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Learn RUBY the HARD WAY

THIRD EDITION

A Simple and Idiomatic Introduction to the Imaginative World of Computational Thinking with Code

ZED A. SHAW

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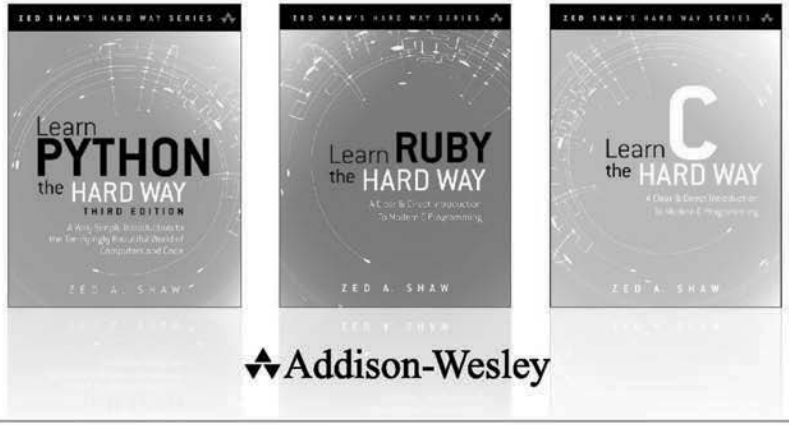
Third Edition

Zed Shaw's Hard Way Series



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Addison-Wesley

Upper Saddle River, NJ • Boston • Indianapolis • San Francisco
New York • Toronto • Montreal • London • Munich • Paris • Madrid
Capetown • Sydney • Tokyo • Singapore • Mexico City

Library of Congress Cataloging-in-Publication Data
Shaw, Zed, author.
Learn Ruby the hard way : a simple and idiomatic introduction to the imaginative world of computational thinking with code / Zed A. Shaw.—Third edition.
pages cm
Includes index.
ISBN 978-0-321-88499-2 (pbk. : alk. paper)
1. Ruby (Computer program language) I. Title.
QA76.73.R83S536 2014
005.1'17—dc23

2014033534

ISBN-13: 978-0-321-88499-2
ISBN-10: 0-321-88499-X

Text printed in the United States on recycled paper at RR Donnelley in Crawfordsville, Indiana.
First printing, December 2014

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Preface

This simple book is meant to get you started in programming. The title says it's the hard way to learn to write code, but it's actually not. It's only the "hard" way because it uses a technique called *instruction*. Instruction is where I tell you to do a sequence of controlled exercises designed to build a skill through repetition. This technique works very well with beginners, who know nothing and need to acquire basic skills before they can understand more complex topics. It's used in everything from martial arts to music, to even basic math and reading skills.

This book instructs you in Ruby by slowly building and establishing skills through techniques like practice and memorization, then applying them to increasingly difficult problems. By the end of the book you will have the tools needed to begin learning more complex programming topics. I like to tell people that my book gives you your "programming black belt." What this means is that you know the basics well enough to now start learning programming.

If you work hard, take your time, and build these skills, you will learn to code.

Acknowledgments

I would like to thank Angela for helping me with the first two versions of this book. Without her, I probably wouldn't have bothered to finish it at all. She did the copyediting of the first draft, and supported me immensely while I wrote it.

I also want to thank Rob Sobers for suggesting I make a Ruby version of my Python book and doing the initial work helping me convert it to use Ruby.

I'd also like to thank Greg Newman for doing the original cover art, Brian Shumate for early website designs, and all of the people who read this book and took the time to send me feedback and corrections.

Thank you.

The Hard Way Is Easier

With the help of this book, you will do the incredibly simple things that all programmers do to learn a programming language:

1. Go through each exercise.
2. Type in each sample *exactly*.
3. Make it run.

That's it. This will be *very* difficult at first, but stick with it. If you go through this book, and do each exercise for one or two hours a night, you will have a good foundation for moving onto another book about Ruby to continue your studies. This book won't turn you into a programmer overnight, but it will get you started on the path to learning how to code.

This book's job is to teach you the three most essential skills that a beginning programmer needs to know: reading and writing, attention to detail, and spotting differences.

Reading and Writing

If you have a problem typing, you will have a problem learning to code, and especially if you have a problem typing the fairly odd characters in source code. Without this simple skill you will be unable to learn even the most basic things about how software works.

Typing the code samples and getting them to run will help you learn the names of the symbols, get familiar with typing them, and get you reading the language.

Attention to Detail

The one skill that separates bad programmers from good programmers is attention to detail. In fact, it's what separates the good from the bad in any profession. You must pay attention to the tiniest details of your work or you will miss important elements of what you create. In programming, this is how you end up with bugs and difficult-to-use systems.

By going through this book, and copying each example *exactly*, you will be training your brain to focus on the details of what you are doing, as you are doing it.

Spotting Differences

A very important skill (that most programmers develop over time) is the ability to visually notice differences between things. An experienced programmer can take two pieces of code that are slightly different and immediately start pointing out the differences. Programmers have invented tools to make this even easier, but we won't be using any of these. You first have to train your brain the hard way; then use the tools.

While you do these exercises, typing each one in, you will be making mistakes. It's inevitable; even seasoned programmers would make a few. Your job is to compare what you have written to what's required, and fix all the differences. By doing so, you will train yourself to notice mistakes, bugs, and other problems.

Do Not Copy-Paste

You must *type* each of these exercises in, manually. If you copy and paste, you might as well not even do them. The point of these exercises is to train your hands, your brain, and your mind in how to read, write, and see code. If you copy-paste, you are cheating yourself out of the effectiveness of the lessons.

Using the Included Videos

Learn Ruby the Hard Way has more than five hours of instructional videos to help you with the book. There is one video for each exercise where I either demonstrate the exercise, or give you tips for completing the exercise. The best way to use the videos is if you are stuck when attempting an exercise or for review after you have completed an exercise. This will slowly wean you off of using videos to learn programming and build your skills at understanding code directly. Stick with it, and slowly you won't need the videos, or any videos, to learn programming. You'll be able to just read for the information you need.

A Note on Practice and Persistence

While you are studying programming, I'm studying how to play guitar. I practice it every day for at least two hours. I play scales, chords, and arpeggios for an hour; and then I learn music theory, ear training, songs, and anything else I can. Some days I study guitar and music for eight hours because I feel like it and it's fun. To me, repetitive practice is natural and just how to learn something. I know that to get good at anything I have to practice every day, even if I suck that day (which is often) or it's difficult. Keep trying and eventually it'll be easier and fun.

Between the time that I wrote *Learn Python the Hard Way* and *Learn Ruby the Hard Way*, I discovered drawing and painting. I fell in love with making visual art at the age of 39; and I have been spending every day studying it in much the same way that I studied guitar, music, and programming. I collected books of instructional material, did what the books said, painted every day, and focused on enjoying the process of learning. I am by no means an "artist," or even that good, but I can now say that I can draw and paint. The same method I'm teaching you in this book applied to my adventures in art. If you break the problem down into small exercises and lessons, and do them every day, you can learn to do almost anything. If you focus on slowly improving and enjoying the learning process, then you will benefit no matter how good you are at it.

As you study this book, and continue with programming, remember that anything worth doing is difficult at first. Maybe you are the kind of person who is afraid of failure, so you give up at the first sign of difficulty. Maybe you never learned self-discipline, so you can't do anything that's "boring." Maybe you were told that you are "gifted," so you never attempt anything that might make you seem stupid or not a prodigy. Maybe you are competitive and unfairly compare yourself to someone like me who's been programming for more than 20 years.

