Freshman Seminar in the Natural Sciences. University of Miami. Fall 2009

Syllabus for FNS 193: Complexity Science: Two's Company, Three is a Crowd

Professor Neil Johnson, Department of Physics

Class: Tues./Thurs., 12:30-1:45; Section Q

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Office Hours: Wednesday 1:25 pm-2:15 pm and by appointment at other times

Teacher Assistant (TA): TBA

Freshman Seminars are designed to be:

• Small-group classes with no more than 18 students

• Open only to freshmen in all undergraduate schools and colleges

• Courses that develop your abilities in intellectual inquiry and critical thinking

• Classes that hone your skills in effective oral and written communication

• Offered on a wide range of interesting topics

• Intended to expose students to real investigations in the methods and materials of a particular discipline

• Often interdisciplinary in nature and/or experimental in subject and design

• A way to explore new interests; no prior background is expected

• An opportunity to develop a mentoring relationship with faculty.

• Three-credit courses fulfilling one of the general education requirements in the natural sciences (i.e. Natural World).
What is Complexity and what can it do for us?

What do traffic jams, climate change, jazz harmonies, stock market crashes, cancer, Alzheimer’s disease, wars and quantum physics all have in common? They are all examples of complexity, or the science of “two’s company, three is a crowd”. Put more formally, Complexity Science can be seen as the study of the phenomena which emerge from a collection of interacting objects—and a crowd is a perfect example, being a phenomenon which emerges from a collection of interacting people. Everyday examples of crowds include collections of commuters, financial market traders, human cells, or insurgents and the associated crowd-like phenomena which emerge are traffic jams, market crashes, cancer tumors, and guerrilla wars. Even extreme weather conditions such as floods, heat waves, hurricanes, and droughts can be seen as crowd effects, emerging from the many interacting packets of water and air in the oceans and atmosphere. The course takes students on a journey through the science of complex systems, to understand why complexity looks set to trigger the next great wave of advances in our intellectual and practical understanding of our world—from medicine and biology through to economics and sociology. Along the way, we will uncover how and why the world seems to function at the edge of order and chaos, and why complexity lies at the heart of the Universe itself. We will also discover why scientists find it so hard to develop a theory of complexity, and experience first-hand the breath-taking speed at which boundaries between academic disciplines are being breached in this quest. In terms of its mechanics, the course will combine presentations, experimental demonstrations, research projects and written assignments. As part of the midterm or final, students may for example set up an experiment to measure the temporal dynamics of crowd formation in the Starbucks on campus, to see if the observed fluctuations are similar to those reported for other complex systems (e.g. vehicle and/or Internet traffic). Similarly, students may wish to measure and analyze line choice in the UM’s Food Court, to see how collective outcomes relate to local and global information about line-lengths.

Complexity is all about understanding the collective behaviors of groups of interacting objects (e.g. people, cars, animals, cells, viruses). As a science, it therefore has its roots in non-equilibrium, many-body statistical physics—however no prior knowledge of physics, math or statistics is required for this course. Nor does this course repeat any of the standard material presented in undergraduate or graduate physics courses. In terms of generic skills, the course will develop the skills of critical thinking, reasoning and analysis, promote effective communication (verbal and written), and expose students to discipline specific methodologies, awareness of research design, and, above all, experience the excitement of being part of a powerful research institution with an ambitious interdisciplinary vision.

About the Instructor: Neil Johnson (Ph.D., Harvard University, 1989) has been a tenured full-time professor in Physics at University of Miami since 2007. Prior to this, he was a tenured full-time Professor of Physics at University of Oxford in England, joining the faculty there in 1992. He heads up a new inter-disciplinary research group in Complexity at UM looking at collective behavior and emergent properties in a wide range of real-world Complex Systems from the physical, biological, medical domains through to social and even financial domains. Professor Johnson has written more than 170 research articles in international journals, and has published two books: Financial Market Complexity (2003) and ‘Two’s Company, Three is Complexity’ (2007). He is the editor for the book series Complex Systems and Inter-disciplinary Science by World Scientific Press, and is the Physics Section Editor for the journal Advances in Complex Systems. He previously served as an Editor of International Journal of Theoretical and Applied Finance.
**Course background, aims, potential outcomes and details of implementation**

