

Liblouisutdml User's and Programmer's Manual

Release 2.5.0

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This manual is for liblouisutdml (version 2.5.0, 25 November 2012), an xml to Braille Translation Library.

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1 Introduction

liblouisutdml is a software component which can be incorporated into software packages to provide the capability of translating any file in the computer lingua franca xml format or plain text into properly transcribed braille. This includes translation into grade two, if desired, mathematical codes, etc. It also includes formatting according to a style sheet which can be modified by the user. The first program into which liblouisutdml has been incorporated is `file2brl`. This program will translate an xml or text file into an embosser-ready braille file. It is not necessary to know xml, because MSWord and other word processors can export files in this format. If the word processor has been used correctly `file2brl` will produce an excellent braille file.

There is a Mac GUI application incorporating liblouisutdml called `louis`. For a link to it go to www.abilityesssoft.com/downloads. You can also obtain a Windows binary on this page. At present it is command-line. We hope to have a GUI soon.

Users who want to generate Braille using `file2brl` will be interested in [Section 2.1 \[Transcribing XML files with file2brl\]](#), page 2. Those who wish to change the output generated by liblouisutdml should read [Chapter 3 \[Customization Configuring liblouisutdml\]](#), page 6. If you encounter a type of xml file with which liblouisutdml is not familiar you can learn how to tell it how to process that file by reading [Chapter 4 \[Connecting with the xml Document\]](#), page 16. If you wish to implement a new braille mathematics code read [Chapter 7 \[Implementing Braille Mathematics Codes\]](#), page 32. Finally, computer programmers who wish to use liblouisutdml in their software can find the information they need in [Chapter 8 \[Programming with liblouisutdml\]](#), page 35.

You will also find it advantageous to be acquainted with the companion library liblouis, which is a braille translator and back-translator (see [Section “Overview” in *Liblouis User’s and Programmer’s Manual*](#)).

2 Transcribing Documents

2.1 Transcribing XML files with file2brl

At the moment, actual transcription with liblouisutdml is done with the command-line (or console) program `file2brl`. The line to type is:

```
file2brl [OPTIONS] [-f config-file] [infile] [outfile]
```

The brackets indicate that something is optional. You will see that nothing is required except the program name itself, `file2brl`. The various optional parts control how the program will behave, as follows:

- `-h`
- `--help` This option causes `file2brl` to print a help message describing usage and exit.
- `-v`
- `--version` This option causes `file2brl` to display the version information and exit.
- `-l`
- `--log-file` This option will cause `file2brl` and `liblouisutdml` to print error messages to `file2brl.log` instead of `stderr`. The file will be in the current directory. This option is particularly useful if `file2brl` is called by a GUI script or Web application.
- `-f configfile`
- `--config-file configfile` This specifies the configuration file which tells `file2brl` how to do the transcription. (It may be a list of file names separated by commas.) This file specifies such things as the number of cells per line, the number of lines per page, The translation tables to be used, how paragraphs and headings are to be formatted, etc. If this part of the command line is omitted, `file2brl` assumes that the configuration file is named `default.cfg`. If the configuration file name contains a pathname `file2brl` will consider this as a path on which to look for files that it needs (see [Section 8.3 \[Files and Paths\]](#), page 36). If no pathname is given the standard paths are searched and finally the current directory. To make `file2brl` search the current directory first, precede the file name with `./`.
- `-Csetting=value`
- `--config-setting setting=value` This option enables you to specify configuration settings on the command line instead of changing the configuration file. You can use as many `-C` options as you wish. Any settings can be specified except those having to do with styles. See [\[Configuration Settings Index\]](#), page 70, for a list of available settings. These must be specified in configuration files. The settings may be in any order. They override any settings in `liblouisutdml.ini` or in the configuration file used by `file2brl`.

-b

--backward

back-translate. The input file must be a braille file, such as `.brf`. The output file is a back-translation of this file. It may be in either plain-text or xhtml (html), according to the setting of `backFormat` in the `outputFormat` section of the configuration file. Html files will contain page numbers and emphasis. To get good html, the liblouis table must have the entry `'space \e 1b'` so that it will pass through escape characters. The `html.sem` file must also contain the line `'pagenum pagenum'`. Text output files simply have a blank line between paragraphs. Encoding of text files is controlled by the `outputEncoding` setting. Html files are always in UTF-8.

-r

--reformat

Reformat. The input file must be a braille file, such as `.brf`. The output is a braille file formatted according to the configuration file. It is advisable to set `backFormat` to html, since this will preserve print page numbers and emphasis. This option can be useful for changing the line length and page length of a braille file, for example, from 40 to 32 cells. It is also an excellent way to check the accuracy of liblouis tables. The original page numbers at the tops and bottoms of pages are discarded, and new ones are generated.

-p

--poorly-formatted

Poorly formatted input translation. Infile is any text file such as may have been obtained by extracting the text in a pdf file. The input file may also be an xml or html file which is so poorly formatted that better braille can be obtained by ignoring the formatting. `file2brl` tries to guess paragraph breaks. The output is generally reasonably formatted, that is, with reasonable paragraph breaks.

-t

--html

The document is an h(t)ml file, not xhtml. This option is useful with files downloaded from the Web in source form. Without it, the program will first try to parse the file as an xml document, producing lots of error messages. It will then try the html parser. With this option, it goes directly to the html parser. See also the `formatFor` configuration (see [\[formatFor setting\]](#), page 9) file setting, which enables you to format the braille output for viewing in a browser.

-T

--text

Consider the document to be a text file, even if it is xml or html.

infile

This is the name of the input file containing the material to be transcribed. The file may be either an xml file or a text file. The `-b`, `-r` and `-p` options discussed above provide for other types of files and processing. Typical xml files are those provided by www.bookshare.org or those derived from a word processor by saving in xml format. If a text file is used paragraphs and headings should be separated by blank lines. In such a file there is no way to distinguish between paragraphs and headings, so they will all be formatted as paragraphs,

as specified by the configuration file. However, if you want a blank line in the braille transcription use two consecutive blank lines in the text file.

outfile This is the name of the output file. It will be transcribed as specified by the configuration file and the `-C` configuration settings. The following paragraphs provide more information on both the input and output files.

`file2brl` is set up so that it can be used in a "pipe". To do this, omit both `infile` and `outfile`. Input is then taken from the standard input unit.

The first file name encountered (a word not preceded by a minus sign) is taken to be the input file and the second to be the output file. If you wish input to be taken from `stdin` and still want to specify an output file, use one minus sign (`'-'`) for the input file.

If only the program name is typed `file2brl` assumes that the configuration file is `default.cfg`, input is from the standard input unit, and output is to the standard output unit.

2.2 Transcribing Text Documents

See the previous section on using `file2brl`. This program recognizes text files automatically and transcribes them according to the information in the configuration files. Paragraphs must be separated with a blank line. If you want a blank line in the output use two blank lines.

2.3 Transcribing Poorly Formatted Documents

```
file2brl -p infile outfile
```

Some text documents, such as those derived from pdf files, and even some xml and html documents, are so poorly formatted that you can get better braille by ignoring whatever markup they contain. The `-p` option of `file2brl` does this. It ignores xml or html markup and uses heuristics to find the beginning of paragraphs. Its choices are usually good. Note that it does not work with rtf files. However, if `rtf2xml` (see [Section 2.6 \[Transcribing RTF files with rtf2brl\]](#), page 5) will convert the file, it will work with the resulting xml file.

2.4 Transcribing html Documents

```
file2brl -t infile outfile
```

The `-t` option prevents `xml2brl` from trying to transcribe `infile` as an xml document. This will produce a lot of error messages. `file2brl` will then try the html parser. Note that xhtml documents are actually xml.

2.5 Transcribing Microsoft Word files with msword2brl

```
msword2brl infile outfile
```

`Infile` must be a Microsoft Word file. The script first calls the `antiword` program, so you must have this installed on your machine. `antiword` is called with `-x db`, which causes the output to be in docbook format. This is piped to `file2brl`. The output file from `file2brl` contains much of the formatting, including emphasis, of the word file.

2.6 Transcribing RTF files with rtf2brl

```
rtf2brl infile outfile
```

Infile must be a rich-text (rtf) file, such as Bookshare provides for proofreading. The script first calls `rtf2xml`, so you must have this program installed on your machine. You can find it on the downloads page of www.abilitiessoft.com. It was copied from its SourceForge project. Since it is a Python program, it can be rather slow. Its output is piped to `file2brl`. The output of `rtf2xml` is xml with the root element `doc`. The file `doc.sem` is fairly complete, so the output of `file2brl` contains much of the formatting, including emphasis, of the original rtf file.

2.7 Transcribing PDF files with pdf2brl

```
pdf2brl infile outfile
```

Infile must be a PDF (Portable Document Format) file. The script first calls the `pdftotext` program, so you must have this installed on your machine. It is part of `xpdf` and most likely already installed if you're on a modern Linux distribution. Otherwise, you can get it from either <http://poppler.freedesktop.org> or <http://www.foolabs.com/xpdf/download.html>. `pdftotext` is called with the `-raw` and `-` options, which cause it to place its output on stdout. This is piped to `file2brl`, which is called with the `-p` option, since output from `pdftotext` is likely to be poorly formatted. The output file from `file2brl` is mostly in sensible paragraphs.

3 Customization: Configuring liblouisutdml

The operation of liblouisutdml is controlled by two types of files: semantic-action files and configuration files. The former are discussed in the section Connecting with the xml Document - Semantic-action Files (see [Chapter 4 \[Connecting with the xml Document - Semantic-Action Files\]](#), page 16). The latter are discussed in this section. A third type of file, braille translation tables, is discussed in the liblouis documentation (see [Section “Overview” in Liblouis User’s and Programmer’s Manual](#)). Another section of the present document which may be of interest is Implementing Braille Mathematical Codes (see [Chapter 7 \[Implementing Braille Mathematics Codes\]](#), page 32).

Besides files, liblouisutdml can also be controlled by configuration strings, which are character strings in memory containing configuration settings separated by end-of-line characters. Such strings can be generated by the `-C` option on the `file2brl` command line, by the `configstring` and `configtweak` semantic actions, or by passing a string to the `lbu_initialize` function.

The information below applies to `file2brl` as much as to liblouisutdml.

Before discussing configuration files in detail it is worth noting that the application program has access to the information in the configuration files by calling the liblouisutdml function `lbu_initialize`. This function returns a pointer to a data structure containing the configuration information. The calling program must include the header file `louisutdml.h`. You do not need to call `lbu_initialize` unless you need the facilities which it provides.

