Introduction to Coding Theory

Error-correcting codes constitute one of the key ingredients in achieving the high degree of reliability required in modern data transmission and storage systems. This book introduces the reader to the theoretical foundations of error-correcting codes, with an emphasis on Reed–Solomon codes and their derivative codes.

After reviewing linear codes and finite fields, the author describes Reed–Solomon codes and various decoding algorithms. Cyclic codes are presented, as are MDS codes, graph codes, and codes in the Lee metric. Concatenated, trellis, and convolutional codes are also discussed in detail. Homework exercises introduce additional concepts such as Reed–Muller codes, and burst error correction. The end-of-chapter notes often deal with algorithmic issues, such as the time complexity of computational problems.

While mathematical rigor is maintained, the text is designed to be accessible to a broad readership, including students of computer science, electrical engineering, and mathematics, from senior-undergraduate to graduate level.

This book contains over 100 worked examples and over 340 exercises—many with hints.

Ron M. Roth joined the faculty of Technion—Israel Institute of Technology (Haifa, Israel) in 1988, where he is a Professor of Computer Science and holds the General Yaakov Dori Chair in Engineering. He also held visiting positions at IBM Research Division (San Jose, California) and, since 1993, at Hewlett–Packard Laboratories (Palo Alto, California). He is a Fellow of the Institute of Electrical and Electronics Engineers (IEEE).

Introduction to Coding Theory

Ron M. Roth

Technion—Israel Institute of Technology
Haifa, Israel

CAMBRIDGE
UNIVERSITY PRESS

Cambridge University Press
Cambridge, New York, Melbourne, Madrid, Cape Town, Singapore, São Paulo

Cambridge University Press
The Edinburgh Building, Cambridge CB2 2RU, UK
Published in the United States of America by Cambridge University Press, New York

www.cambridge.org
Information on this title: www.cambridge.org/9780521845045

First published 2006

Printed in the United Kingdom at the University Press, Cambridge

A catalog record for this book is available from the British Library

Library of Congress Cataloging in Publication Data

ISBN-13 978-0-521-84504-5 hardback
ISBN-10 0-521-84504-1 hardback

Contents