Contents

List of Figures x

Foreword to the Original French Edition xi

Translator's Note xiii

Lecture 1. Introduction, Definitions, and Examples 1
Generalization to the problem of admitting n students to m universities 4
Generalization: Incomplete lists 5
Conversion of incomplete lists to complete lists 6
Exercises 7

Lecture 2. Existence of a Stable Matching: The Fundamental Algorithm 9
Description of the algorithm 9
Proof of the algorithm 12
Conflict of interest 14
Proof of the theorem stated in the first lecture 15
Analysis of the algorithm 15
Exercises 15

Lecture 3. Principle of Deferred Decisions: Coupon Collecting 17
The game of clock solitaire 17
Study of the mean number of proposals 19
Simplification of the problem 19
Coupon collection 21
Conclusion 22
Partial amnesia 23
Exercises 24

Lecture 4. Theoretical Developments: Application to the Shortest Path 25
1. Theory of discrete probability 25
Generating functions 25

Significance of the variance 26
Independent random variables 26
Cumulative distribution 27
2. Variance in the coupon-collector's problem 28
An improvement of Chebyshev's inequality 29
3. Fundamental algorithm: study of the least favorable case 30
4. Shortest path in a graph 31
Description of the algorithm 31
Exercises 35

Lecture 5. Searching a Table by Hashing; Mean Behavior of the Fundamental Algorithm 37
Hashing 37
Mean time to search for information 38
Connection with the matching problem 39
Asymptotic value of the mean number of proposals in the fundamental algorithm 40
Recapitulation 42
Summary 43
Final remark on the subject of hashing 43

Lecture 6. Implementing the Fundamental Algorithm 45
Improvements 46
Initialization of the Table P 47
Arranged marriage between A and a 48
Generalization to several arranged marriages 50
Search for a fair stable matching 50
Exhaustive search of stable matchings 51
Passage to a non-recursive algorithm 53

Lecture 7. Research Problems 55
Intersection of intervals 61
Résumé of the lectures 65

Annotated Bibliography 67
Stable matchings 67
Coupon-collector's problem 67
Shortest-path problem 67
Hashing 67
Data structures and control structures 68
Algorithm analysis 68

Appendix A. Later Developments 69

Appendix B. Solutions to Exercises 71
Exercises of Lecture 1 71
Exercises of Lecture 2 71
Exercises of Lecture 3 71
Exercises of Lecture 4 71

Index 73