A configuration file specification may contain more than one file name, separated by commas. liblouisutdml will process these files in sequence, merging the information they contain. The first file name may also contain a path. liblouisutdml will search for the files it needs first on this path. To make it search first the current directory precede the first file name with `./`. After the path, if any, has been evaluated, but before reading any of the files, liblouisutdml reads in a file called `liblouisutdml.ini`. This file can contain any configuration settings, but it usually contains only the minimum ones for liblouisutdml to operate properly. You may alter the values in the distribution `liblouisutdml.ini`, but you should not delete any settings. Do not specify `liblouisutdml.ini` as your configuration file. This will lead to error messages and program termination. If a configuration file read in later contains a particular setting name, the value specified simply replaces the one specified in `liblouisutdml.ini` or any previously read configuration file.

Originally, configuration files contained four main sections, `outputFormat`, `translation`, `xml` and `style`. The section names, except for `style` are now optional. In addition, a configuration file can contain an include entry. This causes the file named on that line to be read in at the point where the line occurs. The sections need not follow each other in any particular order, nor is the order of settings within each section important. The section names, except for `style` are optional. In this document and in the `liblouisutdml.ini` file, where section and setting names consist of more than one word, the first letter of each word following the initial one is capitalized. This is merely for readability. The case of the letters in these names is ignored by the program. Section and setting names may not contain spaces.

In addition to `liblouisutdml.ini` the distribution also contains a number of configuration files. The most important of these is `preferences.cfg`, which contains all possible

settings and a "default" value for each. You should use this file as a reference. It is the file read by the `file2brl` command-line interface program if no configuration file is given.

Here, then, is an explanation of each section and setting in the `preferences.cfg` file. When you look at this file you will see that the section names start at the left margin, while the settings are indented one tab stop. This is done for readability. It has no effect on the meaning of the lines. You will also see lines beginning with a number sign (`#`), which are comments. Blank lines can also be used anywhere in a configuration file. In general, a section name is a single word or combination of unspaced words. However, each style has a section of its own, so the word `'style'` is followed by a space then by the name of the style. Setting lines begin with the name of the setting, followed by at least one space or tab, followed by the value of the setting. A few settings have two values.

3.1 outputFormat

This section specifies the format of the output file (or string).

`cellsPerLine 40`

The number of cells in a braille line.

`linesPerPage 25`

The number of lines on a braille page

`interpoint no`

Whether or not the output will be used to produce interpoint braille. This affects the placement of page numbers and may affect other things in the future. The only two values recognized are `'yes'` and `'no'`.

`lineEnd \r\n`

This specifies the control characters to be placed at the end of each output line. These characters vary from one intended use of the output to another. Most embossers require the carriage-return and line-feed combination specified above. However, a braille display may work best with just one or the other. Any valid control characters can be specified.

`pageEnd \f`

The control Character to be given at the end of a page. Here it is a forms-feed character, but it can be something else if desired.

`fileEnd ^z`

The control character to be placed at the end of the file, here a control-z.

`printPages yes`

Whether or not to show print page numbers if they are given in the xml input. The two valid values are `'yes'` and `'no'`.

`braillePages yes`

Whether or not to format the output into pages. Here the value is `'yes'`, for use with an embosser. However the user of a braille display may wish to specify `'no'`, so as not to be bothered with page numbers and forms feed characters. If no is specified the lines will still be of the length given in `cellsPerLine`, but the value of `linesPerPage` will be ignored.

paragraphs yes

Whether or not to format the output into paragraphs, using appropriate styles. If ‘no’ is specified, what would be a paragraph is output simply as one long line. Applications that wish to do their own formatting may specify ‘no’.

beginningPageNumber 1

This is the number to be placed on the first Braille page if **braillePages** is yes. This is useful when producing multiple Braille volumes.

printPageNumberAt top

If print page numbers are given in the xml input file they will be placed at the top of each braille page in the right-hand corner. If **pageSeparator** is set to ‘yes’, a page separator line will also be produced on the Braille page where the print page break actually occurs. You may also specify ‘bottom’ for this setting.

braillePageNumberAt bottom

The braille page number will be placed in the bottom right-hand corner of each page. If **interpoint yes** has been specified only odd pages will receive page numbers. You may also specify ‘top’ for this setting. If print page numbers and Braille page numbers are both placed at the top or bottom, they are rendered next to each other with a space in between.

continuePages yes

Print page numbers can be prefixed with a letter (a, b, c, etc.) on continued pages. The two valid values are ‘yes’ and ‘no’.

pageSeparator yes

A page separator line (or page break indicator), a line of unspaced Braille dots 36, will be placed wherever a print page break occurs. No page separator lines are placed on the first or last line of a Braille page, and no page separator lines are shown when the new print page coincides with a new Braille page.

pageSeparatorNumber yes

Show a page number at the far right margin of a page separator line. No space is left between the separator line and the first symbol of the page number.

ignoreEmptyPages yes

An empty page occurs when a **pagenum** tag is immediately followed by another **pagenum** tag. By default, empty pages are completely ignored. If you specify ‘no’ for this setting, a sequence of **pagenum** tags will lead to a *combined* print page number: the number of the first empty page is combined with that of the page on which text reappears, e.g. 5-7. If lettered continuation pages are required (see **continuePages**), they carry only the number of the page on which text reappears.

printPageNumberRange no

By default, only the page number of the *first* print page on a Braille page is shown at the top or bottom. However, if **printPageNumberRange** is set to ‘yes’, the *range* of print pages contained in the current Braille page is displayed. If the first page in this range is a continued print page, it is prefixed with a letter as usual (see **continuePages**).

mergeUnnumberedPages yes

Page breaks without a page number can simply be ignored. This means that unnumbered print pages will be treated as if they were a part of the preceding page. You can also specify ‘no’ for this setting.

pageNumberTopSeparateLine yes

Whether or not to provide a separate line for page numbers when they are placed at the top of a Braille page. The two valid values are ‘yes’ and ‘no’. A print page number range (see **printPageNumberRange**) at the top of a page is always displayed on a separate line.

pageNumberBottomSeparateLine yes

Whether or not to provide a separate line for page numbers when they are placed at the bottom of a Braille page.

hyphenate no

If ‘yes’ is specified words will be hyphenated at the ends of lines if a hyphenation table is available. In contracted English Braille hyphenation is not generally used, but it can save considerable space. The hyphenation table is specified as part of the table list in the **literaryTextTable** setting of the translation section.

outputEncoding ascii8

This specifies that the output is to be in the form of 8-bit ASCII characters. This is generally used if the output is intended directly for a braille embosser or display. The other values of encoding are ‘UTF8’, ‘UTF16’ and ‘UTF32’. These are useful if the application will process the output further, such as for generating displays of braille dots on a screen.

inputTextEncoding ascii8

This setting is used to specify the encoding of an input text file. The valid values are ‘UTF8’ and ‘ascii8’.

formatFor textDevice

This setting specifies the type of device the output is intended for. ‘textDevice’ is any device that accepts plain text, including embossers. You can also specify ‘browser’. In this case the output will be formatted for viewing in a browser. If the input file contains links, they will be preserved and can be used in the normal way. The text will be translated into braille with the correct line length. Math and computer material will be translated appropriately. These files work well in lynx and Internet Explorer, not so well in elinks and Firefox (Before Jaws 10).

backFormat plain

This setting specifies the format of back-translated files. ‘Plain’ specifies plain-text, while ‘html’ specifies xhtml. The latter is always encoded in UTF-8. Plain-text files can be encoded in ascii8, UTF-8 or UTF-16. Html is strongly recommended, since it will preserve print page numbering and emphasis.

backLineLength 70

This setting specifies the length of lines in back-translated files, whether in plain-text or html. This is mainly for human readability. Lines may sometimes be somewhat longer.

interline no

This setting specifies whether interlining is desired. If it is set to ‘yes’, the first line in the output will be a braille translation, the next line will be its back-translation according to the `interlineBackTable`. Back-translation is used instead of simply presenting the print original because a braille line may contain additional information, such as leading blanks, print or braille page numbers, print page separator lines, etc.

lineFill ’

This setting defines the fill character that will be used before the page numbers in the table of contents for example. The default fill character is an apostrophe (dot 3).

3.2 translation

This section specifies the liblouis translation tables to be used for various purposes.

literaryTextTable en-us-g2.ctb

The table used for producing literary braille. This may be either contracted or uncontracted.

uncontractedTable en-us-g1.ctb

The table used for producing uncontracted or Grade One braille. This setting appears to be superfluous and may be eliminated in the future.

compbrailleTable en-us-compbrl.ctb

The table used for producing large amounts of output in computer braille, such as computer programs. The computer braille table is usually combined with one of the two tables above.

mathtextTable en-us-mathtext.ctb

This table specifies how the non-mathematical parts of math books are to be translated. In many cases it will be the same as `literaryTextTable` or `uncontractedTable`. For books translated with the Nemeth Code it is different, because this code requires modification of standard Grade Two.

MathexpTable nemeth.ctb

This is the table used to translate mathematical expressions.

editTable nemeth_edit.ctb

When the output includes both mathematics and text there may be errors where one type of translation directly follows another. The `editTable` removes these errors.

interlineBackTable en-us-interline.ctb

This setting specifies the table to be used for back-translation when interlining is turned on. It must be tailored for this purpose, since an ordinary forward-

translation table may contain entries that do not handle the additional information in braille lines correctly.

3.3 xml

This section provides various information for the processing of xml files.

semanticFiles *gemeth.sem

This setting gives a list of semantic-action files. These files are read in the sequence given in the list. Here the first member of the list is an asterisk ('*'). This means that the corresponding file is to be named by taking the root element of the document and appending '.sem'. This asterisk member may occur anywhere in the list.

xmlheader <?xml version='1.0' encoding='UTF8' standalone='yes'>

This line gives the xml header to be added to strings produced by programs like **Mathtype** that lack one.

entity nbsp ^1

This line defines an entity or substitution in an xml file. It is one of those that has two values. The first is the thing to be replaced, and the second is the replacement. As many entity lines as necessary can be used. The information they contain is added to the information provided by **xmlHeader**. In **liblouisutdml.ini** this line is commented out, because specifying it at this point would prevent the user from specifying his own **xmlheader**.

internetAccess yes

The computer has an internet connection and **liblouisutdml** may obtain information necessary for the processing of this file from the Internet. If this setting is 'no' **liblouisutdml** will not try to use the internet. The necessary information may, however, be provided on the local machine in the form of a "dtd" file.

newEntries yes

liblouisutdml may create a new semantic-action file (beginning with **new_**) for a document with an unknown root element or a file (beginning with **appended_**) containing new entries for an existing semantic-action file. Both kinds of files are placed on the current directory. If this setting is 'no' **liblouisutdml** will not create a file of new entries and if it encounters a document with an unknown root element it will issue an error message. Setting **newEntries** to 'no' may be useful if users should not be bothered with the minutiae of semantic-action files.

