

ZED SHAW'S HARD WAY SERIES

The background features several concentric, glowing circles in shades of blue and green. Small white and blue dots are scattered along these circles, creating a sense of motion or orbits.

Learn **PYTHON** *the* **HARD WAY** FIFTH EDITION



ZED A. SHAW

LEARN PYTHON THE HARD WAY

Fifth Edition

Learn Python the Hard Way

Table of Contents

Cover

Half Title

Title Page

Copyright Page

Contents

Preface

Improvements in the Fifth Edition

Acknowledgments

MODULE 1 Getting Started in Python

Exercise 0 Gearing Up

General Instructions

Minimalist Start

Complete Instructions

Testing Your Setup

Learning the Command Line

Next Steps

Exercise 1 A Good First Program

What You Should See

Study Drills

Common Student Questions

The Blue Plus

Exercise 2 Comments and Pound Characters

What You Should See

Table of Contents

Study Drills

Common Student Questions

Exercise 3 Numbers and Math

What You Should See

Study Drills

Common Student Questions

Exercise 4 Variables and Names

What You Should See

Study Drills

Common Student Questions

Exercise 5 More Variables and Printing

What You Should See

Study Drills

Common Student Questions

Exercise 6 Strings and Text

What You Should See

Study Drills

Break It

Common Student Questions

Exercise 7 Combining Strings

What You Should See

Study Drills

Break It

Common Student Questions

Exercise 8 Formatting Strings Manually

What You Should See

Study Drills

Common Student Questions

Exercise 9 Multi-Line Strings

Table of Contents

What You Should See

Study Drills

Common Student Questions

Exercise 10 Escape Codes in Strings

What You Should See

Escape Sequences

Study Drills

Common Student Questions

Exercise 11 Asking People Questions

What You Should See

Study Drills

Common Student Questions

Exercise 12 An Easier Way to Prompt

What You Should See

Study Drills

Common Student Questions

Exercise 13 Parameters, Unpacking, Variables

If You Get Lost

Code Description

Hold Up! Features Have Another Name

What You Should See

Study Drills

Common Student Questions

Exercise 14 Prompting and Passing

What You Should See

Study Drills

Common Student Questions

Exercise 15 Reading Files

What You Should See

Table of Contents

Study Drills

Common Student Questions

Exercise 16 Reading and Writing Files

What You Should See

Study Drills

Common Student Questions

Exercise 17 More Files

What You Should See

Study Drills

Common Student Questions

MODULE 2 The Basics of Programming

Exercise 18 Names, Variables, Code, Functions

Exercise Code

What You Should See

Study Drills

Common Student Questions

Exercise 19 Functions and Variables

What You Should See

Study Drills

Common Student Questions

Exercise 20 Functions and Files

What You Should See

Study Drills

Common Student Questions

Exercise 21 Functions Can Return Something

What You Should See

Study Drills

Common Student Questions

Exercise 22 Strings, Bytes, and Character Encodings

Table of Contents

Initial Research

Switches, Conventions, and Encodings

Dissecting the Output

Dissecting the Code

Encodings Deep Dive

Breaking It

Exercise 23 Introductory Lists

Accessing Elements of a List

Practicing Lists

The Code

The Challenge

Fruit Challenge

Cars Challenge

Languages Challenge

Final Challenge

Exercise 24 Introductory Dictionaries

Key/Value Structures

Combining Lists with Data Objects

The Code

What You Should See

The Challenge

Fruit Challenge

Cars Challenge

Languages Challenge

Final Challenge

Exercise 25 Dictionaries and Functions

Step 1: Function Names Are Variables

Step 2: Dictionaries with Variables

Step 3: Dictionaries with Functions

Step 4: Deciphering the Last Line

Table of Contents

Study Drill

Exercise 26 Dictionaries and Modules

Step 1: Review of import

Step 2: Find the __dict__

Step 3: Change the __dict__

Study Drill: Find the Dunders

Exercise 27 The Five Simple Rules to the Game of Code

Rule 1: Everything Is a Sequence of Instructions

How can I get this output?

Where are these bytes stored?

Rule 2: Jumps Make the Sequence Non-Linear

Why is this backward?

Can a JUMP go forward?

Rule 3: Tests Control Jumps

What do you mean pop?

Wait, aren't tests like COMPARE_OP used in loops too?

Rule 4: Storage Controls Tests

Rule 5: Input/Output Controls Storage

Putting It All Together

The List of Byte Codes

dis() Is a Side Quest

Exercise 28 Memorizing Logic

The Truth Terms

The Truth Tables

Common Student Questions

Exercise 29 Boolean Practice

What You Should See

Study Drills

Common Student Questions

Exercise 30 What If

Table of Contents

What You Should See

dis() It

Study Drill

Common Student Questions

Exercise 31 Else and If

What You Should See

dis() It

Study Drills

Common Student Questions

Exercise 32 Making Decisions

What You Should See

dis() It

Study Drills

Common Student Questions

Exercise 33 Loops and Lists

What You Should See

dis() It

Study Drills

Common Student Questions

Exercise 34 While Loops

What You Should See

dis() It

Study Drills

Common Student Questions

Exercise 35 Branches and Functions

What You Should See

Study Drills

Common Student Questions

Exercise 36 Designing and Debugging

Table of Contents

From Idea to Working Code

Is This a Professional Process?

About the X/Y Non-Problem

Rules for If-Statements

Rules for Loops

Tips for Debugging

Homework

Exercise 37 Symbol Review

Keywords

Data Types

String Escape Sequences

Old-Style String Formats

Operators

Reading Code

Study Drills

Common Student Questions

MODULE 3 Applying What You Know

Exercise 38 Beyond Jupyter for Windows

Why Learn PowerShell?

