Name: _____

CS423 **Sample** Final Exam.
This version of the exam is for students enrolled in *CS423: Introduction to Complex Systems*. If you are enrolled only in *CS523: Complex Systems* please ask for the corresponding exam. If are enrolled in both CS523 and CS423 ask for the CS523 version of the exam.

The questions in each section refer specifically to the associated reading printed in **bold**. Mark the best answer by filling in the circle next to it. Explanatory comments will not be considered.

The **real** exam is worth 15% of your final grade for this course, and contains 25 questions each equally weighted (1 point each). The exam period is 50 minutes. This sample exam has fewer questions.

Chapter 12: Information Processing in Living Systems

1. (1 point) Which of the following is not a system in which information processing plays a leading role, as described by Mitchell?
   - ◯ ant colonies.
   - ◯ the immune system.
   - √ **Lorenz attractors**
   - ◯ cellular metabolism

Chapter 13: How to Make Analogies (if You Are a Computer)

2. (1 point) Which component of CopyCat are agents that continually explore possibilities for perceptual structures to build in the Workspace?
   - ◯ Temperature
   - √ **Codelets**
   - ◯ Workspace
   - ◯ Slipnet

Chapter 14: Prospects of Computer Modeling

3. (1 point) The decision whether to cooperate or defect is the central component of:
   - ◯ the Cooperation model
   - ◯ Selfishness theory
   - √ **the Prisoner's Dilemma**
   - ◯ the Social Norms game

Chapter 15: The Science of Networks

4. (1 point) The existence of largely separate tight-knit communities in networks is termed:
   - ◯ distribution
   - ◯ grouping
   - ◯ association
   - √ **clustering**

Chapter 16: Applying Network Science to Real-World Networks

5. (1 point) What generates the complexity of humans as compared to plants with the same number of genes?
   - √ **how the genes are organized into networks**
   - ◯ how the genes multiply
   - ◯ how the genes reproduce
   - ◯ how the genes are scale-free

Chapter 17: The Mystery of Scaling

6. (1 point) Mitchell does not claim a power law distribution for:
   - ◯ the size of cities
   - ◯ people's incomes
   - ◯ forest fires
   - √ **the immune system**

Mark Ehlen, Ph.D., Sandia National Labs

7. (1 point) Dr. Ehlen presented his work on modeling which of the following:
   - √ **the food distribution network**
   - ◯ the power grid
   - ◯ airline travel
   - ◯ plague

Melanie Moses, Ph.D., UNM Computer Science

8. (1 point) Scaling laws we see in biology and computer processors are due to:
   - ◯ Power limitations
   - ◯ Volume divided by area
   - ◯ Convergent evolution
   - √ **Fractal-like distribution networks**
   - ◯ Stephen Wolfram

Lance Williams, Ph.D., UNM Computer Science

9. (1 point) The goal of the research presented is to:
   - ◯ Examine the complexity of cytokine signalling transduction networks using Haskell
   - ◯ Show the flaws in a self-reproducing robot built by Jon von Neumann
   - ◯ Present "SimSoup" an artificial-chemistry tool-kit
   - ◯ Design a cell that can replicate using a robot chemist to rapidly explore combinations of chemicals
   - √ **Use a GA to evolve a system analogous to an artificial cell composed of devices borrowed from modern programming languages**

Joshua Hecker, Ph.D., UNM Computer Science and Lockheed Martin

10. (1 point) Which of the following is not a characteristic of a swarm according to Manuel Brambilla:
    - ◯ Agents are autonomous
    - ◯ Agents cooperate
    - √ **Agents have access to a centralized control**
    - ◯ Agents are situated