Contents

1	Intro	oduction	5
	1.1	Outsourced Computation	6
	1.2	Multi-Party Computation	7
	1.3	MPC Applications	8
	1.4	Overview	14
2	Defi	ning Multi-Party Computation	15
	2.1	Notations and Conventions	15
	2.2	Basic Primitives	17
	2.3	Security of Multi-Party Computation	19
	2.4	Specific Functionalities of Interest	28
	2.5	Further Reading	31
3	Fun	damental MPC Protocols	32
	3.1	Yao's Garbled Circuits Protocol	33
	3.2	Goldreich-Micali-Wigderson (GMW) Protocol	37
	3.3	BGW protocol	42
	3.4	MPC From Preprocessed Multiplication Triples	44
	3.5	Constant-Round Multi-Party Computation: BMR	47
	3.6	Information-Theoretic Garbled Circuits	50

	3.7	Oblivious Transfer	4
	3.8	Custom Protocols	9
	3.9	Further Reading	3
4	lmp	lementation Techniques 65	5
	4.1	Less Expensive Garbling	5
	4.2	Optimizing Circuits	4
	4.3	Protocol Execution	9
	4.4	Programming Tools	3
	4.5	Further Reading	5
5	Obli	ivious Data Structures 88	3
	5.1	Tailored Oblivious Data Structures	9
	5.2	RAM-Based MPC	3
	5.3	Tree-Based RAM-MPC	4
	5.4	Square-Root RAM-MPC	7
	5.5	Floram	9
	5.6	Further Reading	2
6	Mali	icious Security 103	3
	6.1	Cut-and-Choose	3
	6.2	Input Recovery Technique	8
	6.3	Batched Cut-and-Choose	0
	6.4	Gate-level Cut-and-Choose: LEGO	1
	6.5	Zero-Knowledge Proofs	4
	6.6	Authenticated Secret Sharing: BDOZ and SPDZ	7
	6.7	Authenticated Garbling	2
	6.8	Further Reading	5
7	Alte	rnative Threat Models 123	7
	7.1	Honest Majority	8
	7.2	Asymmetric Trust	2
	7.3	Covert Security	4
	7.4	Publicly Verifiable Covert (PVC) Security	8