What Is PowerShell?

PowerShell versus Cmdr

Starting Jupyter

Getting Help

Where Are You with start?

Going from Graphics to PowerShell

Where Are You with pwd?

Whats in Here?

Files, Folders, Directories, and Paths

Moving Around

Relative Paths

Creating and Destroying

Table of Contents

Flags and Arguments

Copy and Move

Environment Variables

Running Code

Common Key Sequences

Useful Developer Commands

Crash Landing

Exercise 39 Beyond Jupyter for macOS/Linux

macOS Troubles

Why Learn Bash or ZSH?

What Is Bash?

Starting Jupyter

Getting Help

Where Are You with open?

Going from Graphics to Bash

Where Are You with pwd?

Whats in Here?

Files, Folders, Directories, and Paths

Moving Around

Relative Paths

Creating and Destroying

Hidden Files

Flags and Arguments

Copy and Move

Environment Variables

Running Code

Common Key Sequences

Useful Developer Commands

Crash Landing

Exercise 40 Advanced Developer Tools

Managing conda Environments

Adding conda-forge

Table of Contents

Using pip

Using a .condarc

General Editing Tips

Going Further

Exercise 41 A Project Skeleton

Activate an Environment

Just Use cookiecutter

Building Your Project

Installing Your Project

Testing the Install

Remove test-project

Common Errors

Study Drills

Exercise 42 Doing Things to Lists

What You Should See

What Lists Can Do

When to Use Lists

Study Drills

Common Student Questions

Exercise 43 Doing Things to Dictionaries

A Dictionary Example

What You Should See

What Dictionaries Can Do

Study Drills

Common Student Questions

Exercise 44 From Dictionaries to Objects

Step 1: Passing a Dict to a Function

What You Should See

Step 2: talk inside the Dict

Table of Contents

Step 3: Closures

What You Should See

Step 4: A Person Constructor

Study Drills

Exercise 45 Basic Object-Oriented Programming

Pythons People

Using `dir()` and `__dict__`

About the Dot (`.`)

Terminology

A Word on `self`

Study Drills

Common Student Questions

Exercise 46 Inheritance and Advanced OOP

How This Looks in Code

About `class Name(object)`

Study Drills

Common Student Questions

Exercise 47 Basic Object-Oriented Analysis and Design

The Analysis of a Simple Game Engine

Write or Draw About the Problem

Extract Key Concepts and Research Them

Create a Class Hierarchy and Object Map for the Concepts

Code the Classes and a Test to Run Them

Repeat and Refine

Top Down versus Bottom Up

The Code for Gothon's from Planet Percal #25

What You Should See

Study Drills

Common Student Questions

Exercise 48 Inheritance versus Composition

Table of Contents

What Is Inheritance?

- Implicit Inheritance

- Override Explicitly

- Alter Before or After

- All Three Combined

The Reason for super()

- Using super() with __init__()

Composition

When to Use Inheritance or Composition

Study Drill

Common Student Questions

Exercise 49 You Make a Game

- Evaluating Your Game

- Function Style

- Class Style

- Code Style

- Good Comments

- Evaluate Your Game

Exercise 50 Automated Testing

- What Is the Purpose of Testing?

- How to Test Efficiently

- Install PyTest

- Simple PyTest Demo

- Running pytest

- Exceptions and try/except

- Getting Coverage Reports

- Study Drills

- Common Student Questions

MODULE 4 Python and Data Science

Exercise 51 What Is Data Munging?

Table of Contents

Why Data Munging?

The Problem

The Setup

How to Code

Process Example

Solution Strategies

Awesome ETL Tools

Study Drills

Exercise 52 Scraping Data from the Web

Introducing with

The Problem

The Setup

The Clue

Awesome Scraping Tools

Study Drills

Exercise 53 Getting Data from APIs

Introducing JSON

The Problem

The Setup

The Clue

Awesome API Tools

Study Drills

Exercise 54 Data Conversion with pandas

Introducing Pandoc

The Problem

The Setup

The Clue

Study Drills

Exercise 55 How to Read Documentation (Featuring pandas)

Table of Contents

Why Programmer Documentation Sucks

How to Actively Read Programmer Docs

Step #1: Find the Docs

Step #1 with pandas

Step #2: Determine Your Strategy

Step #2 with pandas

Step #3: Code First, Docs Second

Step #3 with pandas

Step #4: Break or Change the Code

Step #5: Take Notes

Step #6: Use It on Your Own

Step #6 with pandas

Step #7: Write About What You Learned

Step #7 with pandas

Step #8: Whats the Gestalt?

Step #8 with pandas

Reading My pandas Curriculum

Exercise 56 Using Only pandas

Make a Project

The Problem

The Setup

Study Drill

Exercise 57 The SQL Crash Course

What Is SQL?

The Setup

Fixing and Loading

Back Up Your Database

Create, Read, Update, Delete

SELECT

Date and Time

Table of Contents

INSERT

UPDATE

DELETE and Transactions

Math, Aggregates, and GROUP BY

Python Access

Exercise 58 SQL Normalization

What Is Normalization?

First Normal Form

Implementing 1NF

Creating Tables in SQL

Second Normal Form (2NF)

Implementing 2NF

Using Python

Querying 2NF Data

Querying with Joins

Study Drills

Exercise 59 SQL Relationships

One-to-Many (1:M)

One-to-Many in Python

One-to-Many Problem

Many-to-Many (M:M)

Many-to-Many Problem

One-to-One (1:1)

Attributed Relations

Querying M:M Tables

Your Last Study Drill

Exercise 60 Advice from an Even Older Programmer

Index