3.4 style

The following sections all deal with styles. Each style has its own section. Style section names are unlike other section names in that they consist of the word **style**, followed by a space, followed by a style name. With some exceptions, styles are not hard-coded. The user may define any style desired, with any name except **document**, **para**, **heading1**, **heading2**, **heading3**, **heading4**, **contentsheader**, **contents1**, **contents2**, **contents3** and **contents4**. The first two are needed for basic formatting. The others are needed for the table of contents tool. The user must define settings for these styles as for any others. This is done

in `liblouisutdml.ini`, which also contains definitions and settings for many other styles. The user can add styles at any time in her/his own configuration files.

Styles can be nested. That is, a document may contain a section of one style, and inside this may be a section of another style. For example, you might have styles named `frontMatter`, `titlePage`, `dedication`, `contents`, and so on. Your document might contain a section of style `frontMatter`. Inside this section might be subsections of styles `titlePage`, `dedication`, `contents`, and so on. Inside the `titlePage` section there might be other sections with styles `heading1`, `para`, `centered`, etc.

Your `frontMatter` style might also define the "persistent" style setting `braillePageNumberFormat roman`. This setting will apply to all the styles nested within `frontMatter`, unless they have a setting other than `'normal'`, which is the default and means ordinary braille page numbers. However, the `titlePage` style might have the setting `braillePageNumberFormat blank`. This will apply to all styles nested within it. When the `titlePage` section ends, the `frontMatter` setting `'roman'` will be restored. The `'braillePageNumberFormat'` setting is an example of a "persistent" style setting. Most settings apply only to the style for which they are declared.

Below are the settings for the predefined style names. The `'document'` style contains all possible settings. The others contain only settings that are different from the defaults.

3.4.1 style document

This is a predefined style name. All settings have their default values. The user must specify any other values. If a "persistent" style setting is specified, it will apply to the whole document.

linesBefore 0

This setting gives the number of blank lines which should be left before the text to which this style applies. It is set to a non-zero value for some header styles.

linesAfter 0

The number of blank lines which should be left after the text to which this style applies.

leftMargin 0

The number of cells by which the left margin of all lines in the text should be indented. Used for hanging indents, among other things. This is a "persistent" setting, so by default all nested styles will inherit the setting.

rightMargin 0

The equivalent of `'leftMargin'` for the right side of the page. This is also a persistent setting.

firstLineIndent 0

The number of cells by which the first line is to be indented relative to `leftMargin`. `firstLineIndent` may be negative. If the result is less than 0 it will be set to 0. This setting is persistent.

translate contracted

This setting is currently inactive. It may be used in the future. This setting tells how text in this style should be translated. Possible values are `'contracted'`, `'uncontracted'`, `'compbrl'`, `'mathtext'` and `'mathexpr'`.

skipNumberLines no

If this setting is ‘yes’ the top and bottom lines on the page will be skipped if they contain braille or print page numbers. This is useful in some of the mathematical and graphical styles.

format leftJustified

The format setting controls how the text in the style will be formatted. Valid values are ‘leftJustified’, ‘rightJustified’, ‘centered’, ‘computerCoded’, ‘alignColumnsLeft’, ‘alignColumnsRight’, and ‘contents’. The first three are self-explanatory. ‘computerCoded’ is used for computer programs and similar material. The next two are used for tabular material. ‘alignColumnsLeft’ causes the left ends of columns to be aligned. ‘alignColumnsRight’ causes the right ends of columns to be aligned. ‘contents’ is used only in styles specifically intended for tables of contents. In the case of ‘leftJustified’, ‘rightJustified’ and ‘centered’, nested styles inherit this setting by default.

newPageBefore no

If this setting is ‘yes’, the text will begin on a new page. This is useful for certain mathematical and graphical styles. Page numbers are handled properly.

newPageAfter no

If this setting is ‘yes’ any remaining space on the page after the material covered by this style is handled is left blank, except for page numbers.

rightHandPage no

if this setting is ‘yes’ and interpoint is yes the material covered by this style will start on a right-hand page. This may cause a left-hand page to be left blank except for page numbers. If interpoint is ‘no’ this setting is equivalent to newPageBefore.

braillePageNumberFormat normal

This setting specifies the format of braille page numbers. ‘normal’ means ordinary Arabic numbers. ‘roman’ means Roman numbers. ‘p’ means to precede Arabic numbers with the letter "p" (for preliminary). Finally, ‘blank’ causes the page number to be blank (no page numbers). This is a "persistent" style setting.

dontSplit no

If this setting is ‘yes’, the element is protected from being split across pages. This means that if a block of text doesn’t fit on the current page, it will be placed at the beginning of the next one. This setting applies to the whole element, including children, so if nested styles specify other values for ‘dontSplit’, these values will be ignored.

keepWithNext no

If this setting is ‘yes’, the element covered by this style is protected from being split across pages, and in addition it is kept together with the first line of text of the next sibling.

`orphanControl 0`

With this setting you can control how many lines of text of an element must be printed at least at the bottom of a braille page. The default value is ‘0’. To have an effect, the setting must have a value of ‘2’ or more.

3.4.2 style contentsheader

This style is used to specify where the table of contents should be placed and its title. The xml tag assigned to it in the semantic action file should be placed in the document where you want the table of contents, and it should contain the title of that table between its starting and ending markers.

`linesBefore 1`
`linesAfter 1`
`format centered`

3.4.3 style contents1

This style and the other contents styles are used for the table of contents and correspond to the ten heading levels (‘contents5’, ‘contents6’, ‘contents7’, ‘contents8’, ‘contents9’ and ‘contents10’ are not showed here).

`firstLineIndent -2`
`leftMargin 2`
`format contents`

3.4.4 style contents2

`firstLineIndent -2`
`leftMargin 4`
`format contents`

3.4.5 style contents3

`firstLineIndent -2`
`leftMargin 6`
`format contents`

3.4.6 style contents4

`firstLineIndent -2`
`leftMargin 8`
`format contents`

3.4.7 style heading1

This style is used for main headings, such as chapter titles.

`linesBefore 1`
`center yes`
`linesAfter 1`

3.4.8 style heading2

The first level of subheadings after the main heading.

```
linesBefore 1
firstLineIndent 4
```

3.4.9 style heading3

The third level of headings.

```
firstLineIndent 4
```

3.4.10 style heading4

The fourth level of headings. There are six more levels: ‘heading5’, ‘heading6’, ‘heading7’, ‘heading8’, ‘heading9’ and ‘heading10’.

```
firstLineIndent 4
```

3.4.11 style para

Paragraph. This is ordinary body text.

```
firstLineIndent 2
```

4 Connecting with the xml Document - Semantic-Action Files

4.1 Overview

When liblouisutdml (or `file2brl`) processes an xml document, it needs to be told how to use the information in that document to produce a properly translated and formatted braille document. These instructions are provided by a semantic-action file, so called because it explains the meaning, or semantics, of the various specifications in the xml document. To understand how this works, it is necessary to have a basic knowledge of the organization of an xml document.

An xml document is organized like a book, but with much finer detail. First there is the title of the whole book. Then there are various sections, such as author, copyright, table of contents, dedication, acknowledgments, preface, various chapters, bibliography, index, and so on. Each chapter may be divided into sections, and these in turn can be divided into subsections, subsubsections, etc. In a book the parts have names or titles distinguished by capitalization, type fonts, spacing, and so forth. In an xml document the names of the parts are enclosed in angle brackets ('<>'). For example, if liblouisutdml encounters `<html>` at the beginning of a document, it knows it is dealing with a document that conforms to the standards of the extensible markup language (xhtml) - at least we hope it does. When you see a book, you know it's a book. The computer can know only by being told. Something enclosed in angle brackets is called an "element" (more properly, a "tag") in xml parlance. (There may be more between the angle brackets than just the name of the element. More of this later). The first "element" in a document thus tells liblouisutdml what kind of document it is dealing with. This element is called the "root element" because the document is visualized as branching out from it like a tree. Some examples of root elements are `<html>`, `<math>`, `<book>`, `<dtbook>` and `<wordDocument>`. Whenever liblouisutdml encounters a root element that it doesn't know about it creates a new file called a semantic-action file. The name of this file is formed by stripping the angle brackets from the root element, putting 'new_' in front of it and adding a period plus the letters 'sem'. For example, 'new_myformat.sem'. If you look in a directory containing semantic-action files you will see names like `html.sem`, `dtbook.sem`, `math.sem`, and so on. The "new" semantic-action files must be edited by a person and the prefix "new" removed to get an ordinary semantic-action file name.

Sometimes it is advantageous to preempt the creation of a semantic-action file for a new root element. For example, an article written according to the docbook specification may have the root element `<article>`. However, the specification itself has the root element `<book>`. In this case you can specify the `book.sem` file in the configuration file by writing, in the xml section,:

```
semanticFiles book.sem
```

You will note that this setting uses the plural of "file". This is because you can actually specify a list of file names separated by commas. You might want to do this to specify the semantic-action file for the particular braille mathematical code to be used. For example:

```
semanticFiles book.sem,ukmaths.sem
```

You can use an asterisk `*` to specify the semantic-action file corresponding to the root element of the document anywhere in the list.

As you will see in the next section, different braille style conventions and different braille mathematical codes may require different semantic-action files

liblouisutdml records the names of all elements found in the document in the semantic-action file. The document has a multitude of elements, which can be thought of as describing the headings of various parts of the document. One element is used to denote a chapter heading. Another is used to denote a paragraph, Still another to denote text in bold type, and so on. In other words, the elements take the place of the capitalization, changes in type font, spacing, etc. in a book. However, the computer still does not know what to do when it encounters an element. The semantic-action file tells it that.

Consider `html.sem`. A copy is included as part of this documentation with the name `example_html.sem` (see [Section A.3 \[html.sem\], page 44](#)). It may differ from the file that liblouisutdml is currently using. You will see that it begins with some lines about copyrights. Each line begins with a number sign ('#'). This indicates that it is a "comment", intended for the human reader and the computer should ignore it. Then there is a blank line. Finally, there are two other comments explaining that the file must be edited to get proper output. This is because a human being must tell the computer what to do with each element. The semantic files for common types of documents have already been edited, so you generally don't have to worry about this. But if you encounter a new type of document or wish to specify special handling for styles or mathematics you may have to edit the semantic-action file or send it to the maintainer for editing. In any case the rest of this section is essential for understanding how liblouisutdml handles documents and for making changes if the way it does so is not correct.

After another blank line you will see a table consisting of two, and sometimes three, columns. The first column contains a word which tells the computer to do something. For example, the first entry in the table is: '`include nemeth.sem`'. This tells liblouisutdml to include the information in the `nemeth.sem` file when it is deciphering an html (actually xhtml) document (it may be preferable to use the `semanticFiles` setting in the configuration file rather than an include).

