Possible Topics for a Short 745 Project / 20 min Seminar

1. Complexity and Chaos
Santa Fe Institute Reports, Scientific American, New Scientist
http://en.wikipedia.org/wiki/Complex_system
http://dictionary.laborlawtalk.com/Complex_system
Adapting to Complexity Scientific American Jan 1993
From Complexity to Perplexity Scientific American June 1995
http://www.santafe.edu/

2. The Edge of chaos in Cellular Automata
Internet for Langton's Lambda Criterion
A New Kind of Science Stephen Wolfram for class 4 automata
http://www.wolframscience.com/nksonline/toc.html
Waldrop Mitchell (1993) Complexity Penguin.
Schroeder M. (1993) Fractals, Chaos and Power Laws ISBN 0-7167-2136-8.
http://math.hws.edu/xJava/CA/EdgeOfChaosCA.html
http://en.wikipedia.org/wiki/Christopher_Langton
http://www-users.cs.york.ac.uk/~susan/bib/nf/l/langton.htm
http://math.hws.edu/xJava/CA/EdgeOfChaos.html
http://www.let.rug.nl/~kleiweg/ca/ca.html
http://classes.yale.edu/fractals/CA/CAPatterns/Langton/Langton.html
http://psoup.math.wisc.edu/archive/recipe51.html

3. Self-organized Criticality
http://en.wikipedia.org/wiki/Self-organized_criticality
Bak, P. (1996). How Nature Works: The Science of Self-Organized Criticality. New York: Copernicus. ISBN 0-387-94791-4.
Bak, P., Tang, C. and Wiesenfeld, K. (1988). "Self-organized criticality". Physical Review A 38: 364–374.

4. Zipf's Law and languages
Schroeder M. (1993) Fractals, Chaos and Power Laws ISBN 0-7167-2136-8.
New Scientist article on Dolphins http://www.peterussell.com/dolphin/DolphinLang.php
http://www.ee.columbia.edu/~xanadu/papers/suzuki05.pdf
http://faculty.vetmed.ucdavis.edu/faculty/bjmccowan/Pubs/McCowanetal.2005.pdf

5. L-systems and Fractal Plant Form
Prusinkiewicz P., Lindenmayer (1990) The Algorithmic Beauty of Plants Springer-Verlag 1990
http://algorithmicbotany.org/papers/#abop
Heinz-Otto Peitgen, Hartmut Jurgens, Dietmar Saupe (2004) Chaos and fractals : New frontiers of science New York: Springer

6. Cellular Automata and Mollusc Shell Patterns
Kusch I, Markus M 1996 Mollusc Shell Pigmentation: Cellular automation simulations and evidence for undecidability J Theor Biol 178 333-340. PDF (2486 K)
Hans Meinhardt (1995) Algorithmic beauty of sea shells with contributions and images by Przemyslaw Prusinkiewicz and Deborah R. Fowler Berlin ; New York : Springer-Verlag.

7. Time-scale Calculus
Taming nature's numbers New Scientist 19 July 2003
http://web.ecs.baylor.edu/faculty/marks/Research/TimeScales/index.htm
(includes Matlab toolbox)

8. Fractal and Chaotic Music and Automata Music
Schroeder M. (1993) Fractals, Chaos and Power Laws ISBN 0-7167-2136-8 for 1/f noise in music
http://tones.wolfram.com/
http://members.aol.com/dspondike/fractal.html
http://www.fractalmusiclab.com/
http://csounds.com/
http://www.audiosynth.com/

9. Fractal Art
http://www.enchgallery.com/fractals/fractal%20gallery%204.htm
http://www.superliminal.com/fractals/bbrot/bbrot.htm
http://www3.sympatico.ca/olanglois/fractal/
http://www.fractal.org/Julius-Ruis-Gallery/Index-Gallery.htm

10. Attractor Reconstruction and Takens Theorem
Heinz-Otto Peitgen, Hartmut Jurgens, Dietmar Saupe (2004) Chaos and fractals : New frontiers of science New York: Springer

11. Chaos and predicition in Meteorology
Stewart I. (1988), Does God Play Dice? Basil Blackwell, Oxford.
Heinz-Otto Peitgen, Hartmut Jurgens, Dietmar Saupe (2004) Chaos and fractals : New frontiers of science New York: Springer

12. Experiments in Quantum Chaos
Articles provided, including Scientific American and science news
Gutzwiller, M.C. (1992). Quantum chaos. Sci. Am. 266, 78 - 84.
http://www.dhushara.com/book/quantcos/qchao/quantc.htm
Zhang et. al. 1990 Quantum fluctuations in classical chaos Physical Review A 42/6 3646

13. Modeling Population Dynamics including Endangered Species
The Sixth Extinction, Leakey and Lewin.
Peitgen H.O. & Richter P.H., (1986), The Beauty of Fractals Springer-Verlag, Berlin. DC

14. Three dimensional fractal modelling of Natural Forms: Mountains, Landscapes, Clouds
The Science of Fractal Images. Peitgen H.O. et.al.
Chaos and Fractal Peitgen et. al.

15. Conservative chaos, planetary orbits and cantori
Schuster H.J., (1986), Deterministic Chaos , Springer-Verlag, Berlin. DC

16. Fractals in Stochastic Processes and 1/f Noise
Schroeder M. (1993) Fractals, Chaos and Power Laws ISBN 0-7167-2136-8.

17. The Skeleton of Turbulence
Turbulence: Finding order in chaos 01 December 2007 NewScientist
Mathur et. al. (2007) Uncovering the Lagrangian Skeleton of Turbulence Physical Review Letters 98, 144502

18. Chaos in Electronic Systems
Matsumoto, Takahashi 1987 Proceedings of the IEEE 75/8 1033

19. Chaos in Pulsed Lasers
http://ezinearticles.com/?Creating-Artificial-Time-in-a-Vacuum-With-Pulsed-Lasers&id=26011
L. de B. Oliveira-Neto, Glauber J. F. T. da Silva, A. Z. Khoury, and J. R. Rios Leite (1996) Average intensity and bifurcations in a pulsed laser Phys. Rev. A 54, 3405 - 3408

20. Autocatalytic Chemical Systems
http://www.faidherbe.org/site/cours/dupuis/oscil.htm

21. Chaos and Prediction in Financial Markets
Dimitris N. Chorafas & Robert L. Trippi Chaos Theory on the Financial Markets: Applying Fractals, Fuzzy Logic, Genetic Algorithms, Swarm Simulation and the Monte Carlo Method to Manage Market Chaos and Volatility ISBN: 9781557385550. McGraw Hill
http://ideas.repec.org/a/bla/jfinan/v46y1991i5p1839-77.html