Whatever your reason for wanting to quit, *keep at it*. Force yourself. If you run into a Study Drill you can't do, or a lesson you just do not understand, then skip it and come back to it later. Just keep going, because with programming there's this very odd thing that happens. At first, you will not understand anything. It'll be weird, just like with learning any human language. You will struggle with words, and not know what symbols are what, and it'll all be very confusing. Then one day *BANG*—your brain will snap and you will suddenly "get it." If you keep doing the exercises and keep trying to understand them, you will get it. You might not be a master coder, but you will at least understand how programming works.

If you give up, you won't ever reach this point. You will hit the first confusing thing (which is everything at first) and then stop. If you keep trying—keep typing it in, trying to understand it and reading about it—you will eventually get it. If you go through this whole book, and you still do not understand how to code, at least you gave it a shot. You can say you tried your best and a little more and it didn't work out, but at least you tried. You can be proud of that.

A Warning for the Smarties

Sometimes people who already know a programming language will read this book and feel I'm insulting them. There is nothing in this book that is intended to be interpreted as condescending, insulting, or belittling. I simply know more about programming than my *intended* readers. If you think you are smarter than me, then you will feel talked down to and there's nothing I can do about that because you are not my *intended* reader.

If you are reading this book and flipping out at every third sentence because you feel I'm insulting your intelligence, then I have three points of advice for you:

1. Stop reading my book. I didn't write it for you. I wrote it for people who don't already know everything.
2. Empty before you fill. You will have a hard time learning from someone with more knowledge if you already know everything.
3. Go learn Lisp. I hear people who know everything really like Lisp.

For everyone else who's here to learn, just read everything as if I'm smiling and I have a mischievous little twinkle in my eye.

EXERCISE 1

A Good First Program

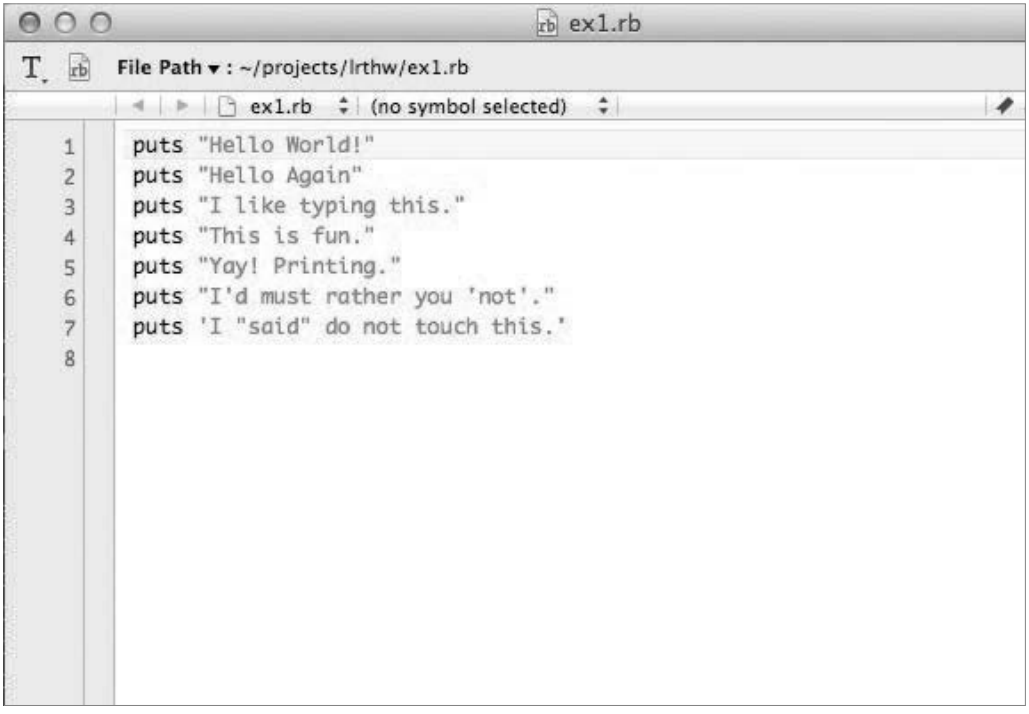
You should have spent a good amount of time in Exercise 0 learning how to install a text editor, run the text editor, run Terminal, and work with both of them. If you haven't done that, then do not go on. You will not have a good time. This is the only time I'll start an exercise with a warning that you should not skip or get ahead of yourself.

Type the following text into a single file named `ex1.rb`. Ruby works best with files ending in `.rb`.

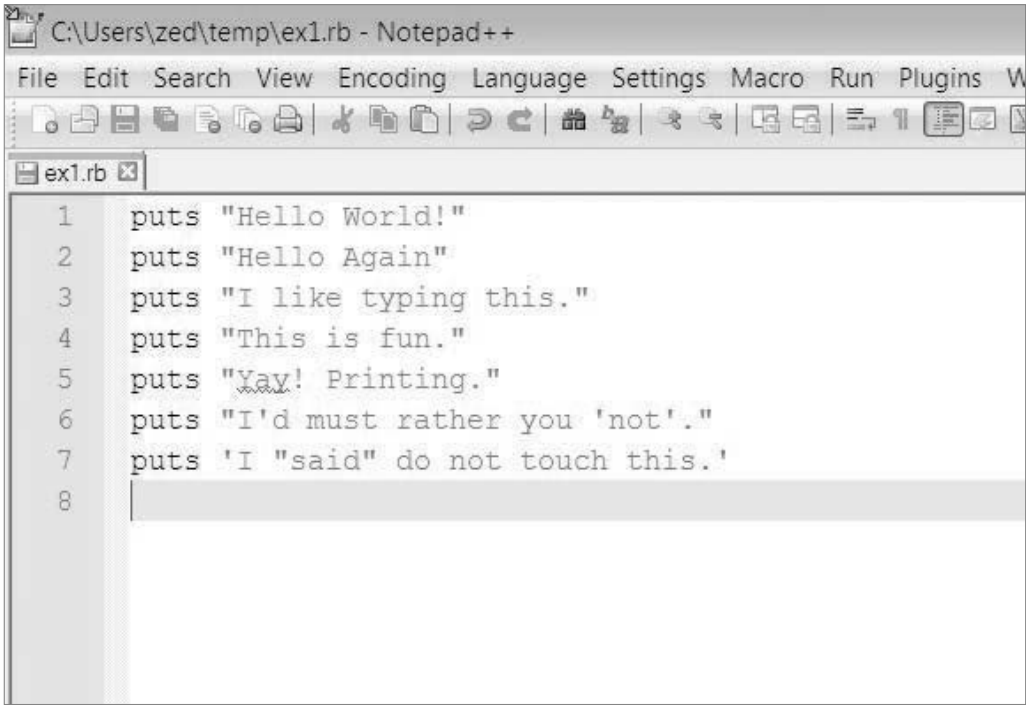
`ex1.rb`

```
1    puts "Hello World!"
2    puts "Hello Again"
3    puts "I like typing this."
4    puts "This is fun."
5    puts "Yay! Printing."
6    puts "I'd much rather you 'not'."
7    puts 'I "said" do not touch this.'
```

If you are on Mac OS X, then this is what your text editor might look like if you use `TextWrangler`:



If you are on Windows using Notepad++, then this is what it would look like:



Don't worry if your editor doesn't look exactly the same, it should be close though. When you create this file, keep in mind these points:

1. I did not type the line numbers on the left. Those are printed in the book so I can talk about specific lines by saying, "See line 5." You do not type line numbers into Ruby scripts.
2. I have the `puts` at the beginning of the line and it looks exactly the same as what I have in `ex1.rb`. Exactly means exactly, not kind of sort of the same. Every single character has to match for it to work. Color doesn't matter, only the characters you type.