The second row of the table is:

```
no hr
```

'`hr`' is an element with the angle brackets removed. It means nothing in itself. However, the first column contains the word '`no`'. This tells liblouisutdml "no do", that is, do nothing. This is not strictly true, since liblouisutdml will sometimes insert a blank space so that words in text do not run together.

After a few more lines with '`no`' in the first column, we see one that says:

```
softreturn br
```

This means that when the element `
` is encountered, liblouisutdml is to do a soft return, that is, start a new line without starting a new paragraph.

The next line says:

```
heading1 h1
```

This tells liblouisutdml that when it encounters the element `<h1>` it is to format the text which follows as a first-level braille heading, that is, the text will be centered and preceded and followed by blank lines. (You can change this by changing the definition of the `heading1` style).

The next line says:

```
italicx em
```

This tells liblouisutdml that when it encounters the element `` it is to enclose the text which follows in braille italic indicators. The ‘x’ at the end of the semantic action name is there to prevent conflicts with names elsewhere in the software. Just where the italic indicators will be placed is controlled by the liblouis translation table in use.

The next line says:

```
skip style
```

This tells liblouis to simply skip ahead until it encounters the element `</style>`. Nothing in between will have any effect on the braille output. Note the slash (‘/’) before the ‘style’. This means the end of whatever the `<style>` element was referring to. Actually, it was referring to specifications of how things should be printed. If liblouisutdml had not been told to skip these specifications, the braille output would have contained a lot of gobledygook.

The next line says:

```
italicx strong
```

This tells liblouis to also use the italic braille indicators for the text between the `` and `` elements.

After a few more lines with ‘no’ in the first column we come to the line:

```
document html
```

This tells liblouisutdml that everything between `<html>` and `</html>` is an entire document. `<html>` was the root element of this document, so this is logical.

After another ‘no’ line we come to:

```
para p
```

liblouisutdml will consider everything between `<p>` and `</p>` to be a normal body text paragraph.

The next line is:

```
heading1 title
```

this causes the title of the document to also be treated as a braille level 1 heading.

Next we have the line:

```
list li
```

The xhtml `` and `` pair of elements is used to enclose an item in a list. liblouisutdml will format this with its own list style. That is, the first line will begin at the left margin and subsequent lines will be indented two cells.

Next we have:

```
table table
```

You will note that the names of actions and elements are often identical. This is because they are both mnemonic. In any case, this line tells liblouisutdml to format the table contained in the xhtml document according to the table formatting rules it has been given for braille output.

Next we have the line:

```
heading2 h2
```

This means that the text between `<h2>` and `</h2>` is to be formatted according to the Liblouisutdml style heading2. A blank line will be left before the heading and the first line will be indented four spaces.

After a few more lines we come to:

```
no table,cellpadding
```

Note the comma in the second column. This divides the column into two subcolumns. The first is the table element name. The second is called an "attribute" in xml. It gives further instructions about the material enclosed between the starting and ending "tags" of the element (`<table>` and `</table>`). Full information requires three subcolumns. The third is called the value and gives the actual information. The attribute is merely the name of the information.

Much further down we find:

```
no table,border,0
```

Here the element is table, the attribute is border and the value is 0. If liblouisutdml were to interpret this, it would mean that the table was to have a border of 0 width. It is not told to do so because tables in braille do not have borders.

Now let's look at the file which is included at the beginning of the `html.sem` file. This is `nemeth.sem`. As with `html.sem`, a copy is included in the appendix (see [Section A.4 \[nemeth.sem\]](#), page 59), but it is not necessarily the one that liblouisutdml is currently using. It illustrates several more things about how liblouisutdml uses semantic-action files.

The first thing you will notice is that for quite a few lines the first and second columns are identical. This is because the MathML element and attribute names are part of a standard, and it was simplest to use the element names for the semantic actions as well. Most of these actions do not do anything and could be replaced with the `generic` semantic action. They are retained for backward compatibility.

The first line of real interest is:

```
math math
```

Every mathematical expression begins with the element `$` (which may have attributes and values), and ends with `$`. This is therefore the root element of a mathematical expression. However, mathematical expressions are usually part of a document, so it is not given the semantic action document. The math semantic action causes liblouisutdml to carry out special interpretation actions. These will become clearer as we continue to look at the `nemeth.sem` file. You will note that this line has three columns. The meaning of the third column is discussed below.

After another uninteresting line we come to two that illustrate several more facts about semantic-action files:

```
mfrac mfrac ^?,/,^#
mfrac mfrac,linethickness,0 ^(^;%,^)
```

Like the math entry above, the first line has three columns. While the first two columns must always be present, the third column is optional. Here, it is also divided into subcolumns by commas. The element `<mfrac>` indicates a fraction. A fraction has two parts, a numerator and a denominator. In xml, we call these parts children of `<mfrac>`. They

may be represented in various ways, which need not concern us here. What is of real importance is that the third column tells liblouisutdml to put the characters ‘~?’ before the numerator, ‘/’ between the numerator and denominator, and ‘~#’ after the denominator. Later on, liblouis will translate these characters into the proper representation of a fraction in the Nemeth Code of Braille Mathematics. (For other mathematical codes, see [Chapter 7 \[Implementing Braille Mathematics Codes\]](#), page 32).

The second line is of even greater interest. The first column is again ‘mfrac’, but this line is for binomial coefficient. The second column contains three subcolumns, an element name, an attribute name and an attribute value. The attribute linethickness specifies the thickness of the line separating the numerator and denominator. Here it is 0, so there is no line. This is how the binomial coefficient is represented in print. The third column tells how to represent it in braille. liblouisutdml will supply ‘~(’, upper number, ‘~%’, lower number, ‘~)’ to liblouis, which will then produce the proper braille representation for the binomial coefficient.

Returning to the line for the math element, we see that the third column begins with a backslash followed by an asterisk. The backslash is an escape character which gives a special meaning to the character which follows it. Here the asterisk means that what follows is to be placed at the very end of the mathematical expression, no matter how complex it is.

For further discussion of how the third column is used see [Chapter 7 \[Implementing Braille Mathematics Codes\]](#), page 32. The third column is not limited to mathematics. It can be used to add characters to anything enclosed by an xml tag.

4.2 Semantic Actions in detail

Here is a complete list of the semantic actions which liblouisutdml recognizes. Some of them are also the names of styles. These are listed in the first table. For a discussion of these, see [Chapter 3 \[Customization Configuring liblouisutdml\]](#), page 6.

Generally the format of a semantic action is:

semanticAction elementSpecifier optionalArguments

elementSpecifier is the second-column value, which may be an element name, an element-attribute pair or an element-attribute-value triplet, separated by commas. This specifies where a semantic action is to be applied. If it is solely an element then the action is applied if this element is encountered. If it is an element-attribute pair then the action is applied if the given element also has the specified attribute. In the last case with a element-attribute-value triplet the action is only applied if the element has the specified attribute and the value of this attribute is equal to the specified value.

contents1 elementSpecifier

Note that the **contents1**, etc. semantic actions are never assigned an actual **elementSpecifier**. They are used internally by the table of contents generator. They should be assigned style settings, however.

contents2 elementSpecifier

contents3 elementSpecifier

contents4 elementSpecifier

contentsheader elementSpecifier

This semantic action must be assigned an element specifier if used. See the discussion of it in the section on styles.

document elementSpecifier
 heading1 elementSpecifier
 heading2 elementSpecifier
 heading3 elementSpecifier
 heading4 elementSpecifier
 para elementSpecifier

The following table explains each of the non-style semantic actions. In general, each one performs a particular function. If a third column is given, the subcolumns will be inserted in order before each branch of any subtree starting from `elementSpecifier`.

blankline elementSpecifier

This semantic action causes a blank line to appear in the output wherever it may occur. It is useful for fine formatting independent of styles. `elementSpecifier` should be an empty element, that is, of the form `<elementSpecifier/>`. If it is not, any content which it may contain will be ignored.

boldx elementSpecifier

Enclose the text which follows in braille bold indicators. The 'x' at the end of the semantic action name is there to prevent conflicts with names elsewhere in the software. Just where the bold indicators will be placed is controlled by the liblouis translation table in use.

boxline elementSpecifier character

A line consisting entirely of the character in the third column is placed in the output. If the third column is blank this semantic action does nothing. It is typically used to form the top and bottom lines of "boxed" material. The character must be chosen to produce the desired dot pattern on the embosser or display in use.

chemistry elementSpecifier

When a module to handle chemical notation is ready, this semantic action will invoke it. The processing will be like that produced by the semantic action `math`.

changetable elementSpecifier

This semantic action is used to change the active translation table. It can switch to a table for another language or to a table for computer braille in a mathematical expression, etc. `elementSpecifier` is in the form `element,attribute`. The document contains something like:

```
<span lang="en-us-g1.ctb">
  This is uncontracted.
</span>
```

The specified table remains in effect from `<element attribute="tablename">` until `</element>`, no matter what is between the two. The previous table is then restored.

compbrl elementSpecifier

The material between `elementSpecifier` and `/elementSpecifier` is translated as computer braille, if the liblouis table in use provides for it. Beginning and ending computer braille indicators are inserted if they are in the table.

configfile elementSpecifier filename

The **configfile**, **configstring** and **configtweak** semantic actions enable the configuration of liblouisutdml to be changed according to the contents of the document being transcribed. **configfile** and **configstring** take effect during the document analysis phase performed by **examine_document.c**. **configtweak** is effective during the transcription phase, performed by **transcribe_document.c** and the functions called in this module.

elementSpecifier is the usual second-column value, which may be an element name, an element-attribute pair or an element-attribute-value triplet, separated by commas. **filename** must be on one of the paths set in the **paths.c** module. The file may contain any configuration settings except those in the xml section. These would be ineffective, since the document has already been parsed.

configstring elementSpecifier setting1=value1;setting2=value2;...

