

Group project 1

Please sit according to your group number.

**Group 1 is towards the front, Group 35
towards the back.**

L3cture app

If you have access to the L3cture app, connect to Eduroam wifi with your standard university username and password and start it.

If you haven't got a smartphone, or don't want to take part, that's fine.

If you receive any error messages using the app, taking a screenshot and emailing it to me would be very helpful!

Further programming and web-design

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To take web-design further, what follows are some suggestions.

HTML and CSS

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Learning HTML properly is essential if you want to do web design more seriously.

Javascript

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Javascript appears as code in the head of an HTML document. For example, the following code appears in the head of the MAS115 course webpage.

```
div_toggle = function(id) {  
    var e = document.getElementById(id);  
    if (e && e.style.display == 'none') {  
        e.style.display = 'block';  
    } else {  
        e.style.display = 'none';  
    }  
}
```

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This function can be called as an href to make <div>s appear and disappear.

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Again, there are Javascript tutorials and courses online.

PHP

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PHP is a scripting language, similar to Python, which runs on a webserver. It is used to create HTML pages by printing out (*echoing*) bits of HTML code.

For example, the following creates the footer on my module webpages.

```
function make_footer() {  
    echo '<div id="bottom_rule"></div>';  
    make_last_updated();  
    echo '</body></html>';  
}
```

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function make_footer() {
    echo '<div id="bottom_rule"></div>';
    make_last_updated();
    echo '</body></html>';
}

function make_last_updated() {
    $modified = last_modified();
    echo '<p class="footer">Last updated: ';
    echo $modified;
    echo '</p>';
}
```

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function make_footer() {
    echo '<div id="bottom_rule"></div>';
    make_last_updated();
    echo '</body></html>';
}

function make_last_updated() {
    $modified = last_modified();
    echo '<p class="footer">Last updated: ';
    echo $modified;
    echo '</p>';
}

function last_modified() {
return date("j F Y",getlastmod($_SERVER['PHP_SELF']));
}
```

Where to learn more

There is a 10 credit Level 2 module called Scientific Computing and Simulation (MAS212).

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MAS212 has MAS115 as a prerequisite, and looks at ways of using Python to 'visualise and analyse numerical results, and then applies the knowledge to explore the physical behaviours of model equations'.

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MAS212 has MAS115 as a prerequisite, and looks at ways of using Python to 'visualise and analyse numerical results, and then applies the knowledge to explore the physical behaviours of model equations'.

If you have enjoyed learning Python, and want to know more about how applied mathematicians use it, then remember this course when picking next year's modules.

Other sources of information

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- <http://code.org> have links to online tutorials;
- *Coursera* run free online courses;
- Youtube and itunesU have video lectures.

There may be modules from other departments that you can take at Level 2, e.g. COM161, although you may need special permission and the timetables might clash.

The $3x + 1$ problem

Here's an apparently simple problem. Given a positive integer x , we halve it if it is even, and multiply it by 3 and add 1 if it is odd.

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In symbols, this defines the function f by

$$f(x) = \begin{cases} x/2, & \text{if } x \text{ is even,} \\ 3x + 1, & \text{if } x \text{ is odd.} \end{cases}$$

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Repeat this. For example, if we start with 13, we run through the sequence

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13 \mapsto

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$$13 \mapsto 40 \mapsto$$

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Repeat this. For example, if we start with 13, we run through the sequence

$$13 \mapsto 40 \mapsto 20 \mapsto$$

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Repeat this. For example, if we start with 13, we run through the sequence

$$13 \mapsto 40 \mapsto 20 \mapsto 10 \mapsto$$

$$f(x) = \begin{cases} x/2, & \text{if } x \text{ is even,} \\ 3x + 1, & \text{if } x \text{ is odd.} \end{cases}$$

Repeat this. For example, if we start with 13, we run through the sequence

$$13 \mapsto 40 \mapsto 20 \mapsto 10 \mapsto 5 \mapsto$$

$$f(x) = \begin{cases} x/2, & \text{if } x \text{ is even,} \\ 3x + 1, & \text{if } x \text{ is odd.} \end{cases}$$