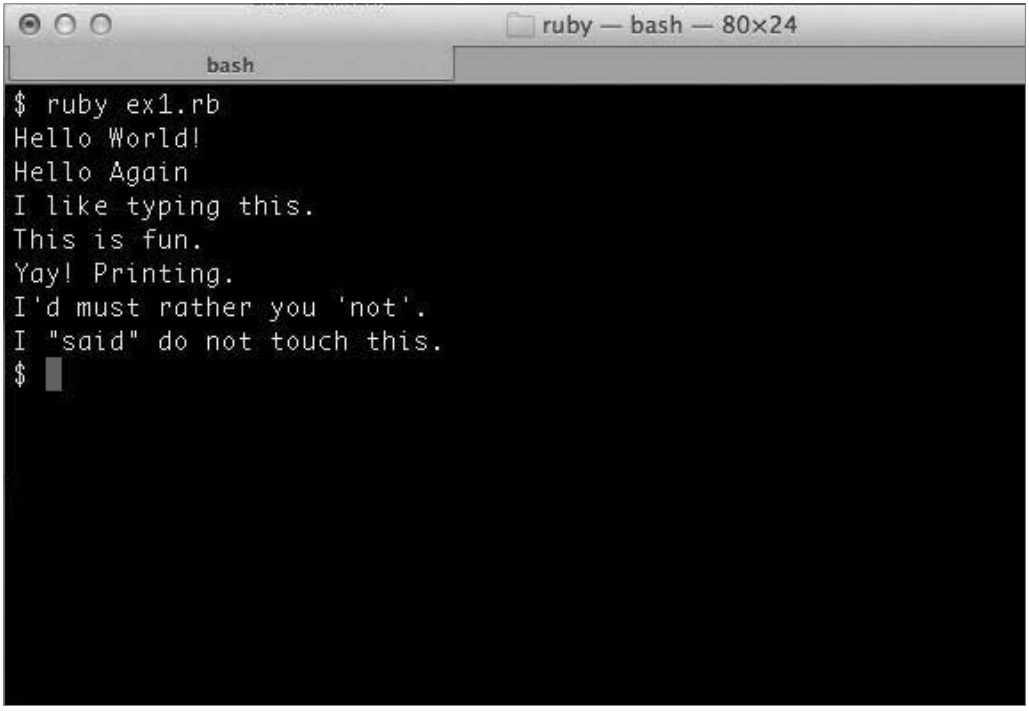
In Terminal *run* the file by typing:

```
ruby ex1.rb
```

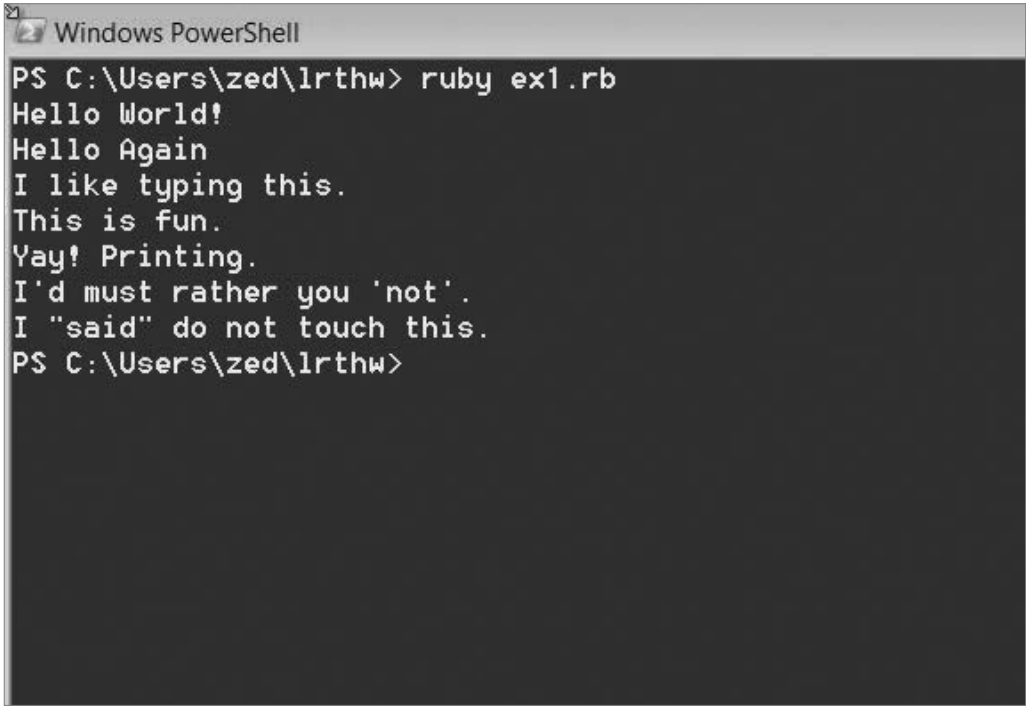
If you did it right, then you should see the same output as in the *What You Should See* section of this exercise. If not, you have done something wrong. No, the computer is not wrong.

What You Should See

On Mac OS X in Terminal you should see this:



On Windows in PowerShell you should see this:



You may see different names before the `ruby ex1.rb` command, but the important part is that you type the command and see the output is the same as mine.

If you have an error, it will look like this:

```
> ruby ex1.rb
ex1.rb:3: syntax error, unexpected tCONSTANT, expecting $end
puts "I like typing this."
```

It's important that you can read these error messages, because you will be making many of these mistakes. Even I make many of these mistakes. Let's look at this line by line.

1. We ran our command in Terminal to run the `ex1.rb` script.
2. Ruby tells us that the file `ex1.rb` has an error on line 3. The type of error is "syntax error," and then some programmer jargon you can usually ignore.
3. It prints the offending line of code for us to see.

WARNING! If you are from another country, and you get errors about ASCII encodings, then put this at the top of your Ruby scripts:

```
# -*- coding: utf-8 -*-
```

It will fix them so that you can use Unicode UTF-8 in your scripts without a problem.

Study Drills

The Study Drills contain things you should *try* to do. If you can't, skip it and come back later.

For this exercise, try these things:

1. Make your script print another line.
2. Make your script print only one of the lines.
3. Put a # (octothorpe) character at the beginning of a line. What did it do? Try to find out what this character does.

From now on, I won't explain how each exercise works unless an exercise is different.

NOTE: An "octothorpe" is also called a "pound," "hash," "mesh," or any number of names. Pick the one that makes you chill out.

Common Student Questions

These are *actual* questions that real students have asked when doing this exercise.

How do you get colors in your editor?
Save your file first as a `.rb` file, such as `ex1.rb`. Then you'll have color when you type.

I get `ruby: No such file or directory – ex1.rb (LoadError)`.
You need to be in the same directory as the file you created. Make sure you use the `cd` command to go there first. For example, if you saved your file in `lrthw/ex1.rb`, then you would type `cd lrthw/` before trying to run `ruby ex1.rb`. If you don't know what any of that means, then go through *Appendix A*.

EXERCISE 2

Comments and Pound Characters

Comments are very important in your programs. They are used to tell you what something does in English, and they are used to disable parts of your program if you need to remove them temporarily. Here's how you use comments in Ruby:

ex2.rb

```
1   # A comment, this is so you can read your program later.
2   # Anything after the # is ignored by ruby.
3
4   puts "I could have code like this." # and the comment after is ignored
5
6   # You can also use a comment to "disable" or comment out a piece of code:
7   # puts "This won't run."
8
9   puts "This will run."
```

From now on, I'm going to write code like this. It is important for you to understand that everything does not have to be literal. Your screen and program may visually look different, but what's important is the text you type into the file you're writing in your text editor. In fact, I could work with any text editor and the results would be the same.

What You Should See

Exercise 2 Session

```
$ ruby ex2.rb
I could have code like this.
This will run.
```

Again, I'm not going to show you screenshots of all the Terminals possible. You should understand that the above is not a literal translation of what your output should look like visually, but the text between the first `$ ruby ...` and last $ lines will be what you focus on.