Note that the **setting=value** pairs are separated by semicolons. Because the string may be longer than a screen line, you can use a backslash ‘\’ followed immediately by a line ending ‘\n’, to continue to another line. The string must not contain any blanks. Any setting which can be specified in a file read with **configfile** can be specified in **configstring**.

configtweak elementSpecifier settings

configtweak is identical to **configstring** except that it is called in the transcription phase. It can be used for things like changing translation tables. For example:

```
configtweak elementSpecifier literaryTextTable=fooTable;\
mathExprTable=barTable
```

configtweak is not a generalization of **changetable**. The latter changes the active table and applies to a subtree. **configtweak** remains in effect until changed by another **configtweak**.

contracted elementSpecifier**footer elementSpecifier**

This semantic action is used to specify a footer which will be placed at the bottom of each page.

```
<elemntSpecifier>This is a footer</elementSpecifier>
```

generic elementSpecifier

This is a general-purpose semantic action. If the third column is blank it does absolutely nothing. If the third column contains a string or subcolumns its contents are placed in the output according to the usual rules. That is, the first subcolumn is placed before the first branch of the subtree rooted at this node, the second is placed before the second branch, etc. If the last (or only) subcolumn begins with ***** it is placed after the last branch, no matter how many branches there may be.

graphic elementSpecifier

When a module which can handle SVG graphics is ready this semantic action will invoke it.

html:link elementSpecifier

This semantic action is used when the configuration file specifies **formatFor browser**. It sets up a link which the browser can follow.

html:target elementSpecifier

This semantic action establishes a target for a link in the same file when **formatFor browser** is specified in the configuration file.

italic:x elementSpecifier

Enclose the text which follows in braille italic indicators. The ‘x’ at the end of the semantic action name is there to prevent conflicts with names elsewhere in the software. Just where the italic indicators will be placed is controlled by the liblouis translation table in use.

linespacing elementSpecifier digit

This semantic action specifies the number of blank lines to be left between adjacent lines in the output. For example if the third column is ‘1’, lines will be double-spaced. ‘0’ specifies normal spacing. The number cannot be greater than ‘3’. **linespacing** remains in effect until another **linespacing** is encountered. It should be assigned to an empty element.

math:action elementSpecifier

In the early stages of development I thought that a separate piece of code might be needed for each of the MathML element tags. It turned out, as noted elsewhere, that most of them could have been handled with the **generic** semantic action. They are retained for backward compatibility. Therefore, unless this is not the case or additional information is needed, they are simply listed.

math:mgroup elementSpecifier**math:mark elementSpecifier****math elementSpecifier**

Every mathematical expression begins with the element **<elementSpecifier>math** (which may have attributes and values), and ends with **</elementSpecifier> (/math)**. This is therefore the root element of a mathematical expression. However, mathematical expressions are usually part of a document, so it is not given the semantic action document. liblouisutdml will, however, handle files and strings which consist of nothing but a mathematical expression properly. The **math** semantic action causes liblouisutdml to carry out special interpretation actions.

`menclose elementSpecifier`
`merror elementSpecifier`
`mfenced elementSpecifier`
`mfrac elementSpecifier`
`mglyph elementSpecifier`
`mi elementSpecifier`
`mlabeledtr elementSpecifier`
`mmultiscripts elementSpecifier`
`mn elementSpecifier`
`mo elementSpecifier`
`mover elementSpecifier`
`mpadded elementSpecifier`
`mphantom elementSpecifier`
`mprescripts elementSpecifier`
`mroot elementSpecifier`

The MathML element `mroot` is actually given the semantic action `reverse`.

`mrow elementSpecifier`

This can be important in implementing Math codes because it is often used to create visual groups, which may be significant for braille.

`ms elementSpecifier`

`mspace elementSpecifier`

This element and its attributes can be helpful for determining spacing.

`msqrt elementSpecifier`

`mstyle elementSpecifier`

This MathML element should usually have the semantic action `skip`.

`msub elementSpecifier`

`msubsup elementSpecifier`

`msup elementSpecifier`

`mtable elementSpecifier`

The file `liblouisutdml.ini` defines the style `matrix`. The semantic-action files for math codes declare `mtable` to be `matrix`. Depending on the attributes of this element, it can be set to other styles, such as long division. The `matrix` style contains the setting `format alignColumnsLeft`.

`mtd elementSpecifier`

This element specifies a column in a mathematical table. For the style `matrix` the third column of the entry in a semantic-action file must contain `*|ec`. This indicates the end of the column. Other specifications using the liblouis `exactdots` feature may also be necessary.

`mtext elementSpecifier`

`mtr elementSpecifier`

This element specifies a row in a mathematical table. The entry in a semantic-action file must contain `*\er` in the third column for the `matrix` style, indicating the end of the row. Other things may also need to be specified using the liblouis `exactdots` feature. Note that rows are not declared as styles nested

inside the `matrix` style. This is because the table must be considered as a whole.

`munder elementSpecifier`

`munderover elementSpecifier`

`music elementSpecifier`

When a module which can interpret MusicML and produce braille music notation is ready this semantic action will invoke it.

`newpage elementSpecifier`

This semantic action causes the rest of the current page to be left blank except for page numbers and footers. A new page is then begun. Like `blankline`, it is useful for fine formatting independent of styles.

`no elementSpecifier`

Originally, this semantic action was intended to be the default and to do nothing when an `elementSpecifier` had no meaning for braille translation. Later it was found that it should insert a blank space if parts of the text would run together, so this is now its action.

`none elementSpecifier`

This is a MathML element.

`nottranslate elementSpecifier`

Output the text between the start and end tags exactly as written. It will, however, be formatted with appropriate line breaks, page numbers etc. If you want to make sure that things appear on the same line separate them with an unbreakable space, `' '` or `' '`.

`pagenum elementSpecifier`

The text between `<elementSpecifier>` and `</elementSpecifier>` is taken to be a print page number. If it does not begin with a digit the string `_` is placed before it. It is then passed to liblouis for translation according to the active table. This table must contain an entry for translating `_` into a letter sign or whatever else is wanted. This string is inserted so that roman page numbers will be handled properly. Unnumbered page breaks are indicated with an empty `pagenum` tag: `<elementSpecifier></elementSpecifier>`.

`reverse elementSpecifier`

The branches of the subtree rooted at this node are reversed in order. This is used in handling roots, where the arguments in the translation are in reverse order to those in MathML. the MathML element `mroot` is declared with this semantic action

`righthandpage elementSpecifier`

If `interpoint yes` has been specified in the configuration file, and the current page is a right-hand one, the rest of the page is skipped except for footer and page number. the following left-hand page is similarly skipped. Otherwise, the action is the same as `newpage`.

`runninghead elementSpecifier`

This semantic action is used to specify a running header, such as a book title, to be placed at the top of each page. If the header is too long it will be truncated.

```
<elementSpecifier>liblouisutdml Manual</elementSpecifier>
```

semantics elementSpecifier

This is a MathML action which seems to be irrelevant to braille translation.

skip elementSpecifier

Skip ahead until encountering the element `</elementSpecifier>`. Nothing in between will have any effect on the braille output.

softreturn elementSpecifier

Do a soft return, that is, start a new line without starting a new paragraph. `elementSpecifier` should be empty, for example, `
`.

uncontracted elementSpecifier

This semantic action seems superfluous and may be eliminated in the future.

underlinex elementSpecifier

Enclose the text which follows in braille underline indicators.

4.3 Pseudo-actions

These actions affect the processing of semantic-action files. They are not connected with any tag in the document. They are executed when they are encountered in the processing of semantic-action files.

4.3.1 include

```
include filename
```

`filename` must be the name of a semantic action file. The file is compiled as though it were part of the file containing the **include** entry. Included files may include other files.

4.3.2 newentries

```
newentries no
```

The second column in this entry must contain ‘no’. Any new entries found in the document will be ignored. No ‘**appended_**’ file will be produced. This affects only documents processed with this semantic-action file. The configuration setting **newEntries** affects all documents.

4.3.3 namespaces

```
namespaces dtb=http://www.daisy.org/z3986/2005/dtbook/
```

This pseudo-action is used to declare namespaces used in XPath expressions. (See following section). The format is ‘**namespaces** `prefix1=url1,prefix2=url2,...`’. The list of namespaces may not contain blanks.

4.4 Using XPath Expressions

```
para &xpath(h4)
```

This example causes any element with the name ‘h4’ to be given the semantic action **para**, no matter what other assignments may be made to it. In general, XPath expressions are entered in the second column with the syntax `&xpath(...)`. That is, the XPath expression

is placed within parentheses following `&xpath`. It may contain parentheses itself, as long as they match. The third column may contain arguments, as with any line in a semantic-action file. XPath expressions are not processed in any particular order. Care should be taken that the node sets which they find do not overlap. If a node is in a node set found by a particular XPath expression it will be given the semantic-action and arguments associated with that expression. This will not be changed subsequently.

The '`&funcname(...)`' notation may be used for other features, such as XPointer, in the future.

5 Special Features

5.1 Table of contents

A table of contents is produced for an xml file if the file contains a tag which has been defined with the `contentsheader` semantic action (see [\[contentsheader\]](#), page 20) and also tags for the `heading1`, `heading2`, `heading3` or `heading4` semantic actions (see [\[heading1\]](#), page 21). The table of contents will contain print and braille page numbers if these features have been enabled. A sequence of fill characters will be inserted before the page numbers, so that the latter are at the right margin. The fill character can be specified in a configuration file with the `lineFill` setting (see [\[lineFill\]](#), page 10). The default fill character is an apostrophe (dot 3).

Five new styles have been defined for the table of contents. The first is the `contentsheader` style (see [\[contentsheader style\]](#), page 14), which is used to specify where the table of contents should be placed and the title that should be given to it. In the latter respect it is much like a heading style. The others correspond to the four heading levels and are `contents1`, `contents2`, `contents3` and `contents4`. These styles are chosen as appropriate while the table of contents is being made. Do not declare them in a semantic-action file. See the `liblouisutdml.ini` file for the current default definitions of all these styles.

The table of contents will be placed where the xml tag is that you declared in the `contentsheader` semantic action (see [\[contentsheader\]](#), page 20). Its title will be whatever is inside that tag, formatted according to the definition of the `contentsheader` style. It begins on a new page. After it is completed the braille page number is reset to `beginningBraillePageNumber` and another new page is started. This means that the xml tag with the `contentsheader` semantic action should occur at the end of the information which you want to be at the head of the output, such as a title page, dedication, etc.

It is not necessary that an xml file contain a tag with the `contentsheader` semantic action. If the file contains headers you can obtain a table of contents by specifying `contents yes` in a configuration file or `-Ccontents=yes` on the command line of `file2brl`. In this case, the table of contents will appear at the beginning of the output. Pages will be numbered beginning with 1. When the table of contents is complete, the material in the file will start on a new page and the page number will be the value given in `beginningBraillePageNumber`.

The `contents1`, etc. styles all have the `format contents` setting. This is a variant of the `leftJustified` format. It has been necessary to change the way `firstLineIndent` is handled to accommodate multilevel lists. Up till now, if `firstLineIndent` was negative, the first line would start at the real left margin, regardless of the value of `leftMargin`. Now the value of `firstLineIndent` is simply added to `leftMargin`. This means that if it is negative it is really subtracted. For example, if `leftMargin` is 4 and `firstLineIndent` is -2 the first line will start in cell 2. If the result of adding these two values is negative it is set to 0.

