Mathematical Methods

for Computer Science

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Methods Course Details

- Course title: Mathematical Methods
- Course lecturers:
  - Dr. J. Bradley (Weeks 2-5)
  - Prof. P. Harrison (Weeks 6-10)
- Course code: 145
- Lectures
  - Mondays: 3–4pm, rm 308
  - Wednesdays: 11–12 noon, rm 308 (until and inc. 7th November)
  - Thursdays: 10–11 am, rm 308
- Tutorials
  - Thursdays: 11–12 noon OR Tuesdays 5–6pm
- Number of assessed sheets: 5 out of 8

Assessed Exercises

- Submission: through CATE
  - `https://sparrow.doc.ic.ac.uk/∼cate/`
- Assessed exercises (for 1st half of course):
  1. set 8 Oct; due 18 Oct
  2. set 15 Oct; due 25 Oct
  3. set 22 Oct; due 8 Nov

Recommended Books

You will find one of the following useful – no need to buy all of them:

- Mathematical Methods for Science Students. (2nd Ed). G Stephenson. Longman 1973. [38]
- Engineering Mathematics. (5th Ed). K A Stroud. Macmillan 2001. [21]
- Interactive Computer Graphics. P Burger and D Gillies. Addison Wesley 1989. [22]
- Analysis: with an introduction to proof. Steven R Lay. 4th edition, Prentice Hall, 2005.

Maths and Computer Science

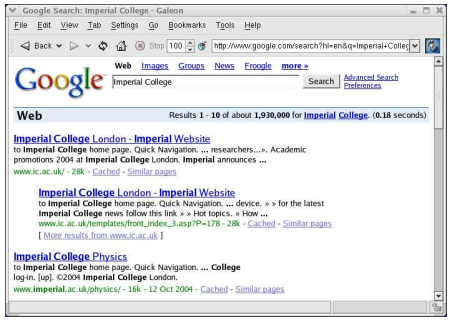
- Why is Maths important to Computer Science?
- Maths underpins most computing concepts/applications, e.g.:
  - computer graphics and animation
  - stock market models
  - information search and retrieval
  - performance of integrated circuits
  - computer vision
  - neural computing
  - genetic algorithms

Highlighted Examples

- Search engines
  - Google and the PageRank algorithm
- Computer graphics
  - near photo realism from wireframe and vector representation

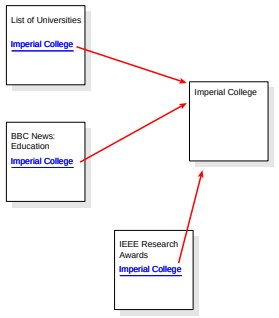
Searching with...

Searching for...



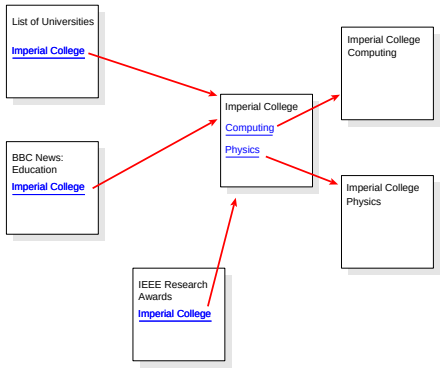
- How does Google know to put Imperial's website top?

The PageRank Algorithm



- PageRank is based on the underlying web graph

Propagation of PageRank



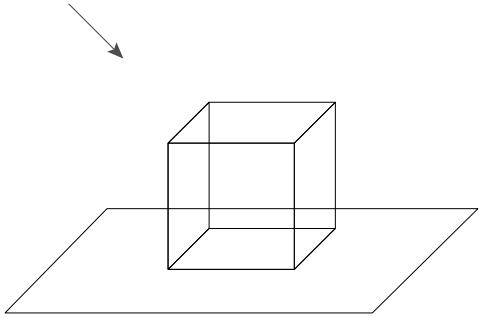
PageRank

- So where's the Maths?
  - Web graph is represented as a matrix
  - Matrix is **9 billion** $\times$ **9 billion** in size
  - PageRank calculation is turned into an eigenvector calculation
  - Does it converge? How fast does it converge?

Computer Graphics

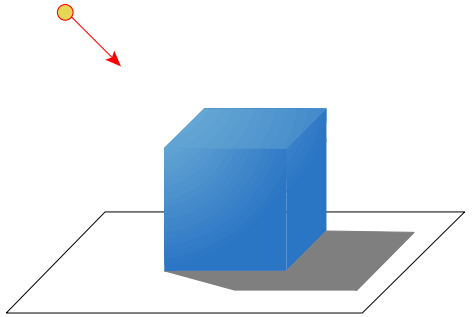
- Ray tracing with: POV-Ray 3.6

Computer Graphics



- Underlying wiremesh model

Computer Graphics



- How can we calculate light shading/shadow?

Computer Graphics

- Key points of model are defined through vectors
- Vectors define position relative to an origin