

26.2 QMath: A Human-Oriented Language and Batch Formatter for OMDoc

Project Home	http://www.matracas.org/qmath/index.en.html
Authors	Alberto González Palomo Toledo, Spain ²

QMATH is a batch processor that produces an OMDoc file from a plain UNICODE text document, in a similar way to how \TeX produces a DVI file from a plain text source. Its purpose is to allow fast writing of mathematical documents, using plain text and a straightforward syntax (like in computer algebra systems) for mathematical expressions.

The “Q” was intended to mean “quick”, since QMATH began in 1998 as an abbreviated notation for MATHML. The first version (0.1) just expanded the formulas found enclosed by “\$” signs, which were abbreviated forms of the MATHML element names, and added the extra markup such as `<mrow>` and the like. The second (0.2) did the same thing, but this time allowing an algebraic notation that was fixed in the source code. Finally, version 0.3 allowed the redefinition of symbols while parsing, but it was not capable of expanding formulas embedded in XML documents like the previous ones did until version 0.3.8.³ For a more detailed history see [Palb].

QMATH is very simple: it just parses a text (UTF-8) file according to a user-definable table of symbols, and builds an XML document from that. The symbol definitions are grouped in files called “contexts”. The idea is that when you declare a context, its file is loaded and from then on these symbol definitions take precedence over any previous one, thus setting the context for parsing of subsequent expressions.

The grouping of symbols in the context files is arbitrary. However, the ones included with QMATH follow the OPENMATH Content Dictionaries hierarchy so that, for instance, the English language syntax for the symbols in the “arith1” CD is defined in the context “Mathematics/OpenMath/arith1”.

Figure 26.1 shows a minimal QMATH document, and the OMDoc document generated from it. The first line (“QMATH 0.3.8”) in the QMATH document is required for the parser to recognize the file. The lines beginning with “:” are metadata items, the first of which, `:en`, declares the primary language for the document, in this case English. Specifying the language is required, as it sets the basic keywords accordingly, and there is no default (privileged) language in QMATH. For example, the English keyword “Context” is written “Contexto” if the language is Spanish. (Similarly, the arithmetic context is “Matemáticas/Aritmética”). Then, the “OMDoc” context is loaded, defining the XML elements to be produced by the metadata items and the different kinds of paragraphs: plain text, theorem, definition, proof, example, etc.

² The author is currently employed part-time in the ACTIVEMATH project, developed by Saarland University and the DFKI, but this work was done on his own, without their supervision or support.

³ This offers an alternative to the OQMATH wrapper mentioned in Section 26.8.

<p>QMATH 0.3.8 :en Context: "Mathematics/OMDoc" :"Diary" :W. Smith :1984-04-04 18:43:00+00:00 Context: "Mathematics/Arithmetic" Theory:[<-thoughtcrime] :"Down with Big Brother" Freedom is the freedom to say $\\$2+2=4\\$. If that is granted, all else follows.</p>	<p>From contexts/en/Mathematics/OpenMath/arith1.qmath: Symbol: plus OP_PLUS "arith1:plus" Symbol: + OP_PLUS "arith1:plus" Symbol: sum APPLICATION "arith1:sum" Symbol: Σ APPLICATION "arith1:sum" ... From contexts/en/Mathematics/OpenMath/relation1.qmath: Symbol: = OP_EQ "relation1:eq" Symbol: neq OP_EQ "relation1:neq" Symbol: $\neg=$ OP_EQ "relation1:neq" Symbol: \neq OP_EQ "relation1:neq" ...</p>
<pre><?xml version='1.0' encoding='UTF-8' standalone='no'?> <!DOCTYPE omdoc PUBLIC "-//OMDoc//DTD OMDoc V1.2//EN" "../../../../../ dtd/omdoc.dtd"> <omdoc xmlns='http://www.mathweb.org/omdoc' version='1.2' xmlns:dc='http://purl.org/dc/elements/1.1/'> <metadata> <dc:language>en</dc:language> <dc:title>Diary</dc:title> <dc:creator role='aut'>W. Smith</dc:creator> <dc:date>1984-04-04T18:43:00+00:00</dc:date> </metadata> <theory xml:id='thoughtcrime'> <imports from="arith1"/> <imports from="relation1"/> <omtext> <metadata><dc:title>Down with Big Brother</dc:title></metadata> <CMP> Freedom is the freedom to say <OMOBJ xmlns='http://www.openmath.org/OpenMath'> <OMA> <OMS cd='relation1' name='eq'/> <OMA> <OMS cd='arith1' name='plus'/> <OMI>2</OMI><OMI>2</OMI> </OMA> <OMI>4</OMI> </OMA> </OMOBJ>. If that is granted, all else follows. </CMP> </omtext> </theory> </omdoc></pre>	

Fig. 26.1. A minimal QMATH document (top left) and its OMDOC result (bottom). Some symbol definitions are displayed in the top right.

After that setup come the document title, author name (one line for each author), and date, which form the content of the OMDOC metadata element.

The document is composed of paragraphs (which can be nested) separated by empty lines, and formulas are written enclosed by “ $\$$ ” signs.

There is an Emacs mode included in the source distribution, that provides syntax highlighting and basic navigation based on element identifiers.

It is also possible to use it on an XML document for expanding only the mathematical expressions. QMATH will detect automatically the input format, either QMATH text or XML, and in the later case output everything verbatim except for the QMATH language fragments found inside the XML processing instructions of the form `<?QMath ... ?>` and the mathematical expressions between “\$”.

```

<?xml version='1.0' encoding='UTF-8' standalone='no'?>
<!DOCTYPE omdoc PUBLIC "-//OMDoc//DTD OMDoc V1.2//EN"
      "../..../ dtd/omdoc.dtd">
<?QMath
:en
Context: "Mathematics/Arithmetic"
?>
<omdoc xmlns='http://www.mathweb.org/omdoc' version='1.2'
      xmlns:dc='http://purl.org/dc/elements/1.1/'>
  <metadata>
    <dc:language>en</dc:language>
    <dc:title>Diary</dc:title>
    <dc:creator role='aut'>W. Smith</dc:creator>
    <dc:date>1984-04-04T18:43:00</dc:date>
  </metadata>
  <theory xml:id='thoughtcrime'>
    <omtext>
      <metadata><dc:title>Down with Big Brother</dc:title></metadata>
      <CMP>
        Freedom is the freedom to say  $2+2=4$ .
        If that is granted, all else follows.
      </CMP>
    </omtext>
  </theory>
</omdoc>

```

Fig. 26.2. The same example document, using QMATH only for the formulas.

While QMATH was a good improvement over manual typing of the OMDOC XML, it does not scale well: in real documents, with more than a couple of nesting levels, it is difficult to keep track of where the current paragraph belongs.

One solution is to use it only for the mathematical expressions, and rely on some XML editor for the document navigation and organization, such as the OMDOC mode for Emacs described in Section 26.16 or the OQMATH mode for JEDIT in Section 26.9. Another is to use the SENTIDO browser/editor in Section 26.3, which reimplements and extends QMATH’s functionality.

QMATH is Free Software distributed under the GNU General Public License (GPL [FSF91]).