5.2 Back-translation

```
file2brl -b infile outfile
```

infile must be a braille file. It can have either upper-case or lower-case letters, etc. outfile will contain the back-translation according to the configuration specifications. It can be in two formats according to the value of `backFormat`. ‘`ascii`’ produces plain text output. The lines will generally correspond to the lines in the original braille file. ‘`html`’ produces a file in xhtml format. This is recommended, since it preserves print page numbers, if present and some of the formatting of the original. It can also be loaded into a browser or word processor, which will format it for good readability. Note that for html format to work your liblouis table must contain the following line:

```
space \x001b 1b escape character
```

To perform the back-translation operation, `file2brl` uses the liblouisutdml function `lbu_backTranslateFile`.

5.3 Reformatting

```
file2brl -r infile outfile
```

As in the previous section, infile must be a braille file. It is back-translated and then forward-translated to produce a braille file in outfile which conforms to configuration specifications. It is useful for changing the line length and page length of a braille file. New braille page numbers will be generated if `braillePages yes` is specified. If `backFormat html` has been specified, print page numbers will be reproduced in the appropriate places. Some formatting may be lost.

5.4 Interlining

Interlining means printing the original text between the lines of translated braille. It requires special embossers or special methods. The present way in which liblouisutdml produces interlining relies on back-translation. However, it is inadequate for mathematics and depends too much on the quality of the liblouis tables. It is scheduled to be replaced, so you should not use it.

5.5 Browser-Friendly Output

```
file2brl infile outfile -CformatFor=browser
```

infile can be any of the file types accepted by `file2brl` (xml, html or text). If it contains html links or targets they will be formatted so that a browser can use them. This may be useful if a file contains internal links to different sections, such as its own table of contents. Text will be translated and formatted according to configuration specifications. If the file contains mathematics expressed as MathML it will be translated according to the mathematics code specified by the configuration. outfile should have the extension ‘`.html`’. It will actually be xhtml. The `-CformatFor=browser` part of the above example specifies a configuration setting, which of course can also be specified in a configuration file.

5.6 CDATA Sections

A `cdata` section may be given the semantic actions `skip`, `no` or `code`. In the first case, the data in the `cdata` section is ignored. In the second case, it is inserted into the output with no translation. In the third case it is translated into computer braille and inserted into the output. Any other semantic action has the same effect as `no`.

6 Special Formats

6.1 Tables

Various methods of handling tables can be devised. One that is in current use requires the following lines in a semantic-action file:

```
list tr \*;
generic td \*;\s
```

The `list` style specifies that the first line should begin at the left margin and subsequent lines should be indented two spaces. The third column specifies that a semicolon should be placed at the very end of the row. The `generic` semantic action causes each column in the table to be followed by a semicolon and a space, as specified in the third column. your liblouis table must also contain the following line:

```
noback always ;\s; 0
```

6.2 Reserving Space for Graphics

Your configuration files should contain lines like these:

```
style graphspace
rightHandPage yes
```

In your semantic-action file you must assign a tag to this style. Note that the semantic action `graphic` will invoke code to translate SVG graphics when this feature is developed. You can nest various styles within the ‘`graphspace`’ style, such as a caption at the beginning. In particular, you should have another invocation of ‘`graphspace`’ at the end to skip to a new page, or the next right-hand page if you are using interpoint.

6.3 Displayed Text

Conventions for setting off a block of text from the rest vary. you may wish to use the `quotation` style or devise a style of your own.

6.4 Displayed Mathematics

Again, conventions vary. you can define your own style for this purpose and invoke it according to the attributes of the `math` tag.

6.5 Spatial Layouts in Mathematics

This is also known as 2d mathematics. It spreads out complex fractions and other materials for easier viewing. It is being developed based on the specifications of MathML 3.

6.6 Arithmetic Examples

This is another format that is being developed using MathML 3. It is difficult in earlier versions.

6.7 Poetry

liblouisutdml.ini defines two styles which can be used to format poetry, as follows:

```
style stanza
linesBefore 1
linesAfter 1
ttype line
leftMargin 2
firstLineIndent -2
```

Your document might then contain the following from Samuel Taylor Coleridge's "Rime of the Ancient Mariner":

```
<stanza>
<lino>He holds him with his glittering eye</line>
<line>The wedding guest stands still</line>
<line>And listens like a three-years' child.</line>
<line>He has no force nor will.</line>
</stanza>
```

Note that when stanzas follow each other liblouisutdml will produce only one blank line between them, not two.

6.8 Dividing a Book Into Volumes

Details are still under development. However, this much can be said. First, obtain a table of contents for the whole book. This requires that your configuration files have the following settings:

```
contents yes
braillePages yes
```

This will tell you the approximate braille pages on which things will be placed in the finished product. You can then calculate the number of pages required for each chapter and how many chapters will fit in a volume of your preferred size. From the point of view of the braille reader, it is desirable to avoid splitting chapters between volumes.

At this point you will probably have to edit the source xml file to indicate the beginning and end of volumes. You can define a liblouisutdml style called 'volume' and assign appropriate xml tags to it in a semantic-action file. Within the volume style you can nest a title page, chapters, etc. A volume table of contents is still under development.

7 Implementing Braille Mathematics Codes

Much information useful in implementing braille mathematical codes is given in the sections on styles and on semantic actions, especially in the discussion of MathML semantic actions. The chapter on Special Formats also contains much useful information.

The Nemeth Code of Braille Mathematical and Science Notation, BAUK maths and Marburg Maths have been implemented. the Nemeth code was the first and uses an implementation which is now obsolete. The discussion below will concentrate on the implementation of BAUK Maths.

Four tables are used to translate xml documents containing a mixture of text and mathematics. They can be found in the subdirectory `lbu_files` of the `liblouisutdml` directory and in the `tables` subdirectory of the `liblouis` distribution. First, the semantic-action file `ukmaths.sem` is used to interpret the mathematical portions of the xml document (The text portions are interpreted by another semantic-action file which will not be discussed here). After the math and text have been interpreted, two liblouis tables, `ukmaths.ctb` and `en-us-g2.ctb` are used to translate them. The latter table may be replaced by another table at the user's discretion. Each piece of mathematics or text is translated separately and the pieces are strung together with blanks between them. This results in inaccuracies where mathematics meets text. The fourth table, also a liblouis table, is used to remove these inaccuracies. It is called `ukmaths_edit.ctb`, and it does things like removing the multi-purpose indicator before a blank, inserting the punctuation indicator before a punctuation mark following a math expression, and removing extra spaces. This table may need editing if a different text translation table is used.

The general format and use of semantic-action files were discussed in the section see [Chapter 4 \[Connecting with the xml Document - Semantic-Action Files\]](#), page 16. In this section we shall concentrate on the optional third column, which is used a lot in `ukmaths.sem`. While the first two columns can be generated by `liblouisutdml` but must be edited by a person, the third column must always be provided by a human.

As previously stated, the third column tells `liblouisutdml` what characters to insert to inform liblouis how to translate the math expression. In fact, you can tell liblouis exactly what dots to insert. This relies on the liblouis opcode `exactdots`. If you look at the file `example_ukmaths.ctb` you will see lines like the following:

```
exactdots @126
exactdots @345
exactdots @123456
```

This opcode has only a string operand. liblouis assumes that the characters following the at sign are its dot pattern.

In your semantic-action file you might have lines like:

```
mfenced mfenced @126,@345
mfenced mfenced,open,{ @246,@135
mover mover ,@4-346,@12456
```

By using this approach you do not have to remember which characters will produce the desired dots in a particular liblouis table or on a particular output device.

Sometimes an element or tag can have an indeterminate number of children. This is true of `<math>` itself. Yet, it may be necessary to place some characters after the very last element. Let us look at the `<math>` entry.

```
math math \eb,\*\ee
```

First let us discuss escape sequences starting with a backslash. These are basically the same as in liblouis. The sequence `'\e'` is shorthand for the escape character, which would otherwise be represented by `'\x001b'`. The beginning of a math expression is denoted by an escape character followed by the letter `b` and the end by an escape character followed by the letter `'e'`. This enables the editing table to do such things as drop the baseline indicator at the end of a math expression and insert a number sign at the beginning, if needed.

Not found in liblouis is the sequence `'*'`. This means to put what follows after the very last child of the math element, no matter how many there are.

As another example consider:

```
mtd mtd \*\ec
```

`mtd` is the MathML tag for a table column. There may be many children of this tag. The entry says to put an escape character (hex `1b`), plus the letter `'c'`, after the very last of them.

As a final example consider:

```
mtr mtr ^.^\\,^(,\*\^.^\\,^)\er
```

`mtr` is the MathML tag for a row in a table, in this case a matrix. Each row in a matrix must begin with the dot pattern `'46-6-12356'` and end with the dot pattern `'46-6-12456'`. As usual a caret is placed before the corresponding characters. Since dot 6 is a comma, it must be escaped. This is done by placing a backslash before the comma. There are two subcolumns. the first contains the characters to be placed at the beginning of each row. The second starts with `'*'`, signifying that the characters following it are to be placed at the end of everything in this row. A subcolumn starting with `'*'` must be the last (or only) subcolumn.

Here this last subcolumn ends with an escape character and the letter `r`, signifying the end of a row.

So much for the semantic action file. Even though the characters in the third column were chosen to correspond with nemeth characters, they may not have to be changed for other math codes. liblouis can replace them with anything needed.

This brings us to a consideration of the two tables used by liblouis to translate mathematics texts. The first, `en-mathtext.ctb` is used to translate text appearing outside math expressions. It is necessary because the Nemeth code requires modifications of Grade 2 braille. Other math codes may not have this requirement.

The table actually used to translate mathematics is `nemeth.ctb`. It includes two other tables, `chardfs.cti` and `nemethdefs.cti`. The first gives ordinary character definitions and is included by all the other tables. Note however, that the unbreakable space, `'\x00a0'`, is translated by dot 9. This is used before and after the equal sign and other symbols in `nemeth.ctb`. The second table contains character definitions for special math symbols, most of which are Unicode characters greater than `'\x00ff'`. The Greek letters are here. So are symbols like the integral sign.

Most of the entries in `nemeth.ctb` should be familiar from other tables. The unfamiliar ones follow the comments ‘`# Semantic pairs`’ and ‘`# pass2 corrections`’. The first simply replace characters preceded by a caret with the character itself. The second make adjustments in the code generated directly from the `nemeth.sem` file. The pass2 opcode is discussed in the liblouis documentation (see [Section “Overview” in *Liblouis User’s and Programmer’s Manual*](#)). Here are some comments on a few of the entries in `nemeth.ctb`.

```
pass2 @1456-1456 @6-1456
```

Replaces double start-fraction indicators with the start complex fraction indicator.

```
pass2 @3456-3456 @6-3456
```

Replaces double end-fraction indicators with the end-complex-fraction indicator.

```
pass2 @56[$d1-5]@5 *
```

Removes the subscript and baseline indicators from numeric subscripts.

```
pass2 @5-9 @9
```

Removes the baseline or multipurpose indicator before an unbreakable space generated by the translation of an equal sign, etc.

```
pass2 @45-3-5 @3
```

Replaces a superscript apostrophe with a simple prime symbol.

```
pass2 @9[]$d @3456
```

Puts a number sign before a digit preceded by a blank.

```
pass2 @9-0 @9
```

Removes a space following an unbreakable space.

