

1. Record Nr.	UNINA9910457222503321
Titolo	Complex systems [[electronic resource] ] : Ecole d'ete de Physique des Houches, session LXXXV, 3-28 July 2006 ; Ecole thematique du CNRS / / edited by Jean-Phillippe Bouchaud, Marc Mezard and Jean Dalibard
Pubbl/distr/stampa	Boston, MA, : Elsevier, 2007
ISBN	1-281-05734-7 9786611057343 0-08-055059-2
Edizione	[1st ed.]
Descrizione fisica	1 online resource (527 p.)
Collana	Les Houches
Altri autori (Persone)	BouchaudJean-Philippe <1962-> MezardMard DalibardJ
Disciplina	003 003.7
Soggetti	System analysis Computational complexity Electronic books.
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	Description based upon print version of record.
Nota di bibliografia	Includes bibliographical references.
Nota di contenuto	Front cover; Complex Systems; Copyright page; Previous sessions; Organizers; Lecturers; Seminar Speakers; Participants; Auditors; Preface; Contents; Course 1. Introduction to phase transitions in random optimization problems; 1. Introduction; 2. Basic concepts: overview of static phase transitions in K-XORSAT; 3. Advanced methods (I): replicas; 4. Advanced methods (II): cavity; 5. Dynamical phase transitions and search algorithms; 6. Conclusions; Appendix A. A primer on large deviations; Appendix B. Inequalities of first and second moments Appendix C. Corrections to the saddle-point calculation of References; Course 2. Modern coding theory: the statistical mechanics and computer science point of view; 1. Introduction and outline; 2. Background: the channel coding problem; 3. Sparse graph codes; 4. The decoding problem for sparse graph codes; 5. Belief Propagation beyond coding theory; 6. Belief Propagation beyond the binary

symmetric channel; 7. Open problems; Appendix A. A generating function calculation; References; Course 3. Mean field theory of spin glasses: statics and dynamics; 1. Introduction  
 2. General considerations 3. Mean field theory; 4. Many equilibrium states; 5. The explicit solution of the Sherrington Kirkpatrick model; 6. Bethe lattices; 7. Finite dimensions; 8. Some other applications; 9. Conclusions; References; Course 4. Random matrices, the Ulam Problem, directed polymers & growth models, and sequence matching; 1. Introduction; 2. Random matrices: the Tracy-Widom distribution for the largest eigenvalue; 3. The longest common subsequence problem (or the Ulam problem); 4. Directed polymers and growth models; 5. Sequence matching problem; 6. Conclusion; References  
 Course 5. Economies with interacting agents 1. Introduction; 2. Models of segregation: a physical analogy; 3. Market relations; 4. Financial markets; 5. Contributions to public goods; 6. Conclusion; References; Course 6. Crackling noise and avalanches: scaling, critical phenomena, and the renormalization group; 1. Preamble; 2. What is crackling noise?; 3. Hysteresis and Barkhausen noise in magnets; 4. Why crackling noise?; 5. Self-similarity and its consequences; References; Course 7. Bootstrap and jamming percolation; 1. Introduction; 2. Bootstrap Percolation (BP); 3. Jamming Percolation (JP)  
 4. Related stochastic models References; Course 8. Complex networks; 1. Introduction; 2. Network expansion and the small-world effect; 3. Degree distributions; 4. Further directions; References; Course 9. Minority games; 1. Introduction; 2. The minority game: definition and numerical simulations; 3. Exact solutions; 4. Application and extensions; 5. Conclusions; References; Course 10. Metastable states in glassy systems; 1. Introduction; 2. Mean-field Spin Glasses; 3. The complexity; 4. Supersymmetry breaking and structure of the states; 5. Models in finite dimension; 6. Conclusion; References  
 Course 11. Evolutionary dynamics

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Sommario/riassunto

There has been recently some interdisciplinary convergence on a number of precise topics which can be considered as prototypes of complex systems. This convergence is best appreciated at the level of the techniques needed to deal with these systems, which include: 1) A domain of research around a multiple point where statistical physics, information theory, algorithmic computer science, and more theoretical (probabilistic) computer science meet: this covers some aspects of error correcting codes, stochastic optimization algorithms, typical case complexity and phase transitions, constr

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