

Contents

1	Introduction	1
1.1	Motivation	4
1.2	Related Work	5
2	Preliminaries	9
2.1	The Standard Testing Model	9
2.2	Combinatorial Properties	11
2.3	The Power of Uniform Sampling	12
2.4	Two Probability Lemmas	15
3	Testing Algorithms for Geometric Properties	17
3.1	Intersection of Geometric Objects	17
3.2	Convex Position	20
3.3	Euclidean Minimum Spanning Tree	28
3.3.1	Basic Definitions and Input Representation	29
3.3.2	Testing EMSTs in Well-Shaped Graphs	31
3.3.3	A Simple Property Tester in Well-Shaped Graphs	34
3.3.4	An Improved Property Tester in Well-Shaped Graphs	37
3.3.5	A Property Tester in Graphs with Maximum Degree 5	43
3.3.6	A Property Tester in General Graphs	48
4	Efficient Property Testers	51
4.1	Abstract Combinatorial Programs	51
4.1.1	Testing Abstract Combinatorial Programs	53
4.2	Property Testing vs. Testing Abstract Combinatorial Programs	56
4.3	Clustering Problems	57
4.3.1	Radius clustering	58
4.3.2	Diameter clustering	60
4.4	Reversal Distance	64
4.5	Property Testing vs. Testing Abstract Combinatorial Programs (<i>continued</i>)	68
4.6	Graph Coloring	70
4.7	Hypergraph Coloring	73
4.8	Testable Hereditary Graph Properties	78

5	Testing Algorithms with Geometric Queries	83
5.1	Property Testing with Range Queries	83
5.2	Testing Convex Position with Range Queries	85
5.3	Map Labeling	89
5.4	Clustering Problems	93
6	Property Testing and Moving Data	97
6.1	Soft Kinetic Data Structures	98
6.1.1	Analysis of Soft Kinetic Data Structures	100
6.1.2	Discussion of The Model	101
6.2	Basic Soft Kinetic Data Structures	101
6.2.1	Sorted Sequences	101
6.2.2	Balanced Search Trees	105
6.2.3	Range Trees	108
6.2.4	Euclidean Minimum Spanning Trees	111
7	Conclusions	113