Housekeeping

• Course syllabus.

• Lecture + Lab work/tutorials.

• Total 1 + 2 hours per week (Tues 12-1pm, Wed 11am – 1pm).
Contact Details

- arwhite@tcd.ie
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- Ext 1062 or +353 1 896 1062
- Room 144
Lessons from Past

• Students were not as familiar with 2nd year material as they should have been.
• Tendency to plead inability to understand basic material.
Management Science

- Making Decisions
- Solving Problems
- Planning

- All these in a coherent, structured and rigorous framework akin to that employed by those adhering to the Scientific method.
Emphasis in this Course

• A knowledge of theory is important.

• An ability to solve real problems, use various tools, and communicate conclusions is critical.
(Some) Typical Problems

• How many litres of fuel do I order for a petrol station in current climate?
• Can I test a new drug using fewer individuals?
• What should I charge for my hotel rooms?
• Is a new intervention cost effective?
Systems and Models

• A **system** is something that takes a collection of inputs, and generates a collection of outputs. It can be considered a mapping from $I$ to $O$. That is $S: I \rightarrow O$

• A **model** is a mapping of known form that agrees with a system for a particular domain. That is $M_S: I \rightarrow O$ s.t. $M_S(i) = S(i)$.

• In practice, it is sufficient that $\|M_S(i) - S(i)\| < \varepsilon$ for some appropriate metric $\|\cdot\|$
In English!

• Systems are complex things, and in general we cannot know how they work – but we do know that there are some observables.
• Models tend to be simpler (but not necessarily simple!) They ‘look’ like the system for a collection of observables of interest.
• Often, they do not exactly agree, but that does not matter too much.
Googol (Lindley, 1988)

• This is a game played by two players.
• The first writes numbers on N pieces of paper, then places them face down.
• The second can then turn over the pieces of paper until at some stage they cry “stop” and declare the piece they have turned over to be the largest.
• If player two is right they get a prize.
• They cannot go back to previous pieces of paper.
Model

- This game can clearly be modeled as a decision problem.
- The choice of a bit of paper is a stochastic node.
- The declaration that a particular piece is the largest is a decision node.
- Being correct or otherwise on declaration is a stochastic event.
Model for Googol
Results

• Solving Googol gives the following strategy;
  – Player 2 should turn over about 37% of pieces of paper without crying stop.
  – After this, they should keep turning until they reach the best so far seen (or run out of pieces of paper.)
  – Then cry stop.
Googol and Renting

• Suppose that you are looking for accommodation.
• This is the same as Googol.
• Faced with $N$ possible options keep trying until 37% of options have been evaluated.
• Choose the next option that is better than the ones already seen.
• More famous metaphor is for a person’s love life.
Algorithm for renting

- Let \( N = \) Number of properties available to you.
- Let \( \text{MaxHouse} = 0 \).
- For (index = 0 to \( N \))
  - View House.
  - Evaluate House.
  - If \( \text{House} > \text{MaxHouse} \) then
    - \( \text{MaxHouse} = \text{House} \).
    - If \( \text{index} < 0.37*\text{N} \) then Dump(\( \text{House} \))
    - Else Bid(\( \text{House} \))
    - End if
  - End if
- End if
- Next index
- Bid(\( \text{House} \))
Serious Message

- Models often oversimplify complex situations.
- However, many people act incoherently when faced with important decision making problems.
- It is worth thinking in a structured way, then acting in a “balanced” fashion.
- Uncertainty, and greying of boundaries dominates.