We now come to the fourth and last table used for math translation, the editing table, `nemeth_edit.ctb`. As explained at the beginning, this table is used to remove inaccuracies where math translation butts up against text translation. For example, the Nemeth code puts numbers in the lower part of the cell. However, punctuation marks are also in the lower part of the cell. So Nemeth puts a punctuation indicator, dots ‘456’, in front of any lower-cell punctuation that immediately follows a mathematical expression. If this occurs inside Mathml it is handled by `nemeth.ctb`. However, a MathML expression is often followed by a punctuation mark which is the first part of text. `liblouisutdml` puts a blank between math and text, but this can result in a mathematical expression followed by a blank and then, say, a period, dots ‘256’. `nemeth_edit.ctb` replaces the blank with the punctuation indicator.

When you look at `nemeth_edit.ctb` you will see that it begins with an include of `chardefs.cti`. Most of the entries are ordinary, but some are interesting. for example,

```
always "\s 0
```

replaces the baseline or multipurpose indicator followed by a space with just a space.

8 Programming with liblouisutdml

8.1 License

Liblouisutdml may contain code borrowed from the Linux screenreader BRLTTY, Copyright © 1999-2009 by the BRLTTY Team.

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8.2 Overview

liblouisutdml is an "extensible renderer", designed to translate a wide variety of xml and text documents into braille, but with a special emphasis on technical material. The overall operation of liblouisutdml is controlled by a configuration file. The way in which a particular type of xml document is to be rendered is specified by a semantic-action file for that document type. Braille translation is done by the liblouis braille translation and back-translation library (see *Section "Overview" in Liblouis User's and Programmer's Manual*). Its operation, in turn is controlled by translation table files. All these files are plain text and can be created and edited in any text editor. Configuration settings can also be specified on the command line of the console-mode transcription program `file2brl`.

The general operation of liblouisutdml is as follows. It uses the libxml2 library to construct a parse tree of the xml document. After the parse tree is constructed, a function called `examine_document` looks it over and determines whether math translation tables, etc. are needed. `examine_document` also constructs a prototype semantic-action file, if one does not exist already. It may also construct another file containing entries not found in an existing file. When it is finished, another function, called `transcribe_document`, does the actual braille transcription. It calls `transcribe_math` to handle MathML subtrees, `transcribe_chemistry` for chemical formula subtrees, `transcribe_graphic` for SVG graphics, etc. Entities are translated to Unicode, if they are not already. Sequences of symbols indicate superscripts, return to the baseline, subscripts, start and end of fractions, etc. The Braille translator and back-translator library liblouis is used to do the braille translation.

The `transcribe_math` function works in conjunction with the latest version of liblouis and a special math translation table to transcribe most mathematical expressions into good braille mathematical Code.

The functions which are not ready for use at the moment, such as `transcribe_chemistry`, are only skeletons. However, I hope that `transcribe_graphics` can be

expanded in the near future to use the graphics capability of the Tiger tactile graphics embossers.

The latest versions of liblouisutdml and liblouis can be downloaded from www.abilitiessoft.com. This site also contains links to a mailing list and to project pages on googlecode.google.com. Note that liblouisutdml will only work with the latest version of liblouis.

liblouisutdml can be compiled to use either 16-bit or 32-bit Unicode internally. This is inherited from liblouis, so liblouis must be compiled first and then liblouisutdml. Wherever 16 bits are mentioned in this document, read 32 if you have compiled the library for 32 bits.

8.3 Files and Paths

liblouisutdml uses three kinds of files, configuration files, semantic-action files, and liblouis translation tables. The first two are discussed elsewhere in this documentation. liblouis translation tables are discussed in the liblouis documentation (see [Section “Overview” in *Liblouis User’s and Programmer’s Manual*](#)) which is distributed with liblouis.

Note that liblouisutdml also generates some files, all of which are placed in the current directory. These files are new prototype semantic-action files, additions to old semantic-action files, temporary files, and log files. The first two can be used to extend the capability of liblouisutdml to process xml documents. The latter two are useful for debugging.

liblouisutdml determines the paths on which it will search for files at run time, as part of its initialization. First, if the first file in a configuration file list includes a path, liblouisutdml will search first on this path. The path may be either absolute or relative. Only the first filename in a configuration file list may have a path. Next, in Windows liblouisutdml determines the path to itself. this is the second path on which it will look for files. The liblouis `tables` directory and the liblouisutdml `lbu_files` directory are relative to this path. In Unix systems, including the Mac., these directories are absolute paths determined at compile time. liblouisutdml searches first the `tables` directory and then the `lbu_files` directory. Finally, it establishes the current directory as the final path to be searched. If you wish the current directory to be the first path searched, prefix the first configuration file name with `‘./’` for Unix or `‘.\’` for Windows.

Paths are handled in the `paths.c` module. This contains the function `set_paths`, which is called from `readconfig.c` and in turn calls `addPath` in the `paths.c` module.

8.4 lbu_version

```
char *lbu_version (void)
```

This function returns a pointer to a character string containing the version of liblouisutdml. Other information such as the release date and perhaps notable changes may be added later.

8.5 lbu_initialize

```
void * lbu_initialize (
    const char *configFilelist,
    const char *logFileName,
    const char *settingsString)
```

This function initializes the libxml2 library, processes `liblouisutdml.ini` and configuration settings given in the configuration files given in `configFilelist`. This is a list of configuration file names separated by commas. If the first character is a comma it is taken to be a string containing configuration settings and is processed like the `settingsString` string. If the parameter `settingsString` is not NULL it is processed last. Such a string must conform to the format of a configuration file. Newlines should be represented with ASCII 10. If `logfilename` is not null, a log file is produced on the current directory. If it is null any messages are printed on stderr. The function returns a pointer to the `UserData` structure. This pointer is void and must be cast to `(UserData *)` in the calling program. To access the information in this structure you must include `louisutdml.h`. This function is used by `file2brl`.

8.6 lbu_translateString

```
int lbu_translateString (
    const char *configfilelist,
    char * inbuf,
    wchar_t *outbuf,
    int *outlen,
    unsigned int mode)
```

This function takes a well-formed xml expression in `inbuf` and translates it into a string of 16-bit (or 32-bit if this has been specified in liblouis) braille characters in `outbuf`. The xml expression must be immediately followed by a zero or null byte. Leading whitespace is ignored. If it does not then begin with the characters '`<?xml`' an xml header is added. If it does not begin with '`<`' it is assumed to be a text string and is translated accordingly. The header is specified by the `xmlHeader` line in the configuration file. If no such line is present, a default header specifying UTF-8 encoding is used. The `mode` parameter specifies whether you want the library to be initialized. If it is 0 everything is reset, the `liblouisutdml.ini` file is processed and the configuration file and/or string (see previous section) are processed. If `mode` is 1 liblouisutdml simply prepares to handle a new document. For more on the `mode` parameter see the next section.

Which 16-bit character in `outbuf` represents which dot pattern is indicated in the liblouis translation tables. The `configfilelist` parameter points to a configuration file or string. Among other things, this file specifies translation tables. It is these tables which control just how the translation is made, whether in Grade 2, Grade 1, the Nemeth Code of Braille Mathematics or something else.

Note that the `*outlen` parameter is a pointer to an integer. When the function is called, this integer contains the maximum output length. When it returns, it is set to the actual length used. The function returns 1 if no errors were encountered and a negative number if a complete translation could not be done.

8.7 lbu_translateFile

```
int lbu_translateFile (
    char *configfilelist,
    char *inputFileName,
    char *outputFileName,
```

```
unsigned int mode)
```

This function accepts a well-formed xml document in `inputFilename` and produces a braille translation in `outputFilename`. As for `lbu_translateString`, the `mode` parameter specifies whether the library is to be initialized with new configuration information or simply prepared to handle a new document. In addition, the `mode` parameter can specify that a document is in html, not xhtml. `liblouisutdml.h` contains an enumeration type with the values `dontInit` and `htmlDoc`. These can be combined with an or (`'|'`) operator. The input file is assumed to be encoded in UTF-8, unless otherwise specified in the xml header. The encoding of the output file may be UTF-8, UTF-16, UTF-32 or Ascii-8. This is specified by the `outputEncoding` line in the configuration file, `configfilelist`. The function returns 1 if the translation was successful.

8.8 lbu_translateTextFile

```
int lbu_translateTextFile (
char *configfilelist,
char *inputFileName,
char *outputFileName,
unsigned int mode)
```

This function accepts a text file in `inputFilename` and produces a braille translation in `outputFilename`. The input file is assumed to be encoded in Ascii8. However, utf-8 can be specified with the configuration setting `inputTextEncoding utf8`. Blank lines indicate the divisions between paragraphs. Two blank lines cause a blank line between paragraphs (or headers). The output file may be in UTF-8, UTF-16, or Ascii8, as specified by the `outputEncoding` line in the configuration file, `configfilelist`. As for `lbu_translateString`, the `mode` parameter specifies whether complete initialization is to be done or simply initialization for a new document.

8.9 lbu_backTranslateFile

```
int lbu_backTranslateFile (
char *configfilelist,
char *inputFileName,
char *outputFileName,
unsigned int mode)
```

This function accepts a braille file in `inputFilename` and produces a back-translation in `outputFilename`. The input file is assumed to be encoded in Ascii8. The output file is in either plain text or html, according to the setting of `backFormat` in the configuration file. Html files are encoded in UTF8. In plain-text, blank lines are inserted between paragraphs. The output file may be in UTF-8, UTF-16, or Ascii8, as specified by the `outputEncoding` line in the configuration file, `configfilelist`. The mode parameter specifies whether or not the library is to be initialized with new configuration information, as described in the section on `lbu_translateString` (see [Section 8.6 \[lbu_translateString\]](#), [page 37](#)).

8.10 lbu_free

```
void lbu_free (void)
```

This function should be called at the end of the application to free all memory allocated by liblouisutdml and liblouis. If you wish to change configuration files during your application, use a **mode** parameter of 0 on the function call using the new configuration information. This will call the **lbu_free** function automatically.

Appendix A Example files

This appendix contains all the files referenced in this document. They are up-to-date at the time of writing, but the actual files used by the software may change. Besides being used for reference, they can be studied to see how things are done.