Instead of the typical course approach of studying material that is well established with proven results, we will take the opportunity in this course to explore the cutting-edge between what is known and what is not known. The science of Complexity sits right at this edge, and covers across a broad range of interdisciplinary topics of personal, national and international importance. Arguably, Complexity is the defining idea of what makes the unknown aspects of important global issues things that we would like to know about, so ‘unknown’. There is no single book that will tell us the story of Complexity Science – instead we have to become investigative reporters and researchers ourselves. It is crucially important, therefore, for you to develop your communication skills beyond a single discipline or book. These skills will help in all sorts of ways in your future careers, whatever you decide to do. In particular, we will integrate into the course material, opportunities to learn the following:

1. How to access a wide range of cutting-edge research papers from various academic disciplines. To achieve this, there will be one early class held in the library and led by the library specialist in this area

2. How to discuss and analyze important issues and results individually, and working in groups. In particular, how to prepare class presentations and lead class discussions on issues in the media, popular science etc. To achieve this, we will mix up the formats for class and assignments to give exposure to a range of working environments.

3. How to write effectively on these topics, using both 'low-stakes' writing and 'high-stakes' writing. To achieve this, we will mix up casual and formal writing. To initiate and help explain this, there will be an early class held by the director of UM's Writing Center.

4. How to investigate the real world using computer simulations. To achieve this, we will use the program NetLogo to explore the world of complexity using hands-on computer experiments. The webpage for NetLogo is http://ccl.northwestern.edu/netlogo/

5. How to integrate multi-media content (e.g. preparing Wikis) so that it aids the learning process.

**The more you put into this course, the more you will get out.** We can together make this a unique experience that will benefit your future activities in many different ways. The outcomes may include changes in your knowledge, skills, intellectual behavior including:

1. Enhancing the academic climate for you to learn

2. Strengthening your general studies curriculum

3. Developing creative approaches to experimental learning

4. Enhancing your critical thinking skills

5. Introducing innovative teaching and learning strategies

6. Increasing your engagement in learning

7. Exploring imaginative ways to use technology in the course

In all cases, these goals and their evaluation are directly aimed at improving the quality of learning. In a nutshell, this course (and College in general) is not just about 'what' you learn, but 'how' you learn it. In fact, the 'what' includes the 'how' if you see what I mean.
Given this, I will make it **my job** to:

1. present the course material effectively
2. stimulate your interest in the course
3. interact with you in order to address your queries and concerns, whenever reasonably possible given my other UM commitments
4. make exams and assignments reflect the goals and objectives of the course and assess what you have learned in this course
5. make sure the course challenges you to think
6. grade, and assign grades, fairly and impartially
7. listen to all your comments and suggestions

To help me with this, please go ahead and tell me **immediately** you feel I am not doing my job. You can do this directly, by email, or anonymously by dropping a message in my mailbox on 3rd floor of Physics Department, Knight Physics Building

**Your job** in this course involves the following:

1. General Class Engagement: To get the most out of our class, we will need to be respectful of the views others have to offer, and of the fact that each of us has something to teach the rest of the class. Everyone’s full engagement is needed to get the most out of the course.

2. Class Required Readings: The idea is that the class is active and for this you need to read the assigned readings. The readings are fundamental to answer the questions that you will discuss orally and for your general class participation. You should prepare for every class by reading and understanding the assigned material and readings.

3. On-Time Work Policy: I expect you to either meet the deadlines or, if there is some **urgent and compelling** reason that you cannot fulfil a specific deadline, set an alternative one with me in advance. Grades for specific assignments will be heavily penalized for late work, e.g. 50-100% loss of points depending on lateness and reason. Proof of any such urgent and compelling reason may be required to avoid being penalized.

