Hi!"`**. To type `!`, hold the `shift` key and type 1.

To save the file, hold down the `Control` key and typo `o` Type `hi.rb` and press Enter. Nano will say "Wrote 1 line" (or "Wrote 2 lines", if you hit Enter after the `puts "Hi!"`).

Hold down the `Control` key and type `x` to quit nano.

In Terminal, type **`ruby hi.rb`** and hit **`Enter`**. You need a space between **`ruby`** and **`hi.rb`**.

You will see something like this:

```
1  ~/stuff[]$ ruby hi.rb
2  Hi!
```

Continue Reading

If this was confusing, please read chapter 2 again.

If this made sense, please continue to chapter 3.

Chapter 3

Question 1

```
irb> 3-2
=> 1
```

Question 2

```
irb> 3.0/2
=> 1.5
```

1.5 is 1 and a half. 3 divided by 2 is 1 and a half. 1 and a half can be written as `1 1/2` but can also be written as `1.5`.

By the way, there's a reason why I said 3.0/2 and not 3/2. But, I don't want to explain that yet. I will later!

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If this was confusing, please read chapter 3 again.

If this made sense, please continue to chapter 4.

Chapter 4

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Chapter 5

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Chapter 6

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Chapter 11

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Question 3

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