CITS2401
Computer Analysis & Visualisation

Lecture 1
Unit Introduction
Agenda

√ What is CAV?
√ Why study CAV?
√ Tools: Excel, Matlab, Mathematica
√ Topics
√ Teaching Methods
√ Assessment
What is CAV?

✓ Computer Analysis and Visualisation aims to provide students with the computing skills they will require to perform simulation and analysis in Engineering and Science.

✓ The unit examines three commonly used tools: Excel, Matlab and Mathematica.

✓ Students will learn the basic principles of problem solving, analysis and visualisation using these tools.
What is CAV?

√ Learn how to manipulate data
√ Learn how to visualize and present data
√ Use the power of computers to do Super Calculations

Why study CAV?

These are core, transferrable skills for all scientists and engineers
Why study CAV?

√ Who am I?
√ Bruce Gardiner
√ Engineering Computational Biology
√ You don’t know where your degree will take you
√ Try to gain transferable skills
√ Modelling, data analysis, programming, and problem solving are all transferable skills
Daily challenges encountered in professional career

√ Complex projects involving a wide range of interacting systems

√ Large amounts of data requiring utilization, analysis and interpretation

√ No simple analytical solutions

√ Need to reuse and reproduce analysis methods
Limitations of electronic calculators

On the importance of calculators to engineers:
http://www.jasoncoleman.net/geekery/calculator/
Data Analysis
Data Analysis

Access

Data Access
Software (Languages/Applications)
Hardware

?
Data Analysis

Access

Explore

Share
MATLAB for Data Analysis

Access

Explore

Share

Automation
Why study CAV?

✓ This unit aims to provide the tools that allow you to perform large scale repeatable analysis, simulation and visualization of datasets and models.

✓ The work of engineers and scientists frequently involves relating observable data and phenomena to models and simulations.

✓ Over the course of your study and career you will may encounter or formulate many different models that you need to simulate, datasets that you need to visualize, or complex procedures and calculations you need to automate.

✓ This unit will provide the basic skills to do this.
Scientific data analysis toolkit

√ Typical tools

• Spreadsheets (Excel)
• General purpose language (e.g. C, C++, Java, Fortran, VB)
• Technical Computing Language (e.g. Matlab, Mathematica, Sage)
• Special Purpose Tools (image processing, statistical analysis)
This semester

✓ Introduce three commonly used and highly useful software tools for data analysis, data visualisation and technical problem solving

  • **Excel** (spread sheet program for basic analysis, organisation, and presentation of data)
  • **Matlab** (widely used software for numerical computations)
  • **Mathematica** (powerful symbolic computation software)

✓ Introduction to computer programming
✓ Introduction to data presentation
A first glance at Microsoft Excel
A first glance at Mathworks Matlab
First glance at Wolfram Mathematica

\begin{verbatim}
In[4]:= Integrate[1/(x^3 - 1), x]

Out[4]= \(-\frac{\text{ArcTan}\left(\frac{1+2x}{\sqrt{3}}\right)}{\sqrt{3}} + \frac{1}{3} \log(-1+x) - \frac{1}{6} \log(1+x+x^2)\) \]

In[5]:= Plot3D[Sin[y + Sin[3 x]], {x, -3, 3}, {y, -3, 3}]
\end{verbatim}
Unit Structure

✓ Each week: 2 hour lecture and 3 hour laboratory (one of 5 laboratory sessions)

✓ Please attend the lab session in which you are enrolled.

✓ Four of the laboratories will be assessed. You will be required to complete the specified tasks and electronically submit your work. (20%).

✓ Two of the laboratories will be in class tests (30%).

✓ There will be an end of semester exam (50%).

✓ 1 hour workshop timetabled but will not be held, perhaps later in semester depending on requirements.
Lecture Plan

√ 24 lectures, 2 hours per week

√ Lecture 1: Introduction to unit

√ Lectures 2-4: Excel

√ Lectures 5-16: Matlab

√ Lectures 19-24: Mathematica

√ Revision (week 13)
## Calendar

<table>
<thead>
<tr>
<th>Week</th>
<th>Beginning</th>
<th>Lecture</th>
<th>Laboratory</th>
<th>Assessment</th>
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<tbody>
<tr>
<td>1</td>
<td>25 February</td>
<td>Introduction to Computers, Analysis and</td>
<td>Data Visualisation</td>
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<td></td>
<td></td>
<td>Visualisation</td>
<td>using Excel</td>
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<td>2</td>
<td>4 March</td>
<td>Data Management using Excel</td>
<td>Data Processing</td>
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<td>using Excel</td>
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<td>3</td>
<td>11 March</td>
<td>Introduction to Matlab</td>
<td>Expressions in</td>
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<td>Matlab</td>
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<td>4</td>
<td>18 March</td>
<td>Matlab Functions</td>
<td>Simple Programs</td>
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<td>5</td>
<td>25 March</td>
<td>Structures and Files</td>
<td>Iterative Functions</td>
<td>Lab 1 (5%)</td>
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<td>1 April</td>
<td>Mid-semester Break</td>
<td>No Lab</td>
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<td>6</td>
<td>8 April</td>
<td>Plotting and Graphics</td>
<td>Data Processing</td>
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<td>7</td>
<td>15 April</td>
<td>Matrix Operations</td>
<td>Lab Test 1</td>
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<td>8</td>
<td>22 April</td>
<td>Linear Systems</td>
<td>Data Visualization</td>
<td>Lab 2 (5%)</td>
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<td>9</td>
<td>29 April</td>
<td>Curve Fitting</td>
<td>Solving Linear</td>
<td>Lab 3 (5%)</td>
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<td>Systems</td>
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<td>10</td>
<td>6 May</td>
<td>Introduction to Mathematica</td>
<td>Visualisation with</td>
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<td>Mathematica</td>
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<td>11</td>
<td>13 May</td>
<td>Programming in Mathematica</td>
<td>Mathematica</td>
<td>Lab 4 (5%)</td>
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<td>Programming</td>
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<td>12</td>
<td>20 May</td>
<td>Symbolic Analysis</td>
<td>Lab Test 2</td>
<td>Lab Test 2</td>
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<td>13</td>
<td>27 May</td>
<td>Course Review</td>
<td>No lab</td>
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<td>3 June</td>
<td>Study break</td>
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<td>10-21 June</td>
<td>Exam Period</td>
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Information

√ Unit webpage:
  http://undergraduate.csse.uwa.edu.au/units/CITS2401/

√ Discussion/help forum:
  https://secure.csse.uwa.edu.au/run/help2401

√ Lectures are recorded

√ Lab demonstrators

√ Unit Coordinator

√ Stream undergraduate advisors

√ LMS.... A little but mostly not.