Study Drills

1. Find out if you were right about what the # character does and make sure you know what it's called (octothorpe or pound character).
2. Take your `ex2.rb` file and review each line going backward. Start at the last line, and check each word in reverse against what you should have typed.

3. Did you find more mistakes? Fix them.
4. Read what you typed out loud, including saying each character by its name. Did you find more mistakes? Fix them.

Common Student Questions

Are you sure # is called the pound character?
I call it the octothorpe because that is the only name that no country uses, and that works in every country. Every country thinks its name for this one character is both the most important way to do it and the only way it's done. To me, this is simply arrogance and, really, y'all should just chill out and focus on more important things like learning to code.

If # is for comments, then how come `# -*- coding: utf-8 -*-` works?
Ruby still ignores that as code, but it's used as a kind of "hack" or workaround for problems with setting and detecting the format of a file. You will also find a similar kind of comment for editor settings.

Why does the # in `puts "Hi # there."` not get ignored?
The # in that code is inside a string, so it will be put into the string until the ending " character is hit. These pound characters are just considered characters and aren't considered comments.

How do I comment out multiple lines?
Put a # in front of each one.

I can't figure out how to type a # character on my country's keyboard.
Some countries use the Alt key and combinations of other keys to print characters foreign to their language. You'll have to look online in a search engine to see how to type it.

Why do I have to read code backward?
It's a trick to make your brain not attach meaning to each part of the code, and doing that makes you process each piece exactly. This catches errors and is a handy error-checking technique.

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Command Line Crash Course

This appendix is a quick, super-fast course in using the command line. It is intended to be done rapidly in about a day or two, and is not meant to teach you advanced shell usage.

Introduction: Shut Up and Shell

This appendix is a crash course in using the command line to make your computer perform tasks. As a crash course, it's not as detailed or extensive as my other books. It is simply designed to get you barely capable enough to start using your computer like a real programmer does. When you're done with this appendix, you will be able to give most of the basic commands that every shell user touches every day. You'll understand the basics of directories and a few other concepts.

The only piece of advice I am going to give you is this:

Shut up and type all of this in.

Sorry to be mean, but that's what you have to do. If you have an irrational fear of the command line, the only way to conquer an irrational fear is to just shut up and fight through it.

You are not going to destroy your computer. You are not going to be thrown into some jail at the bottom of Microsoft's Redmond campus. Your friends won't laugh at you for being a nerd. Simply ignore any stupid weird reasons you have for fearing the command line.

Why? Because if you want to learn to code, then you must learn this. Programming languages are advanced ways to control your computer with language. The command line is the little baby brother of programming languages. Learning the command line teaches you to control the computer using language. Once you get past that, you can then move on to writing code and feeling like you actually own the hunk of metal you just bought.

How to Use This Appendix

The best way to use this appendix is to do the following:

- Get yourself a small paper notebook and a pen.
- Start at the beginning of the appendix and do each exercise exactly as you're told.
- When you read something that doesn't make sense or that you don't understand, *write it down in your notebook*. Leave a little space so you can write an answer.

- After you finish an exercise, go back through your notebook and review the questions you have. Try to answer them by searching online and asking friends who might know the answer. Email me at help@learncodethehardway.org and I'll help you, too.

Just keep going through this process of doing an exercise, writing down questions you have, then going back through and answering the questions you can. By the time you're done, you'll actually know a lot more than you think about using the command line.

You Will Be Memorizing Things

I'm warning you ahead of time that I'm going to make you memorize things right away. This is the quickest way to get you capable at something, but for some people memorization is painful. Just fight through it and do it anyway. Memorization is an important skill in learning things, so you should get over your fear of it.

Here's how you memorize things:

- Tell yourself you *will* do it. Don't try to find tricks or easy ways out of it, just sit down and do it.
- Write what you want to memorize on some index cards. Put one half of what you need to learn on one side, then the other half on the other side.
- Every day for about 15–30 minutes, drill yourself on the index cards, trying to recall each one. Put any cards you don't get right into a different pile, just drill those cards until you get bored, and then try the whole deck and see if you improve.
- Before you go to bed, drill just the cards you got wrong for about 5 minutes, then go to sleep.

There are other techniques, like you can write what you need to learn on a sheet of paper, laminate it, then stick it to the wall of your shower. While you're bathing, drill the knowledge without looking, and when you get stuck glance at it to refresh your memory.

If you do this every day, you should be able to memorize most of the things I tell you to memorize in about a week to a month. Once you do, nearly everything else becomes easier and intuitive, which is the purpose of memorization. It's not to teach you abstract concepts, but rather to ingrain the basics so that they are intuitive and you don't have to think about them. Once you've memorized these basics, they stop being speed bumps preventing you from learning more advanced abstract concepts.

The Setup

In this appendix you will be instructed to do three things:

- Do some things in your shell (command line, Terminal, PowerShell).
- Learn about what you just did.
- Do more on your own.

For this first exercise, you'll be expected to get your Terminal open and working so that you can do the rest of the appendix.

Do This

Get your Terminal, shell, or PowerShell working so you can access it quickly and know that it works.

Mac OS X

For Mac OS X you'll need to do this:

- Hold down the command key and hit the spacebar.
- In the top right corner, the blue "search bar" will pop up.
- Type: terminal
- Click on the Terminal application that looks kind of like a black box.
- This will open Terminal.
- You can now go to your dock and CTRL-click to pull up the menu, then select `Options->Keep` In dock.

Now you have your Terminal open and it's in your dock so you can get to it.

Linux

I'm assuming that if you have Linux, then you already know how to get at your Terminal. Look through the menu for your window manager for anything named "Shell" or "Terminal."

Windows

On Windows, we're going to use PowerShell. People used to work with a program called `cmd.exe`, but it's not nearly as usable as PowerShell. If you have Windows 7 or later, do this:

- Click Start.
- In "Search programs and files" type: powershell
- Hit Enter.

If you don't have Windows 7, you should *seriously* consider upgrading. If you still insist on not upgrading then you can try installing it from Microsoft's download center. Search online to find "powershell downloads" for your version of Windows. You are on your own, though, since I don't have Windows XP, but hopefully the PowerShell experience is the same.

You Learned This

You learned how to get your Terminal open, so you can do the rest of this appendix.

WARNING! If you have that really smart friend who already knows Linux, ignore him when he tells you to use something other than bash. I'm teaching you bash. That's it. He will claim that zsh will give you 30 more IQ points and win you millions in the stock market. Ignore him. Your goal is to get capable enough and at this level it doesn't matter which shell you use. The next warning is stay off IRC or other places where "hackers" hang out. They think it's funny to hand you commands that can destroy your computer. The command `rm -rf /` is a classic that you *must never type*. Just avoid them. If you need help, make sure you get it from someone you trust and not from random idiots on the Internet.

Do More

This exercise has a large "do more" part. The other exercises are not as involved as this one, but I'm having you prime your brain for the rest of the appendix by doing some memorization. Just trust me: this will make things silky smooth later on.

Linux/Mac OS X

Take this list of commands and create index cards with the names on the left on one side, and the definitions on the other side. Drill them every day while continuing with the lessons in this appendix.

pwd print working directory

hostname my computer's network name

mkdir make directory

cd change directory

ls list directory

rmdir remove directory

pushd push directory

popd pop directory

cp copy a file or directory

mv move a file or directory

less page through a file

cat print the whole file

xargs execute arguments

find find files

grep find things inside files

man read a manual page

apropos find which man page is appropriate

env look at your environment

echo print some arguments

export export/set a new environment variable

exit exit the shell

sudo DANGER! become super user root DANGER!