Repeat this. For example, if we start with 13, we run through the sequence

$$13 \mapsto 40 \mapsto 20 \mapsto 10 \mapsto 5 \mapsto 16 \mapsto$$

$$f(x) = \begin{cases} x/2, & \text{if } x \text{ is even,} \\ 3x + 1, & \text{if } x \text{ is odd.} \end{cases}$$

Repeat this. For example, if we start with 13, we run through the sequence

$$13 \mapsto 40 \mapsto 20 \mapsto 10 \mapsto 5 \mapsto 16 \mapsto 8 \mapsto$$

$$f(x) = \begin{cases} x/2, & \text{if } x \text{ is even,} \\ 3x + 1, & \text{if } x \text{ is odd.} \end{cases}$$

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Repeat this. For example, if we start with 13, we run through the sequence

$$13 \mapsto 40 \mapsto 20 \mapsto 10 \mapsto 5 \mapsto 16 \mapsto 8 \mapsto 4 \mapsto 2 \mapsto 1 \mapsto \dots$$

and you can see that we end at the cycle $1 \mapsto 4 \mapsto 2 \mapsto 1$.

L3cture question

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The conjecture could fail in two ways: either there is a cycle with larger numbers, or there is an initial value such that the sequence just gets bigger and bigger, and never cycles at all.

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The task

Your task is to investigate *the $3x + 1$ problem* and to create a website which presents your findings.

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You will find suggestions on what to investigate on the sheet. You should see these suggestions as a starting point for your project.

Your write-up could involve some background material,

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You should aim to create a self-contained account of the subject that your peers who aren't taking MAS115 would be interested in reading.

Submission

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- (ii) your group's final submission in early February.

The individual submission is a short webpage covering the 'Individual Task' on page 3.

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The deadline for uploading the individual submission is midnight at the end of Friday 13th January.

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This will not be marked, but failure to complete it will result in a penalty.

The deadline for uploading the final group submission is midnight at the end of Friday 3rd February.

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There is no minimum or maximum length for the project. As a rough guide, approximately four times the length of the average mini-project is expected.

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You may link to or embed Python scripts, external sites or any other appropriate material.

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You may link to or embed Python scripts, external sites or any other appropriate material.

The title on the index page should be 'The $3x + 1$ Problem: Group Project (Group x)'.

You may use any of the CSS files which appear on the course webpage.

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You will upload your website via the upload system on the course webpage.

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January computer labs

There are two drop-in computer labs in January which you should use to finalize the project in your groups.

- Tuesday 24 January, Diamond Computer Room 3, 13.00–14.30
- Friday 31 January, Diamond Computer Room 3, 13.00–14.30

We strongly encourage groups to arrange to meet at these labs with a plan for how to use the time effectively.

Late work and plagiarism

Late work. It is important that work is submitted on time. Any work submitted after the deadline may be subject to a penalty and could be given a mark of zero. Anybody with circumstances affecting their ability to hand in the work must contact Dr Marsh in advance of the hand-in date.

Plagiarism The project must be your own group's work. You should collaborate with your other group members to identify the work to be done and solve problems. You should not share material with other groups except via the MAS115 discussion board (see below). **Please also ensure you have read and understood the material on plagiarism from the Week 11 lecture.** Where we judge that work has been plagiarised from another source, there is a possibility of a mark of zero being awarded for those projects. Please bear this in mind!

How to approach the project

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When the MAS110 exam is finished, you should ensure you work as a group on the project.

Final comments

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- Proofread! Everyone should read each other's contribution and make sure there are no mistakes.

Here are some final thoughts to help you with the project.

- Make sure the project is a coherent whole and not unrelated pages stuck together.
- The first-person (e.g. 'I wrote a script...') is not appropriate in group work.
- Proofread! Everyone should read each other's contribution and make sure there are no mistakes.
- Challenge and push each other. This is about investigating mathematics.

- Make sure you understand what other people have done, and check it is correct and written clearly.

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- Look out for strangely good work: could it be plagiarised?
- Always make Python code downloadable, or embed with `repl.it`.
- Make your site easy to browse by keeping the structure simple.

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- Don't use capital letters or spaces in filenames.

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- **You must participate satisfactorily in all three group projects to pass the module.**

That's it!

There are no labs tomorrow; we've finished for this semester.
Good luck with the project and your January exam, and have
a good Christmas break!