4. Always follow UM general academic procedures. It is your responsibility. Please read

   [http://www6.miami.edu/umbulletin/info/aca/grades.htm#sys](http://www6.miami.edu/umbulletin/info/aca/grades.htm#sys)

   Quoting this article: “Academic Warning Reports are sent to students who are doing D or F work in any course before the last day to drop a course. Faculty also have the option of providing students with constructive feedback relating to their attendance and the quality of their work. Academic Warning Reports are due on the 30th class day.”

**If you suddenly become unhappy about something, or have an urgent query, please contact me in the following order of preference:**

1. Email me at njohnson@physics.miami.edu
2. Call me at 305 333 6920
3. Drop a note in my mailbox to talk with me, leaving contact information.

4. Bang on my door.

The best way of contacting me outside of regular office hours is by email since I am often in other departments, or even down in the Medical School. Please don’t be upset if you only receive a 2-word ‘holding’ answer, since I am probably typing it out quickly on my iPhone. Here is a quick translation of some typical replies: ‘let’s talk’ means ‘let’s make an appointment during next class, so we can discuss in depth’. This will be for things which are hard to discuss without a desk, pen, paper etc. ‘OK’ means that you can go ahead with your plan, or the answer to your question is literally OK. ‘No’ means ‘I advise you not to’ or ‘That is not entirely correct’ etc. I won’t easily be able to add words like ‘please’ or ‘thank you’ in my iPhone email, so my apologies in advance if it sounds abrupt. My goal is simply to try to get back to you as soon as possible. Constructive criticism about the course is particularly welcomed, since it can help me improve things if possible. You can even leave an anonymous note in my mailbox if you prefer.

Top grades require top-class work. So please do not come to me to ask for higher grades than your work deserves. Knowing how to self-critique your own work in an objective way is a very useful skill to develop, and is actually a critical part of the learning process. Your UM experience is all about education -- and sometimes the most important lessons are self-taught.

Please refer to the official UM grade chart at the end of this syllabus.
Classes and Assignments:

1. The ways in which we all learn include (1) listening, (2) watching, (3) writing, and (4) talking. We will use all four in this course. Everything we do, including assignments, will be geared toward this purpose. Always ask me the purpose of a given assignment if you are wondering. I will never assign work for the sake of it, since the last thing you need at College is more things to make you busy. Instead, all the work we do and that I assign will have a purpose within the aims of the course.

2. Our two parallel themes are:

Theme 1: What is Complexity Science, and what is so ‘new’ and ‘exciting’ about it as compared to existing theories?

Theme 2: What are the key challenges for individuals and society at the local and global scale? What novel things can Complexity Science say about these key challenges?

3. In addition to specific assignments, quizzes, midterms and final, we will have

A. Recurring weekly assignments, due irrespective of where we are in the syllabus:

Due every Tuesday starting September 15: Collect 3 articles (or more generally, 3 media items) from the general media related to the ‘key challenges’ (Theme 2) that we identify early on in the course. As the semester progresses and Theme 1 develops, you will be able to refine your selection process and hence be clearer about how Complexity Science is related to the topic of the article, and the extent to which Complexity Science can say something new. You should be able to defend why you chose the article in terms of:

- what the article is telling us
- why you chose it in the context of the course material
- how you think it is related to Complexity Science
- what Complexity Science might offer in terms of a new insight into this problem

Print out the article, or copy or cut it, and paste it onto a blank US Letter sheet. If this is not possible (e.g. YouTube clip) then print out an example still shot and write down the link on the paper. You are free to choose the sources, though I recommend regularly checking The New York Times, Scientific American, The New Scientist, Nature, Science, The Economist, all in both print and online forms. You can also use www.cnn.com, www.bbc.co.uk, www.scientificamerican.com, www.newscientist.com, or any source which you believe to be trustworthy. Cross-check to see how other sources may be reporting the same article. Cross-check very well if you have any doubts about the accuracy of the source. During class, I will ask you to carry out a 1-page low-stakes writing exercise to accompany your three articles.

