MAT1830

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While you're waiting:

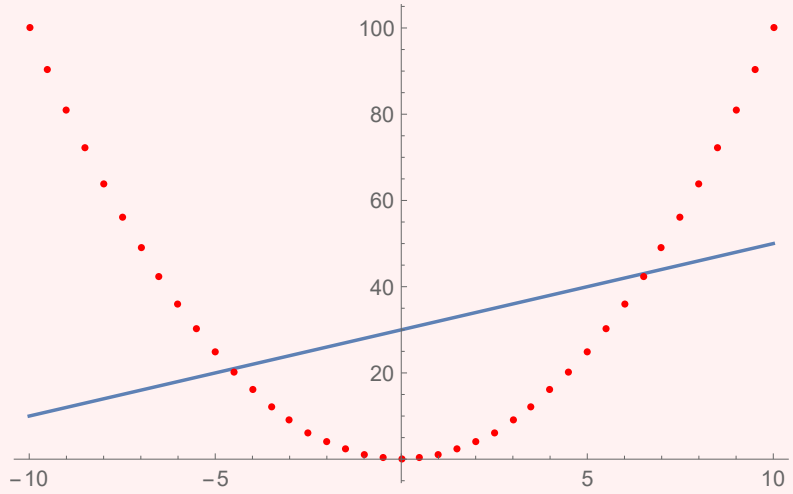
- Point your phone's browser at `flux.qa` and log in.
- Press the plus in the top right corner, enter LQMTZZ, and press join.

Discrete mathematics studies objects which have distinct separated values (e.g. integers), as opposed to objects which vary smoothly (e.g. real numbers). You can think of it as being "digital" mathematics rather than "analogue" mathematics.

Discrete mathematics is particularly important in computer science and the two fields are very closely linked.

Flux Exercise (LQMTZZ)

In the following plot, which colours represent discrete/continuous functions?



A. Blue is discrete, red is continuous.

B. Blue is continuous, red is discrete.

C. Both are discrete.

D. Both are continuous.

Answer: B.

This course covers a wide range of topics in discrete mathematics including the following:

- Numbers
- Logic
- Induction and recursion
- Sets, functions and relations
- Probability
- Graph theory

1.1 What to expect

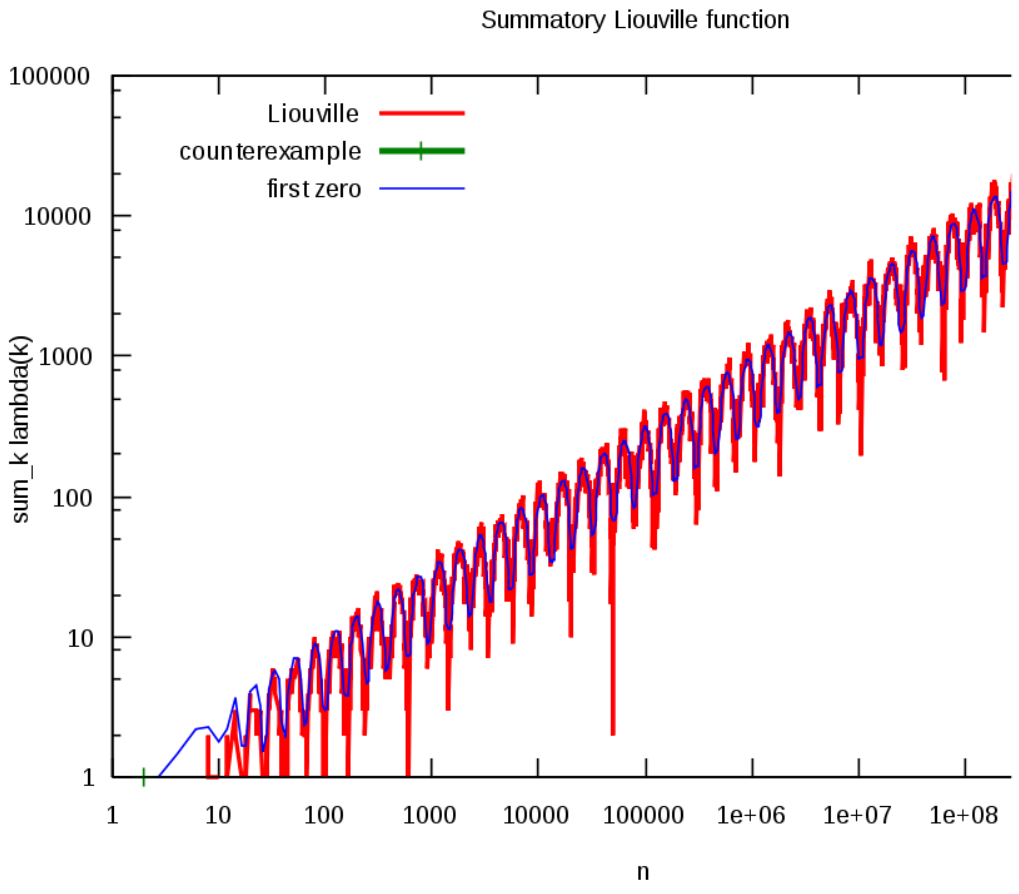
What we do here might be a bit different to a lot of the maths you've done in the past. We'll be concentrating on really understanding the concepts, rather than simply learning how to solve certain types of questions.

