Contents

Pre	<i>page</i> xiii		
1	Intro	duction	1
	1.1	The New Field of Complex Networks	1
		1.1.1 Realms of Application and Empirical	
		Evidence	1
		1.1.2 An Interdisciplinary Approach	8
	1.2	Socioeconomic Networks and the Issue of	
		Embeddedness	10
		1.2.1 Labor Markets	11
		1.2.2 Technological Diffusion	13
		1.2.3 Social Movements and Group Recruitment	15
		1.2.4 Informal Insurance	15
		1.2.5 Peer Effects in (Anti)Social Behavior	16
		1.2.6 Trade and Trust	16
		1.2.7 R&D Interfirm Partnerships	17
		1.2.8 Organizations, Networks, and "Network	
		Organizations"	18
	1.3	The Complexity of Social Networks	19
	1.4	Diffusion, Search, and Play in Social Networks: An	
		Overview of What Follows	23
2	Com	plex Networks: Basic Theory	28
	2.1	Preliminaries	28
		2.1.1 Networks: Definition and Representation	28
		2.1.2 Some Types of Networks	29
		2.1.3 Network Characteristics	30
	2.2	Poisson Random Networks	36
	2.3	General Random Networks	43
	2.4	Small Worlds	54
	2.5	Scale-Free Networks	64

x Contents

3	Epid	emic Diffusion	75		
	3.1	Alternative Theoretical Scenarios	75		
	3.2	The SI Model: Resilient Diffusion	76		
	3.3	The SIR Model: The Reach of Diffusion Waves	84		
	3.4	The SIS Model: Long-Run Prevalence	87		
		3.4.1 Long-Run Prevalence in Regular Networks	88		
		3.4.2 Long-Run Prevalence in Random Networks	90		
	3.5	Diffusion Policy	95		
		3.5.1 Immunization	95		
		3.5.2 Cure	98		
	3.6	Structured Networks	101		
4	Neis	hborhood Effects in Diffusion and Play	109		
	4.1	Neighborhood-Dependent Diffusion in Random Networks	109		
		4.1.1 Diffusion Waves under Permanent Adoption	110		
		4.1.2 Long-Run Prevalence under Temporary			
		Adoption	118		
	4.2	Structured Networks: The Role of Cohesiveness	123		
	4.3	Strategic Adjustment in Large Coordination Setups	132		
		4.3.1 Lattice Networks	134		
		4.3.2 Tree Networks	139		
	4.4	Persistent Innovation	145		
5	Searching in Social Networks				
	5.1	Search in Random Networks	156		
	5.2	Search in Networks with an Underlying Structure	162		
		5.2.1 Lattice Networks	162		
		5.2.2 Small Worlds	165		
		5.2.3 Hierarchic Structures	169		
	5.3	Search and Congestion	174		
		5.3.1 Network Architecture and Performance	175		
		5.3.2 Optimal Network Design	183		
		5.3.3 Networks with a Hierarchic Backbone	187		
6	Search, Diffusion, and Play in Coevolving Networks				
	6.1	Game-Theoretic Models of Network Formation	195		
		6.1.1 Leading Scenarios	196		
		6.1.2 A Static Equilibrium Approach	199		
		6.1.3 A Dynamic Long-Run Approach	209		
	6.2	Network-Based Search for Partners in a Changing			
		Environment	215		
		6.2.1 A Growing Environment	216		
		6.2.2 A Volatile Environment	226		
	6.3	Network Evolution and Play	236		
		6.3.1 Playing a Coordination Game	237		
		6.3.2 Other Strategic Setups	244		

	6.4 Incentives and Complexity in Social Networks	254
	Afterword	256
A	Generating Functions	259
В	The Ising Model	263
C	Mean-Field Theory C.1 The Mean-Field Ising Model C.2 Mean-Field Analysis of Evolving Networks	268 268 272
Bil	275	
Inc	291	

хi

Contents