At the end of the semester, I will collect together each person’s folder containing their three weekly articles, and the accompanying 1 written page, which you will have compiled under the headings of the key challenges (Theme 2). You should therefore make sure you end up with a reasonably even coverage of these key challenges.

B. Individual and group presentations based on (1) original research articles, and (2) popular science reports concerning recent scientific advances. The former will be primarily Nature and Science articles, and the latter will be primarily Scientific American articles.

C. Unannounced quizzes. Simple and quick, but aimed at informal writing (i.e. low-stakes writing) and on-the-spot thinking. Make-up quizzes will only be possible under exceptional circumstances, and at the instructor’s discretion.
4. CHRONOLOGICAL DETAILS OF CLASSES AND ASSIGNMENTS. More details about later classes and assignments will be given as the course progresses and an assessment of collective progress is made. The purpose is to co-develop our ideas about Complexity Science at the same time as our appreciation of potential applications develop. Hence assignments may be adapted to enable the pace of learning to be changed according to the general class needs. For this reason, earlier assignments are described in more detail than later ones.

CLASS August 27

1. Getting to know each other:

   What is your background in terms of subjects, major etc.? In terms of the way you think, what are your strengths and weaknesses? In terms of learning styles, what are your strengths and weaknesses?

2. Read through the syllabus (i.e. this document).

3. Introduction to Complexity Science, its novelty and its potential use

4. What are the key challenges facing individuals and society at the local and global scale, and how might Complexity Science help? This is a key outcome of the class discussion, since it will guide our future work during the semester.

5. Announcement of next week’s class activities

6. Formally set Assignments 1 and 2, due on 8 September.

CLASS September 1: Meet at Richter Library’s 3rd floor information literacy lab at 12:30pm. Mr. William Jacobs, Science and Engineering Librarian at University of Miami (305 284-4059) will take you through some of the points related to online research materials -- in particular, electronic article searching with a focus on the journals Nature, Science, Scientific American and New Scientist. Mr. Jacobs is an expert in the topic of online scientific material and its relationship to learning and assignments. You should come out of this class reasonably confident about searching for, and downloading, electronic articles from the web. To aid with this, and provide a focus for Mr. Jacob’s class, there is the following Assignment 1 to be brought to class on 8 September.

Assignment 1, due in class on 8 September: Access, download and print the following articles. You can do this outside class hours, or inside if you have time. Don’t worry yet about the detailed content of these articles, or what topic they address – this will become clear during the following weeks. Just treat it as an exercise in learning how to access online material. As the course evolves, the context and importance of these articles will become clearer, and what they tell us about specific applications of the ideas of Complexity Science will also become clearer. This is part of the aim for the course, since these papers are representative of the literature on real-world applications in Complexity Science. Assignments will be set later in the semester on these papers, and group activities/discussions devised.

I am purposely writing these references in a variety of formats, since they provide a sample of the many formats that you will see in research papers, according to the rules of the journal concerned. As an additional challenge to help you learn the search process, I may have added an occasional typo, or left out part of the information in a given citation!
From the journal Nature:


From the journal Science:


From the American Physical Society journals:

Article 5: Common team mechanism underlying on-line and on-street group dynamics. Physical Review E Vol. 79, p. 066117 (2009); Neil F. Johnson, Chen Xu, Zhenyuan Zhao, Nic Ducheneaut, Nick Yee, George Tita, Pak Ming Hui

Preprints (HTML, pages and PDF files) available on the web:

Article 6: Common group dynamic drives modern epidemics across social, financial and biological domains”, preprint (2009); Zhenyuan Zhao, Juan Pablo Calderon, Chen Xu, Pak Ming Hui and Neil F. Johnson

To download this PDF, simply paste the following URL into your web browser

http://lanl.arxiv.org/pdf/0907.3600

Article 7: FPS Student Fellowship Award Winners and Project Descriptions

http://www.aps.org/units/fps/newsletters/200907/thomas.cfm

You should print this article, in particular making sure you have a readable copy of the section “Self-Organized Capping of Global Carbon Emissions”