For a lot of the questions we ask, there won't be a single fixed procedure you can apply to get the answer. Instead, you'll have to think carefully about what the question is asking and try to work out what is really going on. Don't be afraid to try different things, play around, and look at examples.

We'll also be emphasising the importance of proving results.

1.2 Proofs

A proof is essentially just a water-tight argument that a certain statement must be true. As we'll see, even if you are pretty sure that something is true, it can be really useful to have a proof of it, for a number of reasons.


Summatory Liouville function
Liouville
counterexample
first zero
sum_k lambda(k)
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10000
1000
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1
1
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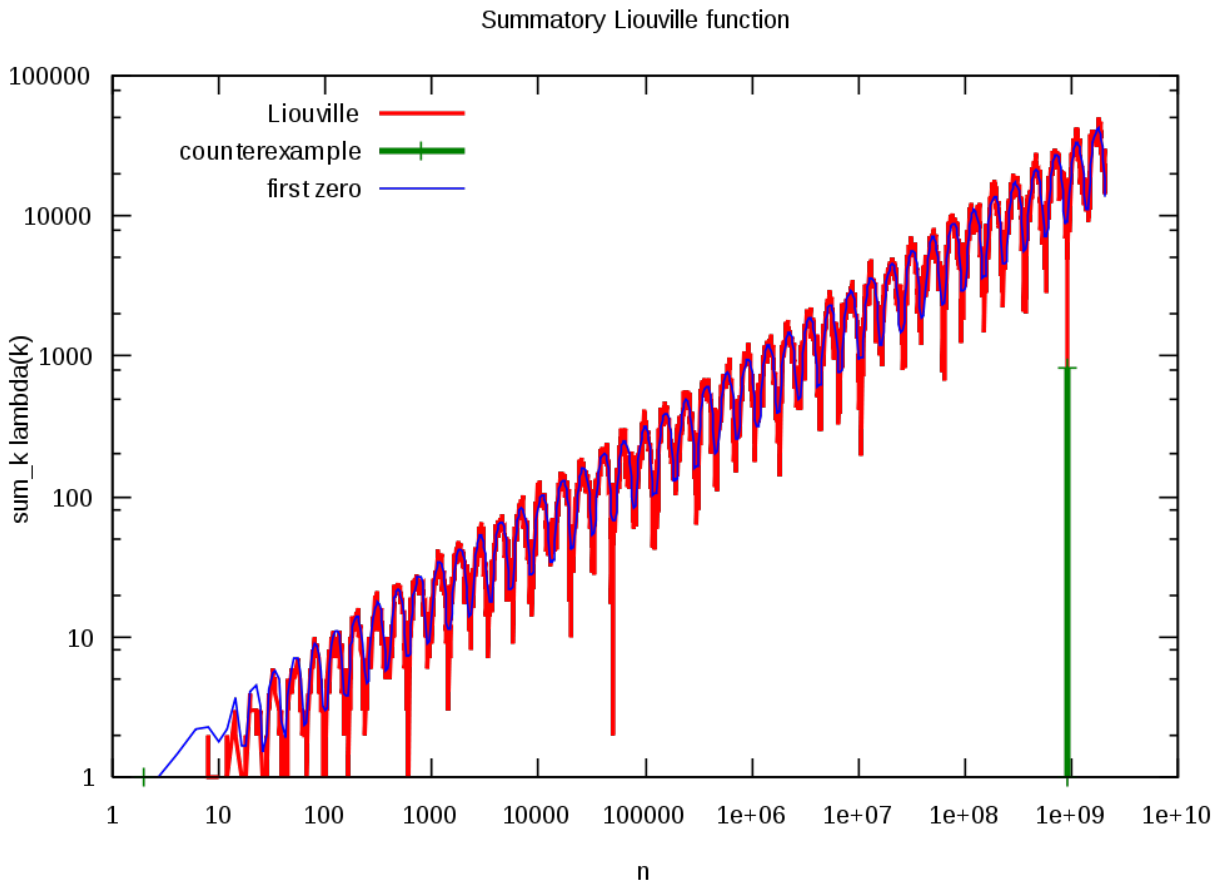
1000
10000
100000
1e+06
1e+07
1e+08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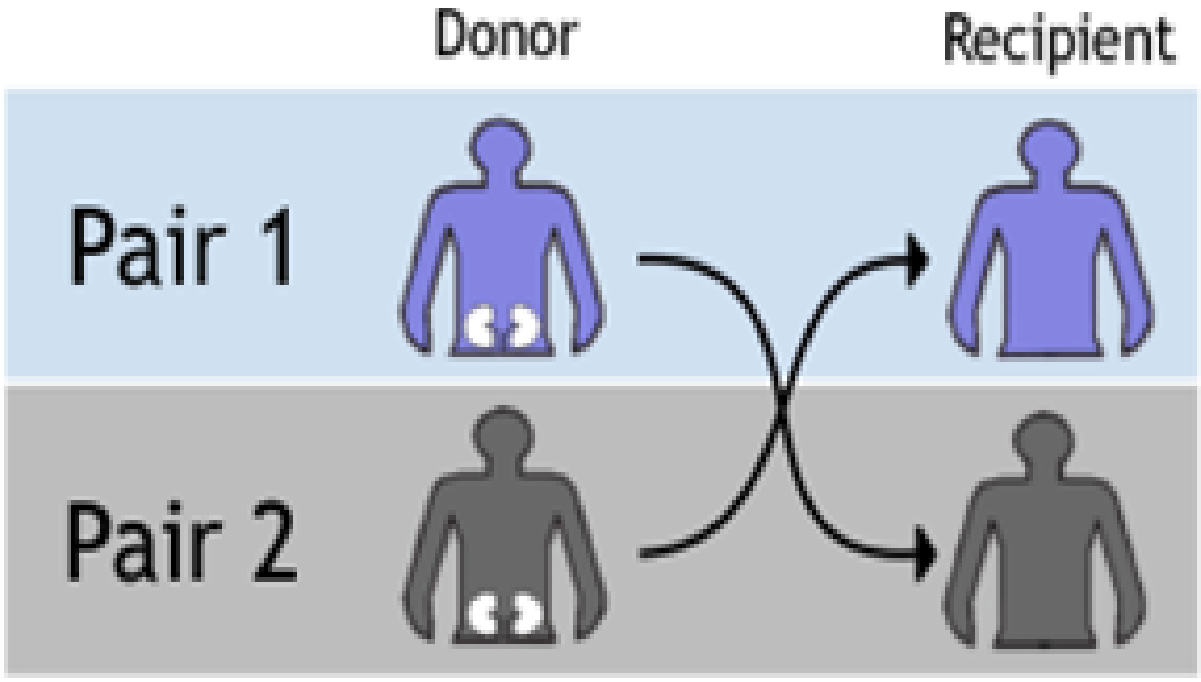
1.4 Maths in computer science

