



# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	This Dissertation . . . . .	2
1.2	Mathematical Foundations . . . . .	3
1.2.1	Sets . . . . .	3
1.2.2	Alphabets and Strings . . . . .	4
1.2.3	Functions and Constants . . . . .	4
1.2.4	Combinatorics . . . . .	6
1.2.5	Probability Theory . . . . .	6
1.2.6	Graphs . . . . .	7
1.3	Online Computation . . . . .	9
1.4	Online Computation With Advice . . . . .	11
1.5	The String Guessing Problem . . . . .	14
<b>2</b>	<b>k-SERVER on a Path</b>	<b>17</b>
2.1	Preliminaries . . . . .	20
2.2	2-PATHSERVER on a Path of Length 2 . . . . .	23
2.3	2-PATHSERVER on Finite Paths . . . . .	28
<b>3</b>	<b>Disjoint Path Allocation</b>	<b>37</b>
3.1	Reduction from 2-GUESS . . . . .	39
3.2	A Lower Bound Without Using a Reduction . . . . .	43
<b>4</b>	<b>Graph Searching and Exploration</b>	<b>55</b>
4.1	Preliminaries . . . . .	58
4.2	Graph Searching . . . . .	59
4.2.1	Optimality . . . . .	59
4.2.2	Lower Bound . . . . .	60
4.2.3	Upper Bound . . . . .	64
4.3	Graph Exploration . . . . .	71
4.3.1	Sun Graphs . . . . .	71
4.3.2	Reduction from String Guessing . . . . .	74
4.3.3	Further Adjustments . . . . .	80



<b>5</b>	<b>Probabilistic Adversary</b>	<b>83</b>
5.1	Preliminaries . . . . .	85
5.2	Monolog Model . . . . .	88
5.2.1	Upper Bound . . . . .	88
5.2.1.1	The Algorithm . . . . .	89
5.2.1.2	Analysis of Total Hamming Weights . . . . .	89
5.2.1.3	Analysis of the Algorithm . . . . .	97
5.2.1.4	Optimality . . . . .	104
5.2.2	Lower Bound . . . . .	106
5.2.3	Comparing Upper and Lower Bound . . . . .	122
5.3	Dialog Model . . . . .	123
5.3.1	Upper Bound . . . . .	124
5.3.2	Lower Bound . . . . .	127
5.3.2.1	Bound for Odd $k$ . . . . .	127
5.3.2.2	Generalization for General $k$ . . . . .	135
5.3.3	Comparing Upper and Lower Bound . . . . .	139
5.4	Comparing Monolog and Dialog Model . . . . .	140
5.5	Reductions in the Probabilistic Setting . . . . .	141
<b>6</b>	<b>Conclusion</b>	<b>147</b>
	<b>Bibliography</b>	<b>151</b>