Article 8: Collective behavior in cancer cell populations. Thomas S. Deisboeck and Iain D. Couzin. BioEssays 31:190–197. To download the PDF, simply paste the following URL into your web browser


Article 9: Johnson, N. et al. Universal patterns underlying ongoing wars and terrorism. PDF available from http://arxiv.org/abs/physics/0605035 To download the PDF, simply paste the following URL into your web browser http://arxiv.org/pdf/physics/0605035v1 (no need to print out the whole document. Just pages 1-10)


Bring them all along to the September 8 class. You will be graded on this task.

CLASS September 3

Presentation in regular class time and location (room 110 Knight Physics Building) by Ms. April Mann who is the University of Miami Writing Center Director (305 284-2956). This is an opportunity to learn from a writing expert, within the context of Assignment 2 which is as follows.

Assignment 2, due in class on September 8: This is a writing exercise based on broad scientific themes and online material. Ahead of the class, visit two (or more) websites which discuss Complexity Science (also known as ‘Complexity’, or ‘Complex Systems’). The sites could be Wikipedia, and another site (just Google
‘Complexity Science’, or ‘Complexity’ or ‘Complex Systems’. Then print out their content (2-3 pages) and bring it along to the September 3 class.

During or after Ms. Mann’s class, your task is to summarize and assess the combined material that you have printed out and bought along. Specifically, based on the content, prepare a 2-page paper (Font 10, single spaced with a maximum of 2 diagrams allowed) on what ‘Complexity Science’ is perceived to be according to these sites, why it is seen as novel, and what new things it could tell us about the world in general, and science in particular. I am less concerned about the detailed content than I am about the way in which you present the assignment. This is an exercise in writing, and the key elements of effective writing will be reinforced by Ms. April Mann’s discussion with you during class. Bring your printed paper to class on September 8, and be prepared to present your work orally, to discuss and defend it on September 8.

CLASS September 8

Oral discussion of Assignments 1 and 2. What difficulties did you encounter? How did you go about solving them? What do you think you learned? About your skills, the web, the research field, journals etc.

Key elements of Complexity: What features should a system have to be called ‘complex’?

Research in Complexity comprises data analysis to identify ‘stylized facts’ which lie hidden in the data, and identifying models which can reproduce these stylized facts.

Data analysis: Power-laws vs. normal distributions. Burstiness.

Models: Computer simulations (e.g. NetLogo) and analytic analysis. Based on combinations of the ideas of complex networks (e.g. small-world network), agent-based populations (e.g. El Farol model), and non-linear dynamics (e.g. logistic map).

Key challenges: (1) Pandemic spreading (e.g. swine flu), (2) Carbon emissions and markets, (3) Human conflict, (4) Cancer and other ‘incurable’ diseases. Why are they all complex?

CLASS September 10

Class presentation based on “How Kevin Bacon Cured Cancer”. Formally set Assignment 3, due on Sept 15:

Assignment 3: What does the movie tell us about network science, and what is its relationship to Complexity Science? Based on a search which you undertake on the Internet, does the movie provide a balanced view of the field of network science? (2-3 pages of low-stakes writing which you must bring to class on Sept 15, but also be prepared to present your work orally as well as on paper)

CLASS September 15

Key elements of Complexity. Relationship to disorder, chaos. Equilibrium vs non-equilibrium. Feedback.