Windows

If you're using Windows, then here's your list of commands:

pwd print working directory

hostname my computer's network name

mkdir make directory

cd change directory

ls list directory

rmdir remove directory

pushd push directory

popd pop directory

cp copy a file or directory

robocopy robust copy

mv move a file or directory

more page through a file

type print the whole file

forfiles run a command on lots of files

dir -r find files

select-string find things inside files

help read a manual page

helpctr find which manual page is appropriate

echo print some arguments

set export/set a new environment variable

exit exit the shell

runas DANGER! become super user root DANGER!

Drill, drill, drill! Drill until you can say these phrases right away when you see that word. Then drill the inverse, so that you read the phrase and know which command will do that. You're building your vocabulary by doing this, but don't spend so much time you go nuts and get bored.

Paths, Folders, and Directories (pwd)

In this exercise you learn how to print your working directory with the pwd command.

Do This

I'm going to teach you how to read these "sessions" that I show you. You don't have to type everything I list here, just some of the parts:

- You do *not* type in the $ (UNIX) or > (Windows). That's just me showing you my session so you can see what I got.
- You type in the stuff after `$ or >`, then hit Enter. So if I have `$ pwd`, you type just pwd and hit Enter.
- You can then see what I have for output followed by another $ or > prompt. That content is the output and you should see the same output.

Let's do a simple first command so you can get the hang of this:

Linux/OS X

Exercise 2 Session

```
$ pwd
/Users/zedshaw
$
```

Windows

Exercise 2 Windows Session

```
PS C:\Users\zed> pwd

Path
----
C:\Users\zed

PS C:\Users\zed>
```

WARNING! In this appendix I need to save space so that you can focus on the important details of the commands. To do this, I'm going to strip out the first part of the prompt (the `PS C:\Users\zed` above) and leave just the little > part. This means your prompt won't look exactly the same, but don't worry about that.

Remember that from now on I'll include only the > to tell you that's the prompt. I'm doing the same thing for the UNIX prompts, but UNIX prompts are so varied that most people get used to $ meaning "just the prompt."

You Learned This

Your prompt will look different from mine. You may have your user name before the $ and the name of your computer. On Windows it will probably look different, too. The key is that you see this pattern:

- There's a prompt.
- You type a command there. In this case, it's pwd.
- It printed something.
- Repeat.

You just learned what pwd does, which means "print working directory." What's a directory? It's a folder. Folder and directory are the same thing, and they're used interchangeably. When you open your file browser on your computer to graphically find files, you are walking through folders. Those folders are the exact same things as these "directories" we're going to work with.

Do More

- Type pwd 20 times and each time say "print working directory."
- Write down the path that this command gives you. Find it with your graphical file browser of choice.
- No, seriously, type it 20 times and say it out loud. Sssh. Just do it.

If You Get Lost

As you go through these instructions, you may get lost. You may not know where you are or where a file is and have no idea how to continue. To solve this problem, I am going to teach you the commands to type to stop being lost.

Whenever you get lost, it is most likely because you were typing commands and have no idea where you've ended up. What you should do is type pwd to *print your current directory*. This tells you where you are.

The next thing you need is a way of getting back to where you are safe, your home. To do this, type cd ~ and you are back in your home.

This means if you get lost at any time, you should type:

```
pwd
cd ~
```

The first command pwd tells you where you are. The second command `cd ~` takes you home so you can try again.

Do This

Right now figure out where you are, and then go home using pwd and `cd ~`. This will ensure that you are always in the right place.

You Learned This

How to get back to your home if you ever get lost.

Make a Directory (mkdir)

In this exercise you learn how to make a new directory (folder) using the `mkdir` command.

Do This

Remember! *You need to go home first!* Do your pwd and then `cd ~` before doing this exercise. Before you do *all* exercises in this appendix, always go home first!

Linux/OS X

Exercise 4 Session

```
$ pwd
$ cd ~
$ mkdir temp
$ mkdir temp/stuff
$ mkdir temp/stuff/things
$ mkdir -p temp/stuff/things/frank/joe/alex/john
$
```

Windows

Exercise 4 Windows Session

```
> pwd
> cd ~
> mkdir temp


    Directory: C:\Users\zed


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
d----         12/17/2011   9:02 AM            temp


> mkdir temp/stuff


    Directory: C:\Users\zed\temp


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
d----         12/17/2011   9:02 AM            stuff


> mkdir temp/stuff/things


    Directory: C:\Users\zed\temp\stuff

Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
d----         12/17/2011   9:03 AM            things


> mkdir temp/stuff/things/frank/joe/alex/john
```

```
    Directory: C:\Users\zed\temp\stuff\things\frank\joe\alex


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
d----         12/17/2011   9:03 AM            john


>
```

This is the only time I'll list the pwd and `cd ~` commands. They are expected in the exercises *every time*. Do them all the time.

You Learned This

Now we get into typing more than one command. These are all the different ways you can run `mkdir`. What does `mkdir` do? It make directories. Why are you asking that? You should be doing your index cards and getting your commands memorized. If you don't know that "`mkdir` makes directories," then keep working the index cards.

What does it mean to make a directory? You might call directories "folders." They're the same thing. All you did in this exercise is create directories inside directories inside of more directories. This is called a "path" and it's a way of saying "first temp, then stuff, then things, and that's where I want it." It's a set of directions to the computer of where you want to put something in the tree of folders (directories) that make up your computer's hard disk.

WARNING! In this appendix I'm using the / (slash) character for all paths since it works the same on all computers now. However, Windows users need to know that you can also use the \ (backslash) character and other Windows users will expect that at times.

Do More

- The concept of a "path" might confuse you at this point. Don't worry. We'll do a lot more with them and then you'll get it.
- Make 20 other directories inside the temp directory in various levels. Go look at them with a graphical file browser.
- Make a directory with a space in the name by putting quotes around it: `mkdir "I Have Fun"`
- If the `temp` directory already exists, then you'll get an error. Use `cd` to change to a work directory that you can control and try it there. On Windows, Desktop is a good place.

Change Directory (cd)

In this exercise you learn how to change from one directory to another using the `cd` command.

Do This

I'm going to give you the instructions for these sessions one more time:

- You do *not* type in the $ (UNIX) or > (Windows).
- You type in the stuff after this, then hit Enter. If I have `$ cd temp` you just type `cd temp` and hit Enter.
- The output comes after you hit Enter, followed by another $ or > prompt.
- Always go home first! Do pwd and then `cd ~` so you go back to your starting point.

Linux/OS X

Exercise 5 Session

```
$ cd temp
$ pwd
~/temp
$ cd stuff
$ pwd
~/temp/stuff
$ cd things
$ pwd
~/temp/stuff/things
$ cd frank/
$ pwd
~/temp/stuff/things/frank
$ cd joe/
$ pwd
~/temp/stuff/things/frank/joe
$ cd alex/
$ pwd
~/temp/stuff/things/frank/joe/alex
$ cd john/
$ pwd
~/temp/stuff/things/frank/joe/alex/john
```

```
$ cd ..
$ cd ..
$ pwd
~/temp/stuff/things/frank/joe
$ cd ..
$ cd ..
$ pwd
~/temp/stuff/things
$ cd ../../..
$ pwd
~/
$ cd temp/stuff/things/frank/joe/alex/john
$ pwd
~/temp/stuff/things/frank/joe/alex/john
$ cd ../../../../../../../
$ pwd
~/
$
```

Windows

Exercise 5 Windows Session

```
> cd temp
> pwd

Path
----
C:\Users\zed\temp


> cd stuff
> pwd

Path
----
C:\Users\zed\temp\stuff


> cd things
```

```
> pwd

Path
----
C:\Users\zed\temp\stuff\things

> cd frank
> pwd

Path
----
C:\Users\zed\temp\stuff\things\frank


> cd joe
> pwd

Path
----
C:\Users\zed\temp\stuff\things\frank\joe


> cd alex
> pwd

Path
----
C:\Users\zed\temp\stuff\things\frank\joe\alex


> cd john
> pwd

Path
----
C:\Users\zed\temp\stuff\things\frank\joe\alex\john


> cd ..
```

```
> cd ..
> cd ..
> pwd

Path
----
C:\Users\zed\temp\stuff\things\frank


> cd ../..
> pwd

Path
----
C:\Users\zed\temp\stuff


> cd ..
> cd ..
> cd temp/stuff/things/frank/joe/alex/john
> cd ../../../../../../../
> pwd

Path
----
C:\Users\zed


>
```

You Learned This

You made all these directories in the last exercise, and now you're just moving around inside them with the cd command. In my session, I also use pwd to check where I am, so remember not to type the output that pwd prints. For example, on line 3 you see ~/temp but that's the output of pwd from the prompt above it. *Do not type this in*.

