

XML and Structured Information

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1 Marks, etc.

This is the first coursework for the XML module: it will be due in on the last Friday of term (12 December), at 12 noon, by the automatic coursework submission system. You should do it in pairs, and it will count 20% towards the mark for the module. You should find partners and email Karen Finesilver (karen@dcqs.qmul.ac.uk) with the names of your pair: you should do this before the end of next week (October 24). If you do not do this, I will come after you.

1.1 Automatic Submission

1. Go to <https://intranet.dcs.qmul.ac.uk/information/personal/newyou.php> where you should see a list of the assessments for which you are registered.
2. Upload (i.e. submit) only 1 file. Either a documents (e.g. PDF) or a zip containing multiple files - further information can be found on the submission upload page. Instruction on the acceptable formats should be given in the coursework instructions.
3. You can check what you have submitted and it is possible to resubmit up to the deadline.

2 The Problem

Your task is to write an XSLT stylesheet that solves linear equations using the LUP decomposition method (Thomas Cormen, Charles Leiserson and Ronald Rivest, *Introduction to Algorithms* MIT 1994), pp. 749ff).

2.1 Files

I have written for you a schema, `linearEquation.xsd`, that represents linear equations: the document

```
<?xml version="1.0" encoding="UTF-8"?>
<linearEquation xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:noNamespaceSchemaLocation="file:/homes/graham/teaching/xml/marks/course
  <LHS>
    <row>
      <entry value="0.0"/>
      <entry value="1.0"/>
    </row>
    <row>
      <entry value="1.0"/>
      <entry value="2.0"/>
    </row>
  </LHS>
  <RHS>
    <entry value="5.3"/>
    <entry value="2.8"/>
  </RHS>
</linearEquation>
```

represents the equation

$$\begin{pmatrix} 0 & 1 \\ 1 & 2 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = \begin{pmatrix} 5.3 \\ 2.8 \end{pmatrix}$$

i.e.

$$\begin{aligned} x_2 &= 5.3 \\ x_1 + 2x_2 &= 2.8 \end{aligned}$$

I require the values of the x_i , which in this case should be

$$\begin{aligned} x_1 &= -7.8 \\ x_2 &= 5.3 \end{aligned}$$

3 Remarks, etc

1. I want a well-structured and comprehensible solution: you should use named templates appropriately, and give them comprehensible names
2. Although I've been doing recursive arithmetic in the lectures, I expect you to use the normal XPath arithmetic expressions for this: there is a good summary of these in *XML in a Nutshell*, p. 176.
3. Do a lot of checking. Although the schema says that there should be a matrix and a vector, it does not say that the rows of the matrix should be equal in length, nor that the matrix should be square (i.e. number of rows

= length of rows), nor that the number of the rows should be the length of the vector on the right of the equation. We need all of these for the equation to make sense. Your stylesheet should check these, and output an error message if they fail.

Furthermore, the equation may not have a unique solution, or may not have any solution (either of these may happen if, for example, two rows of the matrix are the same, though they can happen in other cases than this). You can see how to check for this in the pseudocode on p. 759 of Cormen et al.; if it occurs, then again fail with an error message.

4. you might find the grid view in Oxygen convenient when inputting matrices.
5. Deliverables:
 - (a) your stylesheet
 - (b) an explanation of what your stylesheet does, saying (in particular) what each template does and how it fits in to the computation
 - (c) some example files that you have tested your stylesheet with

6. Marking Criteria

- correctness
- enough checking
- clarity of code
- clarity of explanation