CLASS September 17

Introduction to the program NetLogo. Please bring laptops, or be ready to work with a partner who has a laptop.
Start to identify one program that will form the basis of a study project that each person will present for the Midterm. We will discuss in class the quantities to be explored in each case, since they are generic, but to give an idea: You will explore the Netlogo program (e.g. El Farol), to see what happens over as wide a range of the parameters as you can. Read what it says about these parameters in the manual, try and guess what you think will happen, then alter the value and see if you were right. For example for El Farol, two features to focus on are (1) the average value of the attendance, and how close it is to the capacity. Call this x. (2) the size of the fluctuations around this average value. Call this dx. You may be able to devise a way of determining these numbers from the plot using the program, or manually using a ruler or paper against the screen. A key question is: How do the average (x) and the fluctuations (dx) vary as the parameters are varied? Can you explain this behavior? Finally, what real-world situation can you think of, for which your results might be used? Think of the application, and work out the role of the 'bar', the 'seating capacity' etc. Then try to link the two to see what insight your results might offer. I will then grade it for clarity of presentation and writing, accuracy, insight and conclusions reached, as well as the application discussion. (The reason for preferring short reports is that it is harder to write something good and short than something which rambles on. That is why the shorter papers in science tend to be the more important and prestigious ones. We know this from language -- the best sayings and phrases also tend to be the shortest). What about rare events?

**CLASS September 22**

Continuation: NetLogo. Please bring laptops, or be ready to work with a partner who has a laptop.

**CLASS September 24**

Revisiting disorder. Entropy.

**CLASS September 29**

Chaos. Introduction to the logistic map.

**CLASS October 1**

Chaos. Exploring the logistic map.

**CLASS October 6**

Statistical complexity. Power laws and the importance of not being normal.

**CLASS October 8**

Power laws. Ways of generating them and what this might tell us about complex systems.

**CLASS October 13**

Agent-based models. El Farol.
CLASS October 15
El Farol revisited. Relationship to real-world systems.

CLASS October 20
By this stage of Midterms, the class will have a clearer idea of the elements that can constitute a description of a Complex System, and hence what characterizes Complexity Science, and also some applications. These ideas will be fully explored in the second half of the course. At this stage, the Midterm will examine the more practical hands-on aspect afforded to us by the NetLogo program and the study projects that each person has had underway for the previous weeks.

MIDTERM presentations and discussions based around NetLogo (1/4). Everybody must hand in a hardcopy of their written reports at the beginning of this class. Also, be prepared to orally describe their program’s features, parameters of the model, sensitivity to the parameters, mean vs fluctuations, possible applicability in real-world systems, relationship to key challenges. Order of oral presentation to be drawn randomly from a hat.

CLASS October 22
MIDTERM presentations and discussions (2/4). Everybody must prepared to orally describe their program's features, parameters of the model, sensitivity to the parameters, mean vs fluctuations, possible applicability in real-world systems, relationship to key challenges. Order of oral presentation to be drawn randomly from a hat.

CLASS October 27
MIDTERM presentations and discussions (3/4). Everybody must prepared to orally describe their program’s features, parameters of the model, sensitivity to the parameters, mean vs fluctuations, possible applicability in real-world systems, relationship to key challenges. Order of oral presentation to be drawn randomly from a hat.

CLASS October 29
MIDTERM presentations and discussions (4/4). Everybody must prepared to orally describe their program's features, parameters of the model, sensitivity to the parameters, mean vs fluctuations, possible applicability in real-world systems, relationship to key challenges. Order of oral presentation to be drawn randomly from a hat.

CLASS November 3
Feedback and grades from midterms. What can we learn, individually and collectively? Perceptions of different styles of presentation and communication, and their effectiveness.
CLASS November 5

Network science. What is it, and how is it related to Complexity Science? What additional insight can it offer into the key challenges?

CLASS November 10

Key challenge: Pandemic spreading (e.g. swine flu)

CLASS November 12

Key challenge: Carbon emissions and markets

CLASS November 17

Key challenge: Human conflict

CLASS November 19

Key challenge: Cancer

CLASS November 24

General discussion: Relationships between the key challenges?

CLASS November 26  NO CLASS: Happy Thanksgiving!!