You should also see how I use the `..` to move "up" in the tree and path.

Do More

A very important part of learning to use the command line interface (CLI) on a computer with a graphical user interface (GUI) is figuring out how they work together. When I started using computers, there was no "GUI" and you did everything with the DOS prompt (the CLI). Later, when computers became powerful enough that everyone could have graphics, it was simple for me to match CLI directories with GUI windows and folders.

Most people today, however, have no comprehension of the CLI, paths, and directories. In fact, it's very difficult to teach it to them and the only way to learn about the connection is for you to constantly work with the CLI until one day it clicks that things you do in the GUI will show up in the CLI.

The way you do this is by spending some time finding directories with your GUI file browser, then going to them with your CLI. This is what you'll do next.

- `cd` to the `joe` directory with one command.
- `cd` back to `temp` with one command, but not further above that.
- Find out how to `cd` to your "home directory" with one command.
- `cd` to your Documents directory, then find it with your GUI file browser (e.g., Finder, Windows Explorer, etc.).
- `cd` to your Downloads directory, then find it with your file browser.
- Find another directory with your file browser, then `cd` to it.
- Remember when you put quotes around a directory with spaces in it? You can do that with any command. For example, if you have a directory `I Have Fun`, then you can do: `cd "I Have Fun"`

List Directory (ls)

In this exercise you learn how to list the contents of a directory with the `ls` command.

Do This

Before you start, make sure you `cd` back to the directory above temp. If you have no idea where you are, use `pwd` to figure it out and then move there.

Linux/OS X

Exercise 6 Session

```
$ cd temp
$ ls
stuff
$ cd stuff
$ ls
things
$ cd things
$ ls
frank
$ cd frank
$ ls
joe
$ cd joe
$ ls
alex
$ cd alex
$ ls
$ cd john
$ ls
$ cd ..
$ ls
john
$ cd ../../../
$ ls
frank
$ cd ../../
$ ls
stuff
$
```

Windows

Exercise 6 Windows Session

```
> cd temp
> ls
```

```
    Directory: C:\Users\zed\temp


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
d----         12/17/2011   9:03 AM            stuff


> cd stuff
> ls

    Directory: C:\Users\zed\temp\stuff


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
d----         12/17/2011   9:03 AM            things


> cd things
> ls

    Directory: C:\Users\zed\temp\stuff\things


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
d----         12/17/2011   9:03 AM            frank


> cd frank
> ls
```

```
    Directory: C:\Users\zed\temp\stuff\things\frank


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
d----         12/17/2011   9:03 AM            joe


> cd joe
> ls


    Directory: C:\Users\zed\temp\stuff\things\frank\joe


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
d----         12/17/2011   9:03 AM            alex


> cd alex
> ls


    Directory: C:\Users\zed\temp\stuff\things\frank\joe\alex


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
d----         12/17/2011   9:03 AM            john


> cd john
> ls
> cd ..
> ls
```

```
    Directory: C:\Users\zed\temp\stuff\things\frank\joe\alex


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
d----         12/17/2011   9:03 AM            john


> cd ..
> ls

    Directory: C:\Users\zed\temp\stuff\things\frank\joe


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
d----         12/17/2011   9:03 AM            alex


> cd ../../..
> ls

    Directory: C:\Users\zed\temp\stuff


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
d----         12/17/2011   9:03 AM            things


> cd ..
> ls
```

```
    Directory: C:\Users\zed\temp


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
d----         12/17/2011   9:03 AM            stuff


>
```

You Learned This

The `ls` command lists out the contents of the directory you are currently in. You can see me use `cd` to change into different directories and then list what's in them so I know which directory to go to next.

There are a lot of options for the `ls` command, but you'll learn how to get help on those later when we cover the `help` command.

Do More

- *Type every one of these commands in!* You have to actually type these to learn them. Just reading them is *not* good enough. I'll stop yelling now.
- On UNIX, try the `ls -lR` command while you're in `temp`.
- On Windows, do the same thing with `dir -R`.
- Use `cd` to get to other directories on your computer and then use `ls` to see what's in them.
- Update your notebook with new questions. I know you probably have some, because I'm not covering everything about this command.
- Remember that if you get lost, then use `ls` and `pwd` to figure out where you are, then go to where you need to be with `cd`.

Remove Directory (rmdir)

In this exercise you learn how to remove an empty directory.

Do This

Linux/OS X

Exercise 7 Session

```
$ cd temp
$ ls
stuff
$ cd stuff/things/frank/joe/alex/john/
$ cd ..
$ rmdir john
$ cd ..
$ rmdir alex
$ cd ..
$ ls
joe
$ rmdir joe
$ cd ..
$ ls
frank
$ rmdir frank
$ cd ..
$ ls
things
$ rmdir things
$ cd ..
$ ls
stuff
$ rmdir stuff
$ pwd
~/temp
$
```

WARNING! If you try to do `rmdir` on Mac OS X and it refuses to remove the directory even though you are *positive* it's empty, then there is actually a file in there called `.DS_Store`. In that case, type `rm -rf <dir>` instead (replace `<dir>` with the directory name).

Windows

Exercise 7 Windows Session

```
> cd temp
> ls


    Directory: C:\Users\zed\temp


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
d----         12/17/2011   9:03 AM            stuff


> cd stuff/things/frank/joe/alex/john/
> cd ..
> rmdir john
> cd ..
> rmdir alex
> cd ..
> rmdir joe
> cd ..
> rmdir frank
> cd ..
> ls


    Directory: C:\Users\zed\temp\stuff


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
d----         12/17/2011   9:14 AM            things


> rmdir things
> cd ..
> ls
```

```
    Directory: C:\Users\zed\temp


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
d----        12/17/2011   9:14 AM            stuff


> rmdir stuff
> pwd

Path
----
C:\Users\zed\temp


> cd ..
>
```

You Learned This

I'm now mixing up the commands so make sure you type them exactly and pay attention. Every time you make a mistake, it's because you aren't paying attention. If you find yourself making many mistakes, then take a break or just quit for the day. You've always got tomorrow to try again.

In this example you'll learn how to remove a directory. It's easy. You just go to the directory right above it, then type `rmdir <dir>`, replacing `<dir>` with the name of the directory to remove.

Do More

- Make 20 more directories and remove them all.
- Make a single path of directories that is 10 deep and remove them one at a time just like I did.
- If you try to remove a directory with content you will get an error. I'll show you how to remove these in later exercises.

Moving Around (pushd, popd)

In this exercise you learn how to save your current location and go to a new location with pushd. You then learn how to return to the saved location with popd.

