Contents

PREFACE TO THE FIRST RUSSIAN EDITION vii

PREFACE TO THE SECOND RUSSIAN EDITION xi

PREFACE TO THE THIRD RUSSIAN EDITION xv

PREFACE TO THE ENGLISH EDITION xix

CHAPTER 1 **Probability**

1.1 Definition of Probability. Random Events and Random Variables 1

1.2 Properties of Probability. Addition and Multiplication of Events. Incompatible and Independent Events 7

1.3 Conditional Probability 20

1.4 The Variance of a Random Variable. Chebyshev's Inequality and the Law of Large Numbers 26

1.5 Algebra of Events and General Definition of Probability 36

CHAPTER 2 **Entropy and Information**

2.1 Entropy as a Measure of the Amount of Uncertainty 44

2.2 The Entropy of Compound Events. Conditional Entropy 59

2.3 The Concept of Information 73

2.4 Entropy (revisited). The Determination of Entropy from its Properties 93

CHAPTER 3 **The Solution of Certain Logical Problems by Calculating Information**

3.1 Simple Examples 101

3.2 The Counterfeit Coin Problem 108

3.3 Discussion 121

CHAPTER 4 **Application of Information Theory to the Problem of the Information Transmission Through Communication Channels**

4.1 Basic Concepts. Efficiency of a Code 137

4.2 Shannon-Fano and Huffman Codes. Fundamental Coding Theorem 147

4.3 Entropy and Information of Various Messages Encountered in Practice 177

4.4 Transmission of Information over Noisy Channels 258

4.5 Error-Detecting and Error-Correcting Codes 304

APPENDIX I **Properties of Convex Functions** 347

APPENDIX II **Some Algebraic Concepts** 364

APPENDIX III **Table of Values of $-p \log p$** 392

APPENDIX IV **Short Table of the Function**

$h(p) = -p \log p - (1 - p) \log (1 - p)$ 395

References 397

Name Index 409

Subject Index 413