Joy of Computing

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Joy of Computing

In the words of Donald Knuth:

“[Programming is] not just an ordinary subject. It is intrinsically empowering, and applicable to many different kinds of knowledge”

Knuth, D.: Twenty Questions for Donald Knut (2014),
Joy of Computing

• Introduction to computer science for students from all backgrounds
• Communicate fundamental concepts through beautiful applications
• Visualisation through use of the Snap! programming language
Joy of Computing – Course Structure

1. Programming in Snap!
2. Computational thinking via applications
   - Computational Social Science
   - Computational Biology
   - Machine Learning
   - Optimisation
3. Computer architecture
4. The breadth of computer science
Agenda

- Programming in Snap!
- Computational Biology and Optimisation – Rachael McNaughton
- Machine Learning – Andrew Wrigley
- Computational Social Science – Joshua Chia
- Conclusion and Questions
Programming in Snap!

Demo
Computational Biology

Concept:
Dynamic Programming

Application:
DNA/Protein Sequence Alignment
– Core task in bioinformatics
– Simple implementation
– Nice visual interpretation
Computational Biology - Assignment

Task:
Implement a dynamic programming algorithm to find the optimal global alignment between two DNA sequences

Extension:
• Extend algorithm to find local alignments
• Find the most similar sequence using real DNA
Computational Biology – Snap! Demo

Demo
Optimisation

Concept:

Search

Application:

Solving a Sudoku puzzle

– Familiar problem
– ‘Search’ process is easy to visualise
Optimisation - Assignment

Task:
Implement the backtracking algorithm with depth-first search to solve a 4x4 Sudoku puzzle

Extension:
Implement a more efficient search algorithm using forward checking to solve 9x9 Sudoku puzzles
Optimisation – Snap! Demo

Demo