Do This

Linux/OS X

Exercise 8 Session

```
$ cd temp
$ mkdir -p i/like/icecream
$ pushd i/like/icecream
~/temp/i/like/icecream ~/temp
$ popd
~/temp
$ pwd
~/temp
$ pushd i/like
~/temp/i/like ~/temp
$ pwd
~/temp/i/like
$ pushd icecream
~/temp/i/like/icecream ~/temp/i/like ~/temp
$ pwd
~/temp/i/like/icecream
$ popd
~/temp/i/like ~/temp
$ pwd
~/temp/i/like
$ popd
~/temp
$ pushd i/like/icecream
~/temp/i/like/icecream ~/temp
$ pushd
~/temp ~/temp/i/like/icecream
$ pwd
~/temp
$ pushd
```

```
~/temp/i/like/icecream ~/temp
$ pwd
~/temp/i/like/icecream
$
```

Windows

Exercise 8 Windows Session

```
> cd temp
> mkdir -p i/like/icecream


    Directory: C:\Users\zed\temp\i\like


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
d----         12/20/2011  11:05 AM            icecream


> pushd i/like/icecream
> popd
> pwd

Path
----
C:\Users\zed\temp


> pushd i/like
> pwd

Path
----
C:\Users\zed\temp\i\like


> pushd icecream
> pwd
```

```
Path
----
C:\Users\zed\temp\i\like\icecream


> popd
> pwd

Path
----
C:\Users\zed\temp\i\like


> popd
>
```

You Learned This

You're getting into programmer territory with these commands, but they're so handy I have to teach them to you. These commands let you temporarily go to a different directory and then come back, easily switching between the two.

The `pushd` command takes your current directory and "pushes" it into a list for later, then it *changes* to another directory. It's like saying, "Save where I am, then go here."

The `popd` command takes the last directory you pushed and "pops" it off, taking you back there.

Finally, on UNIX, the command `pushd`, if you run it by itself with no arguments, will switch between your current directory and the last one you pushed. It's an easy way to switch between two directories. *This does not work in PowerShell.*

Do More

- Use these commands to move around directories all over your computer.
- Remove the `i/like/icecream` directories and make your own, then move around in them.
- Explain to yourself the output that `pushd` and `popd` will print out for you. Notice how it works like a stack?

- You already know this, but remember that `mkdir -p` will make an entire path even if all the directories don't exist. That's what I did very first for this exercise.

Making Empty Files (Touch, New-Item)

In this exercise you learn how to make an empty file using the `touch` (`new-item` on Windows) command.

Do This

Linux/OS X

Exercise 9 Session

```
$ cd temp
$ touch iamcool.txt
$ ls
iamcool.txt
$
```

Windows

Exercise 9 Windows Session

```
> cd temp
> New-Item iamcool.txt -type file
> ls


    Directory: C:\Users\zed\temp


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
-a---         12/17/2011   9:03 AM            iamcool.txt


>
```

You Learned This

You learned how to make an empty file. On UNIX `touch` does this, and it also changes the times on the file. I rarely use it for anything other than making empty files. On Windows, you don't have this command, so you learned how to use the `New-Item` command, which does the same thing but can also make new directories.

Do More

- UNIX: Make a directory, change to it, and then make a file in it. Then move up one level and run the `rmdir` command in this directory. You *should* get an error. Try to understand why you got this error.
- Windows: Do the same thing, but you won't get an error. You'll get a prompt asking if you really want to remove the directory.

Copy a File (cp)

In this exercise you learn how to copy a file from one location to another with the `cp` command.

Do This

Linux/OS X

Exercise 10 Session

```
$ cd temp
$ cp iamcool.txt neat.txt
$ ls
iamcool.txt neat.txt
$ cp neat.txt awesome.txt
$ ls
awesome.txt iamcool.txt neat.txt
$ cp awesome.txt thefourthfile.txt
$ ls
awesome.txt  iamcool.txt  neat.txt  thefourthfile.txt
$ mkdir something
$ cp awesome.txt something/
$ ls
awesome.txt iamcool.txt  neat.txt  something  thefourthfile.txt
```

```
$ ls something/
awesome.txt
$ cp -r something newplace
$ ls newplace/
awesome.txt
$
```

Windows

Exercise 10 Windows Session

```
> cd temp
> cp iamcool.txt neat.txt
> ls


    Directory: C:\Users\zed\temp


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
-a---         12/22/2011   4:49 PM          0 iamcool.txt
-a---         12/22/2011   4:49 PM          0 neat.txt


> cp neat.txt awesome.txt
> ls


    Directory: C:\Users\zed\temp


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
-a---         12/22/2011   4:49 PM          0 awesome.txt
-a---         12/22/2011   4:49 PM          0 iamcool.txt
-a---         12/22/2011   4:49 PM          0 neat.txt


> cp awesome.txt thefourthfile.txt
> ls
```

```
    Directory: C:\Users\zed\temp


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
-a---         12/22/2011   4:49 PM          0 awesome.txt
-a---         12/22/2011   4:49 PM          0 iamcool.txt
-a---         12/22/2011   4:49 PM          0 neat.txt
-a---         12/22/2011   4:49 PM          0 thefourthfile.txt


> mkdir something

    Directory: C:\Users\zed\temp


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
d----         12/22/2011   4:52 PM            something


> cp awesome.txt something/
> ls

    Directory: C:\Users\zed\temp


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
d----         12/22/2011   4:52 PM            something
-a---         12/22/2011   4:49 PM          0 awesome.txt
-a---         12/22/2011   4:49 PM          0 iamcool.txt
-a---         12/22/2011   4:49 PM          0 neat.txt
-a---         12/22/2011   4:49 PM          0 thefourthfile.txt

> ls something
```

```
    Directory: C:\Users\zed\temp\something


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
-a---        12/22/2011   4:49 PM          0 awesome.txt


> cp -recurse something newplace
> ls newplace


    Directory: C:\Users\zed\temp\newplace


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
-a---        12/22/2011   4:49 PM          0 awesome.txt

>
```

You Learned This

Now you can copy files. It's simple to just take a file and copy it to a new one. In this exercise I also make a new directory and copy a file into that directory.

I'm going to tell you a secret about programmers and system administrators now: they are lazy. I'm lazy. My friends are lazy. That's why we use computers. We like to make computers do boring things for us. In the exercises so far you have been typing repetitive boring commands so that you can learn them, but usually it's not like this. Usually if you find yourself doing something boring and repetitive, there's probably a programmer who has figured out how to make it easier. You just don't know about it.

The other thing about programmers is they aren't nearly as clever as you think. If you overthink what to type, then you'll probably get it wrong. Instead, try to imagine what the name of a command is and try it. Chances are that it's a name or some abbreviation similar to what you thought it was. If you still can't figure it out intuitively, then ask around and search online. Hopefully it's not something really stupid like ROBOCOPY.

Do More

- Use the `cp -r` command to copy more directories with files in them.
- Copy a file to your home directory or desktop.
- Find these files in your graphical user interface and open them in a text editor.
- Notice how sometimes I put a / (slash) at the end of a directory? That makes sure the file is really a directory, so if the directory doesn't exist I'll get an error.

Moving a File (mv)

In this exercise you learn how to move a file from one location to another using the `mv` command.

Do This

Linux/OS X

Exercise 11 Session

```
$ cd temp
$ mv awesome.txt uncool.txt
$ ls
newplace  uncool.txt
$ mv newplace oldplace
$ ls
oldplace  uncool.txt
$ mv oldplace newplace
$ ls
newplace  uncool.txt
$
```

Windows

Exercise 11 Windows Session

```
> cd temp
> mv awesome.txt uncool.txt
> ls
```

```
    Directory: C:\Users\zed\temp


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
d----         12/22/2011   4:52 PM            newplace
d----         12/22/2011   4:52 PM            something
-a---         12/22/2011   4:49 PM          0 iamcool.txt
-a---         12/22/2011   4:49 PM          0 neat.txt
-a---         12/22/2011   4:49 PM          0 thefourthfile.txt
-a---         12/22/2011   4:49 PM          0 uncool.txt


> mv newplace oldplace
> ls

    Directory: C:\Users\zed\temp


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
d----         12/22/2011   4:52 PM            oldplace
d----         12/22/2011   4:52 PM            something
-a---         12/22/2011   4:49 PM          0 iamcool.txt
-a---         12/22/2011   4:49 PM          0 neat.txt
-a---         12/22/2011   4:49 PM          0 thefourthfile.txt
-a---         12/22/2011   4:49 PM          0 uncool.txt


> mv oldplace newplace
> ls newplace
```

```
    Directory: C:\Users\zed\temp\newplace


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
-a---         12/22/2011   4:49 PM          0 awesome.txt


> ls


    Directory: C:\Users\zed\temp


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
d----         12/22/2011   4:52 PM            newplace
d----         12/22/2011   4:52 PM            something
-a---         12/22/2011   4:49 PM          0 iamcool.txt
-a---         12/22/2011   4:49 PM          0 neat.txt
-a---         12/22/2011   4:49 PM          0 thefourthfile.txt
-a---         12/22/2011   4:49 PM          0 uncool.txt


>
```

You Learned This

Moving files or, rather, renaming them. It's easy: give the old name and the new name.

