DEPARTMENT OF MATHEMATICS

MATHS 190 Lecture 17 Summary

In this lecture we looked at systems whose behaviour can be extremely complicated even though they are governed by a few simple rules.

We began by noticing that many things in nature repeat or grow.

- Money in a bank (assuming the bank doesn't go bankrupt).
- Populations of things like rabbits or insects.
- Solar system
- Seasons

We then discussed simple models of how bank balances and populations grow. These models are based on iterating a simple rule. We looked at a simple model of population growth which incorporates the fact that growth slows dows as the resources of the environment get used up, and noted that the behaviour could be quite complex even though the model was so simple.

We then looked at the Game of Life, an abstract model of populations, and looked at some solutions on the computer. The universe in the Game of Life is a 2-dimensional grid of cells. Cells can be alive/full or dead/empty. Cells can die of "loneliness" (zero or one neighbours) or "overcrowding" (four or more neighbours). An empty cell comes alive if it has exactly three live neighbours. The solutions can be exploding, periodic, disappearing, travelling, or stationary, or a mixture of all of these. It is very difficult to predict the long-term behaviour.

Before you come to the next lecture:

You should spend an hour or two thinking and reading about the ideas presented in the lecture. You should also:

- Read section 6.5

Other activities you could do if you have time are:

- Download the Game of Life (e.g., from `http://www.bitstorm.org/gameoflife/` or somewhere else) and play with various starting combinations.
- If you're interested in programming, try writing a program to solve the Game of Life yourself.
- Think of other ways of modelling populations. What about if there are multiple populations, some of which eat the others? How would you model that?