CLASS December 1

Preparation for FINAL

CLASS December 3

Preparation for FINAL. The FINAL is your opportunity to bring together the key ideas from the course in a unified way, and my opportunity to test your understanding of the course on the level of overall comprehension and on the level of its details. The better your performance, the higher grade you will get. I am confident that you will all do well, but naturally some will do better than others in the details of presentation, attention to details, clarity, sophistication of content, logical flow etc. and hence will obtain higher grades.

In addition on 3 December, I will collect in your folder of articles related to the weekly assignment of media reports on the key challenges, as described earlier, together with the 1-page writings, which you have organized under the key challenge topic headings stated above. You should make sure you have reasonably
even coverage of these key challenge topics, and also a wide coverage of media sources. The grade will reflect the diligence which you have shown and the content of the folder.

DETAILS OF THE FINAL EXAM: The final is meant to mimic the typical presentation scenario in academia and industry, whereby a longer written report may be required and is hence pre-prepared, but where a briefing is also given orally (e.g. as in a typical conference setting). This briefing cannot assume that people have necessarily read the paper – which is indeed commonly the case in the real world. The rules for the paper are below, and happen to follow a program from Texas A&M Writing Center. The bulk of this syllabus was inspired by UM’s Writing Center, which is an amazing resource for you while at UM.

1. FINAL PAPER

Your challenge is to write an article on one of the key challenges, written in the style of a journal research paper -- in particular a Nature journal ‘Letter’ subject to the same presentation, formatting and length requirements. This helps teach the importance of complying with specific formatting rules. In terms of the content of the paper, your aim will be to show how the specific topic that you have chosen from the key challenges, relates to the key elements of Complexity Science as discussed in the course.

In terms of planning well ahead of the Final, you should start by choosing the general topic from one of the key challenges that we have identified, and writing a short draft abstract (in the style of the opening paragraph of a Letter to Nature). Do this by the middle of September. You should then have your topic approved by October 15. You should then start your own thorough literature search on the material, and identify NetLogo programs that might support your project. You should then write an outline for your paper and also compile a list of references. This is due on Tuesday 3 November. You should then work hard in the background, continuing to research your paper throughout early November, while also refining the draft of the rest of the Letter document. You should have a complete draft of your paper by November 12. You should then produce a finalized version of your paper by November 17. You should hand in 3 copies of your paper on November 17, so it can be reviewed by 3 of your classmates who have chosen a different topic. You will review 3 of your classmates papers in the remaining 4 topics by November 24, producing a written 1-page report and able to orally present your views. You should focus on each paper’s strengths and weaknesses in terms of organization, structure, grammar, references, use of figures and tables, etc. You will then revise your own paper based on the comments that you receive. You will then submit the final version of your paper at the start of class on Tuesday December 1.

2. FINAL PRESENTATION

The challenge of the class presentation is to provide a 5-minute presentation which encapsulates your paper, to an audience with general knowledge of Complexity but who may not have read your paper. These presentations will be made during the allotted exam period. The presentations must be made available to me in an electronic format that I can read (e.g. PDF) by 9am Monday 7 December. Your oral presentation will be cut off after exactly 5 minutes. There will then be a few minutes for questions. Your score will be assessed based on the supposition that we are in a conference setting, e.g. based on your ability to finish your talk within the allotted time, to convey a coherent and clear message, to have content which is legible and understandable, with no conflicting notation etc. If you wish to see how professional academics give talks, and pick up ideas of what to do (or sometimes what not to do), you are encouraged to attend faculty colloquia within UM.

Summary of Grade:

The grade will be made up of a combination of class-based work (approximately 20% of grade), assignments (approximately 20% of grade), quizzes (approximately 10% of grade), midterms (approximately 15% of
grade), final exam (approximately 20% of grade), and final project folder (approximately 15% of grade). This percentage split may be adapted as the semester progresses. Any changes will be announced in class.

In terms of working, I will make clear when you should work in groups or pairs, and when the assignment should be done alone. For example, in some cases I may announce that the preparation work is group-based, but the final report will be individual work. If you have problems with being in a particular group, please feel free to speak to me in private.