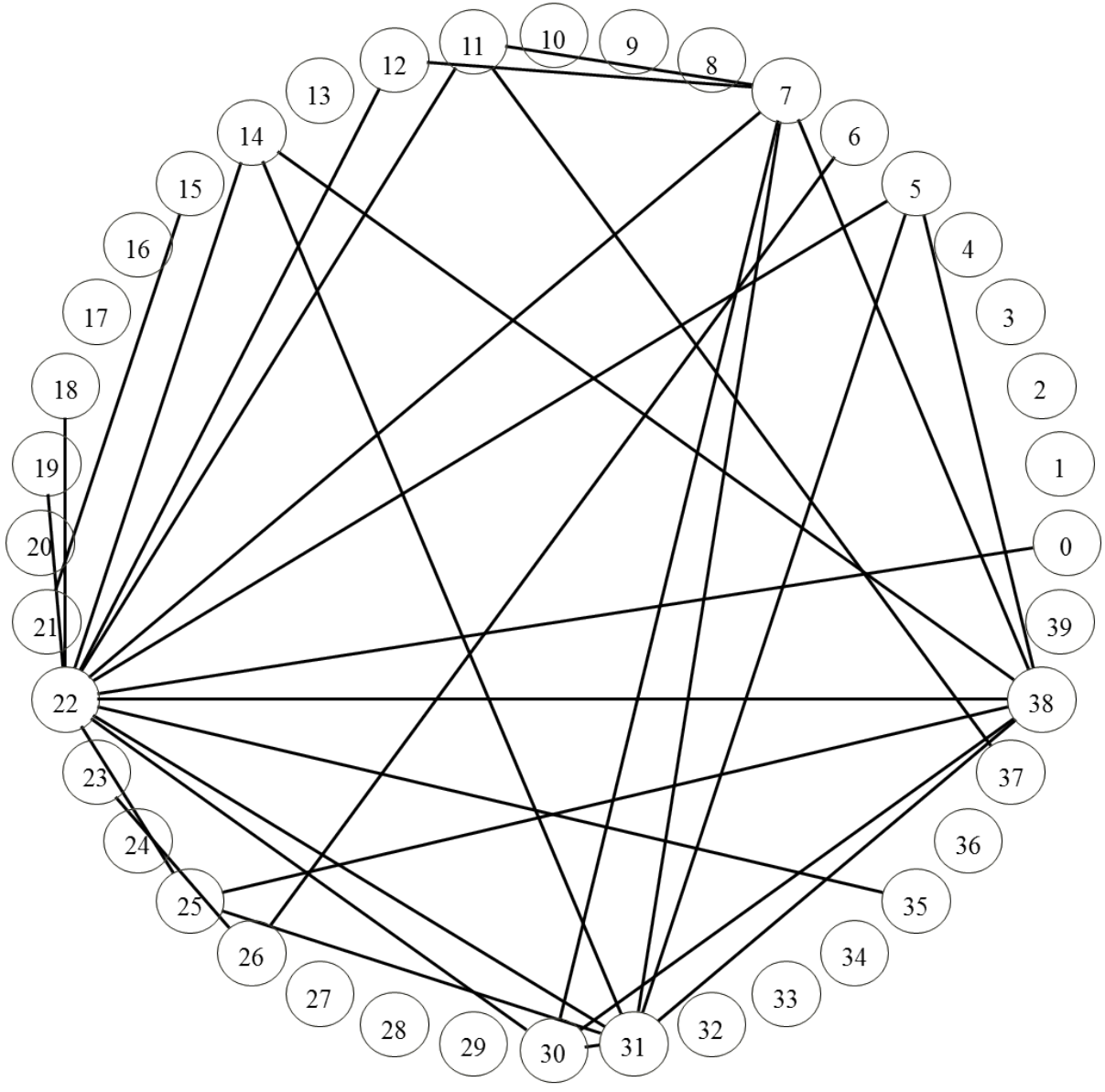
As we mentioned above, maths and computer science are very closely related. The topics in this course all have many applications to computer science. For example:

- Number theory is used in cryptography to enable secure communication, identity verification, online banking and shopping etc.
- Logic is used in digital circuit design and in program control flow.
- Induction and recursion are used to study algorithms and their effectiveness.
- Functions are important in the theory of programming and relations are vital in database theory and design.
- Probability is vital for understanding randomized algorithms and for creating systems to deal with uncertain situations.
- Graph theory is used in software which solves allocation and scheduling problems.

Example: Kidney donation



Example: Kidney donation



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