

# COMPUTER SCIENCE

## DISTILLED

LEARN THE ART OF SOLVING  
COMPUTATIONAL PROBLEMS

W LADSTON FERREIRA FILHO



code energy

Las Vegas

©2017 Wladston Viana Ferreira Filho

All rights reserved.

Edited by Raimondo Pictet.

Published by CODE ENERGY LLC

 hi@code.energy

 <http://code.energy>

 [http://twitter.com/code\\_energy](http://twitter.com/code_energy)

 <http://facebook.com/code.energy>

 304 S Jones Blvd # 401 Las Vegas NV 89107 

No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without permission from the publisher, except for brief quotations embodied in articles or reviews.

While every precaution has been taken in the preparation of this book, the publisher and the author assume no responsibility for errors or omissions, or for damages resulting from the use of the information contained herein.

Publisher's Cataloging-in-Publication Data

Ferreira Filho, Wladston.

Computer science distilled: learn the art of solving computational problems / Wladston Viana Ferreira Filho. — 1st ed.

x, 168 p. : il.

ISBN 978-0-9973160-0-1

eISBN 978-0-9973160-1-8

1. Computer algorithms. 2. Computer programming. 3. Computer science. 4. Data structures (Computer science). I. Title.

004 – dc22

2016909247

First Edition, February 2017.

*Friends are the family we choose for ourselves. This book is dedicated to my friends Rômulo, Léo, Moto and Chris, who kept pushing me to “finish the damn book already”.*

I know that two & two make four—and should be glad to prove it too if I could—though I must say if by any sort of process I could convert 2 & 2 into *five* it would give me much greater pleasure.

—LORD BYRON

*1813 letter to his future wife Annabella.  
Their daughter Ada Lovelace was the first programmer.*

# CONTENTS

PREFACE . . . . .	ix
1 BASICS . . . . .	1
1.1 Ideas . . . . .	1
1.2 Logic . . . . .	5
1.3 Counting . . . . .	13
1.4 Probability . . . . .	19
2 COMPLEXITY . . . . .	25
2.1 Counting Time . . . . .	27
2.2 The Big-O Notation . . . . .	30
2.3 Exponentials . . . . .	31
2.4 Counting Memory . . . . .	33
3 STRATEGY . . . . .	35
3.1 Iteration . . . . .	35
3.2 Recursion . . . . .	38
3.3 Brute Force . . . . .	40
3.4 Backtracking . . . . .	43
3.5 Heuristics . . . . .	46
3.6 Divide and Conquer . . . . .	49
3.7 Dynamic Programming . . . . .	55
3.8 Branch and Bound . . . . .	58
4 DATA . . . . .	65
4.1 Abstract Data Types . . . . .	67
4.2 Common Abstractions . . . . .	68
4.3 Structures . . . . .	72
5 ALGORITHMS . . . . .	85
5.1 Sorting . . . . .	86
5.2 Searching . . . . .	88
5.3 Graphs . . . . .	89
5.4 Operations Research . . . . .	95