Just remember, not everyone can get an A. Indeed, here are the directly quoted definitions from the University of Miami website [http://www6.miami.edu/umbulletin/info/aca/grades.htm#sys](http://www6.miami.edu/umbulletin/info/aca/grades.htm#sys)

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Excellent attainment</td>
</tr>
<tr>
<td>B</td>
<td>Good attainment</td>
</tr>
<tr>
<td>C</td>
<td>Fair attainment</td>
</tr>
<tr>
<td>D</td>
<td>Poor attainment (earns credit but may not fulfill requirement for a major)</td>
</tr>
<tr>
<td>F</td>
<td>Failure (effective Fall 1995)</td>
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<tr>
<td>W</td>
<td>Course dropped on or before the last day for withdrawing from classes as published in the official calendar of the University. Credit can be earned only by successful repetition of the course.</td>
</tr>
<tr>
<td>I</td>
<td>Incomplete work in passing status with the instructor’s permission to complete the course. An “I” will be assigned only if the instructor is satisfied that there are reasonable non-academic grounds for the student’s incomplete work.** An “I” is not intended to be assigned in order to permit a student to repeat a course without registration or to permit a student to do additional work in order to improve upon grades earned during the semester. The student who receives an “I” must complete the course with a passing grade within the time frame specified by the professor of the course but not longer than the end of one calendar year, or prior to graduation, whichever occurs first. An Academic Dean may approve an extension initiated by the course instructor. An “I” not completed prior to the student’s graduation shall be changed to an “IE” or “IF” by action of the student’s Academic Dean.*</td>
</tr>
<tr>
<td>IP</td>
<td>Denotes in progress grade assigned upon satisfactory completion of the first-semester of a two-semester sequence, with the final grade for both courses to be submitted at the end of the second semester of the sequence. Please note that all “IP”s must be converted to a letter grade or “IF” at graduation. “IF” will also be converted to “IF” upon any departure from the University for a period in excess of one year.*****</td>
</tr>
<tr>
<td>IF</td>
<td>Symbol indicating that an “I” grade was not appropriately completed.**** The symbol “IF” is equivalent to an “F” when computing a student's average.</td>
</tr>
<tr>
<td>CR</td>
<td>Grade signifying that credit only is awarded based on a “C” average or better.</td>
</tr>
<tr>
<td>NC</td>
<td>Grade signifying that no credit is awarded based on a course average below a grade of “C”.</td>
</tr>
</tbody>
</table>

HONOR CODE: The Honor Code, initiated at the request of the Undergraduate Student Body Government, ratified by student referendum, approved by the Faculty Senate, by the President of the University, and administered by students, protects the academic integrity of the University of Miami by encouraging consistent ethical behavior among its undergraduate students. The Code provides standards that prohibit all forms of scholastic dishonesty, including cheating, plagiarism, collusion, and falsification or misrepresentation of experimental data. The Code covers all written and oral examinations, term papers, creative works, assigned computer related work, and any other academic work done at the University by an undergraduate
student. All undergraduate students are responsible for reading, understanding, and upholding the Honor Code. Signed pledges are required for written work submitted for evaluation, but the absence of a signed pledge does not free a student from the ethical standards required by the Code. Procedures for dealing with infractions of the Code, including provisions for appeals, are printed in the text of the Honor Code. Copies may be obtained from the Office of the Dean of Students or from the office of the Undergraduate Student Body Government, or on-line at www.miami.edu/honor-council. In keeping with the traditional prerogatives of university faculties, nothing in the Code infringes on the faculty’s assignment of grades undertaken in a class. Instructors are informed when students have been found guilty of infractions involving their classes. Courses in which students have been failed for academic dishonesty may neither be dropped nor repeated under the terms of the freshman repeat rule.

**BOOKS**

The Social Atom. Publisher: Bloomsbury USA (2007)


Available for purchase from UM Bookstore (upstairs under course name)


Available in Richter Library on reserve, for 3 hour loans. Call number Q175.32.C65 J64 2007