Do More

- Move a file in the `newplace` directory to another directory, then move it back.

View a File (less, MORE)

To do this exercise you're going to do some work using the commands you know so far. You'll also need a text editor that can make plain text (.txt) files. Here's what you do:

- Open your text editor and type some stuff into a new file. On OS X this could be TextWrangler. On Windows this might be Notepad++. On Linux this could be `gedit`. Any editor will work.

- Save that file to your desktop and name it `test.txt`.
- In your shell use the commands you know to *copy* this file to your `temp` directory that you've been working with.

Once you've done that, complete this exercise.

Do This

Linux/OS X

Exercise 12 Session

```
$ less test.txt
[displays file here]
$
```

That's it. To get out of `less`, just type `q` (as in quit).

Windows

Exercise 12 Windows Session

```
> more test.txt
[displays file here]
>
```

WARNING! In the output I'm showing `[displays file here]` to "abbreviate" what that program shows. I'll do this when I mean to say, "Showing you the output of this program is too complex, so just insert what you see on your computer here and pretend I did show it to you." Your screen will not actually show this.

You Learned This

This is one way to look at the contents of a file. It's useful because, if the file has many lines, it will "page" so that only one screenful at a time is visible. In the *Do More* section, you'll play with this some more.

Do More

- Open your text file again and repeatedly copy-paste the text so that it's about 50–100 lines long.
- Copy it to your `temp` directory again so you can look at it.

- Now do the exercise again, but this time page through it. On UNIX you use the spacebar and `w` (the letter w) to go down and up. Arrow keys also work. On Windows, just hit the spacebar to page through.
- Look at some of the empty files you created.
- The `cp` command will overwrite files that already exist, so be careful when copying files around.

Stream a File (cat)

You're going to do some more setup for this one so you get used to making files in one program and then accessing them from the command line. With the same text editor from the last exercise, create another file named `test2.txt` but this time save it directly to your `temp` directory.

Do This

Linux/OS X

Exercise 13 Session

```
$ less test2.txt
[displays file here]
$ cat test2.txt
I am a fun guy.
Don't you know why?
Because I make poems,
that make babies cry.
$ cat test.txt
Hi there this is cool.
$
```

Windows

Exercise 13 Windows Session

```
> more test2.txt
[displays file here]
> cat test2.txt
I am a fun guy.
Don't you know why?
```

```
Because I make poems,
that make babies cry.
> cat test.txt
Hi there this is cool.
>
```

Remember that when I say `[displays file here]`, I'm abbreviating the output of that command so I don't have to show you exactly everything.

You Learned This

Do you like my poem? Totally going to win a Nobel. Anyway, you already know the first command, and I'm just having you check that your file is there. Then you `cat` the file to the screen. This command spews the whole file to the screen with no paging or stopping. To demonstrate that, I have you do this to the `test.txt`, which should just spew a bunch of lines from that exercise.

Do More

- Make a few more text files and work with `cat`.
- UNIX: Try `cat test.txt test2.txt` and see what it does.
- Windows: Try `cat test.txt,test2.txt` and see what it does.

Removing a File (rm)

In this exercise you learn how to remove (delete) a file using the `rm` command.

Do This

Linux/OS X

Exercise 14 Session

```
$ cd temp
$ ls
uncool.txt  iamcool.txt  neat.txt  something  thefourthfile.txt
$ rm uncool.txt
$ ls
```

```
iamcool.txt  neat.txt  something  thefourthfile.txt
$ rm iamcool.txt neat.txt thefourthfile.txt
$ ls
something
$ cp -r something newplace
$
$ rm something/awesome.txt
$ rmdir something
$ rm -rf newplace
$ ls
$
```

Windows

Exercise 14 Windows Session

```
> cd temp
> ls


    Directory: C:\Users\zed\temp


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
d----         12/22/2011   4:52 PM            newplace
d----         12/22/2011   4:52 PM            something
-a---         12/22/2011   4:49 PM          0 iamcool.txt
-a---         12/22/2011   4:49 PM          0 neat.txt
-a---         12/22/2011   4:49 PM          0 thefourthfile.txt
-a---         12/22/2011   4:49 PM          0 uncool.txt


> rm uncool.txt
> ls
```

```
    Directory: C:\Users\zed\temp


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
d----         12/22/2011   4:52 PM            newplace
d----         12/22/2011   4:52 PM            something
-a---         12/22/2011   4:49 PM          0 iamcool.txt
-a---         12/22/2011   4:49 PM          0 neat.txt
-a---         12/22/2011   4:49 PM          0 thefourthfile.txt


> rm iamcool.txt
> rm neat.txt
> rm thefourthfile.txt
> ls


    Directory: C:\Users\zed\temp


Mode                 LastWriteTime     Length Name
----                 -------------     ------ ----
d----         12/22/2011   4:52 PM            newplace
d----         12/22/2011   4:52 PM            something


> cp -r something newplace
> rm something/awesome.txt
> rmdir something
> rm -r newplace
> ls
>
```

You Learned This

Here we clean up the files from the last exercise. Remember when I had you try to `rmdir` on a directory with something in it? Well, that failed because you can't remove a directory with files in it. Instead you have to remove the file, or recursively delete all of its contents. That's what you did at the end of this example.

Do More

- Clean up everything in `temp` from all the exercises so far.
- Write in your notebook to be careful when running recursive remove commands on files.

Exiting Your Terminal (exit)

Do This

Linux/OS X

Exercise 23 Session

```
$ exit
```

Windows

Exercise 23 Windows Session

```
> exit
```

You Learned This

Your final exercise is how to exit a Terminal. Again, this is very easy, but I'm going to have you do more.

Do More

For your last set of exercises, I want you to use the help system to look up a set of commands you should research and learn how to use on your own.

Here's the list for UNIX:

- `xargs`
- `sudo`
- `chmod`
- `chown`

For Windows, look up these things:

- `forfiles`
- `runas`
- `attrib`
- `icacls`

Find out what these are, play with them, and then add them to your index cards.

Command Line Next Steps

You have completed the crash course. At this point you should be a barely capable shell user. There's a huge list of tricks and key sequences you don't know yet, and I'm going to give you a few final places to go research more.

UNIX Bash References

The shell you've been using is called bash. It's not the greatest shell but it's everywhere and has a lot of features so it's a good start. Here's a short list of links about bash you should visit:

Bash Cheat Sheet http://cli.learncodethehardway.org/bash_cheat_sheet.pdf created by Raphael and CC licensed.

Reference Manual http://www.gnu.org/software/bash/manual/bashref.html

PowerShell References

On Windows, there's really only PowerShell. Here's a list of useful links related to PowerShell:

Owner's Manual http://technet.microsoft.com/en-us/library/ee221100.aspx

Cheat Sheet http://www.microsoft.com/download/en/details.aspx?displaylang=en&id=7097

Master PowerShell http://powershell.com/cs/blogs/ebook/default.aspx

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