A.1 liblouisutdml.ini

```
# canonical Configuration File

# This file contains all possible settings, together with their
# default values.

# It is read automatically when liblouisutdml starts. You should use it as
# a reference but never specify it as a configuration file.

# There are three kinds of lines in the file. the first has a single
# column beginning at the left margin. This column contains the name of
# a category of settings, such as outputFormat or translation. These
# lines are optional. The
# second type of line contains the word style in the first column,
# followed by at least one space or tab, and then a style name. The
# third kind of line is indented one tab stop to set it off from the
# others. It contains a setting name, at least one blank space or tab,
# and the value of the setting.

outputFormat
cellsPerLine 40
linesPerPage 25
interpoint no
lineEnd \r\n
pageEnd \f
fileEnd ^z
printPages yes
braillePages yes
paragraphs yes
beginningPageNumber 1
printPageNumberAt top
braillePageNumberAt bottom
hyphenate no
outputEncoding ascii8
inputTextEncoding ascii8
backFormat plain
backLineLength 70
formatFor textDevice
interline no
lineFill '
```

```

translation
literarytextTable en-us-g2.ctb
uncontractedTable en-us-g1.ctb
compbrlTable en-us-compbrl.ctb
mathtextTable en-us-g2.ctb
mathexprTable nemeth.ctb
editTable nemeth_edit.ctb
interlineBackTable en-us-interline.ctb
xml
semanticFiles *,nemeth.sem
xmlheader "<?xml version='1.0' encoding='UTF8' standalone='yes'?"
# entity nbsp ^1
internetAccess yes
newEntries yes

# Unlike the other categories, the style category must be followed by
# the name of a style.

style document
linesBefore 0
linesAfter 0
leftMargin 0
firstLineIndent 0
translate contracted
skipNumberLines no
format leftJustified
newPageBefore no
newPageAfter no
righthandPage no
braillePageNumberFormat normal

style arith
style attribution
format rightJustified
style biblio
style caption
leftMargin 4
firstLineIndent 2
style code
linesBefore 1
linesAfter 1
skipNumberLines yes
format computerCoded
style contentsheader
linesBefore 1
format centered
linesAfter 1

```

```
style contents1
firstLineIndent -2
leftMargin 2
format contents
style contents2
firstLineIndent -2
leftMargin 4
format contents
style contents3
firstLineIndent -2
leftMargin 6
format contents
style contents4
firstLineIndent -2
leftMargin 8
format contents
style dedication
newPageBefore yes
newPageAfter yes
format centered
style directions
style dispmath
leftMargin 2
style disptext
leftMargin 2
firstLineIndent 2
style exercise1
leftMargin 2
firstLineIndent -2
style exercise2
leftMargin 4
firstLineIndent -2
style exercise3
leftMargin 6
firstLineIndent -2
style glossary
firstLineIndent 2
style graph
skipNumberLines yes
style graphlabel
style heading1
linesBefore 1
format centered
linesAfter 1
style heading2
linesBefore 1
firstLineIndent 4
```

```
style heading3
firstLineIndent 4
style heading4
firstLineIndent 4
style index
style line
firstLineIndent -2
leftMargin 2
style list
firstLineIndent -2
leftMargin 2
style matrix
format alignColumnsLeft
style music
skipNumberLines yes
style note
style para
firstLineIndent 2
style quotation
linesBefore 1
linesAfter 1
style section
firstLineIndent 4
style spatial
style stanza
linesBefore 1
linesAfter 1
style style1
style style2
style style3
style style4
style style5
style subsection
firstLineIndent 4
style table
linesBefore 1
linesAfter 1
style titlepage
newPageAfter yes
style trnote
firstLineIndent 7
leftMargin 5
style volume
```

A.2 default.cfg

```
outputFormat
```

```

cellsPerLine 32
linesPerPage 25
interpoint no
braillePages no
# backFormat html
# hyphenate yes
# interline yes
translation
literaryTextTable en-us-g2.ctb,corrections.ctb
# literaryTextTable en-us-g2.ctb,hyph_en_US.dic
# literaryTextTable no-no-g1.ctb
# interlineBackTable en-us-interline.ctb
compbrlTable en-us-comp8.ctb
xml
internetAccess no
# newEntries no
# semanticFiles book.sem
# entity nbsp ~1

```

A.3 html.sem

```

# This file was produced by liblouisutdml and is considered part of
# the code. See the file copyright-notice for permissions and
# restrictions. This notice also applies to any files with names
# beginning with 'appended_'.

```

```

# You must edit this file as explained in the documentation to get
# proper output.
nottranslate ntr
trnote trnote
contentsheader contentshere
no hr
no body
softreturn br
heading1 h1
italicx em
skip style
italicx strong
no ol
no head
document html
no a
para p
heading1 title
list li
table table

```

```
no param
pagenum pagenum
no div
no span
no link
heading2 h2
no img
no td
no tr
no object
no ul
no link,type
no img,width
no table,cellpadding
no img,src
no div,class
no td,class
no p,class
no table,border
no table,width
htmllink link,href
no param,name
no param,value
no link,rel
no a,id
no table,cellspacing
no td,colspan
no img,height
no object,classid
no object,width
changetable span,lang
no span,class
no object,height
no a,class
no img,alt
htmllink a,href
htmltarget a,name
no p,align
no a,name,light
no a,name,decisi
no a,name,city
no a,name,ascent
no a,name,homeco
no a,name,forest
no a,name,prolog
no p,align,center
no a,name,homest
```

```

no link,type,text/css
no a,id,TrigonometricFun
no img,width,300
no img,height,300
no a,href,http://ocw.mit.e
no td,colspan,3
no table,border,0
no table,cellpadding,0
no td,class,navbar
no param,name,archive
no a,href,../tools/content
no object,height,450
no span,class,math-inline-bold
no link,href,../calculus.css
no param,name,codebase
no span,class,math-inline-norm
no img,alt,figure
no p,class,text-right
no a,href,contents.xhtml
no img,src,images/trigo_fun
no object,classid,java:Trigonometr
no p,class,text-center
no a,class,doclink
no table,cellspacing,0
no a,href,../glossary_nota
no div,class,math-block-norma
no link,href,../mathml.css
no param,value,trigonometricFun
no a,href,../index.xhtml
no link,rel,stylesheet
no param,value,../applets/
no object,width,760
no table,width,100%
no img,width,184
no div,class,math-block-bold
no img,height,116
no img,src,images/law_sines
no img,src,images/ln.gif
no param,value,rotatingCoordina
no object,classid,java:RotatingCoo
no a,id,RotatingCoordina
no a,id,Exercise_3_2
no a,id,Exercise_3_5
no object,classid,java:Operations0
no a,id,Definition
no param,value,operationsOnVect
no param,value,multiplicationVe

```

```

no img,src,images/polar_coo
no param,value,determinantVecto
no html,lang
no html,lang,no
no i
no sup
no style,type
no style,type,text/css
no p,class,indent
no p,class,center
no p,class,right
no span,class,math-inline-normal
no object,classid,java:OperationsOnVectors.class
no a,href,http://ocw.mit.edu/OcwWeb/Mathematics/18-013ASprin
code pre
no meta
no h1,align
no meta,content
no meta,name
no meta,name,description
no h1,align,center
no meta,name,keywords
no meta,content,Pope_John_Paul_II's_Apostolic__Letter_'Salvifici_D
no meta,content,suffering__Christian_suffering__redemptive_sufferi
no font
no b
no small
no h3
no sub
no font,size
no td,align
no mstyle,fontfamily
no td,width
no mi,fontstyle
no ol,type
no mstyle,fontfamily,helvetica
no mi,fontstyle,italic
no td,align,center
no meta,content,TtM_3.72
no td,width,1
no meta,name,GENERATOR
no ol,type,1
no div,class,p
no font,size,-1
no mi,fontstyle,normal
no span,lang,en-us-g1.ctb
no none

```

```

no col
no caption
no thead
no cite
no tbody
no mprescripts
no math,id
no mo,minsize
no math,smilref
no h1,class
no p,id
no caption,title
no table,id
no object,data
no thead,id
no div,title
no col,id
no tbody,id
no div,id
no caption,id
no math,alttext
no meta,scheme
no object,id
no p,title
no td, rowspan
no cite,id
no math, altimg
no mspace, linebreak
no table, title
no td, id
no tr, id
no math, overflow
no div, id, d4e64
no math, id, d1e21
no p, title, paragraph: _We_have_performed...
no div, id, d4e54
no div, id, d4e59
no meta, content, Text
no mi, mathvariant, bold-italic
no div, id, d4e49
no math, overflow, scroll
no div, id, front
no p, id, d4e72
no math, alttext, __lamda_sub_c
no meta, scheme, EID
no p, id, d4e62
no p, id, d4e67

```

```

no p,id,d4e52
no object,id,f1
no object,id,f2
no p,id,d4e57
no object,id,f3
no tbody,id,d13e73
no tr,id,d13e74
no math,smilref,dtb_e057003.smil#d1e21
no td,colspan,1
no tr,id,d13e67
no td,colspan,2
no p,title,paragraph:_We_report_measure...
no caption,id,d13e2
no math,id,d1e770
no meta,scheme,PACS_code
no p,title,paragraph:_Angle_resolved_ph...
no object,data,e057003_2.svg
no math,smilref,dtb_e057003.smil#d1e770
no p,title,paragraph:_The_transition_me...
no col,id,d13e60
no col,id,d13e61
no col,id,d13e62
no col,id,d13e63
no col,id,d13e64
no caption,title,caption
no div,title,Author_Information
no link,href,default.css
no math,alttext,__cap_nb_cap_se_sub_2
no math,id,d1e113
no math,alttext,__lamda_sub_ay
no mspace,linebreak,goodbreak
no math,id,d1e121
no meta,name,dc:Type
no math,id,d1e129
no span,class,sentence
no div,title,frontmatter
no cite,id,d4e2807
no div,class,doctitle
no math,smilref,dtb_e057003.smil#d1e113
no td,rowspan,1
no p,title,paragraph:_We_thank_I._Mazin...
no math,smilref,dtb_e057003.smil#d1e121
no math,smilref,dtb_e057003.smil#d1e129
no math,altimg,math_img/math_2.png
no cite,id,d4e2838
no div,class,frontmatter
no thead,id,d13e66

```

```

no table,title,Table:_Variation_of_the_...
no cite,id,d4e2816
no cite,id,d4e2829
no math,alttext,_2__cap_h_-_cap_nb_cap_se_sub_2
no td,id,d13e88
no td,id,d13e71
no td,id,d13e75
no param,name,SRC
no td,id,d13e68
no td,id,d13e69
no object,classid,CLSID:8483EB52-5EF2-44F5-A685-C9FD08F9B18C
no html,lang,en
no object,data,e057003_3.svg
no tr,id,d13e193
no tr,id,d13e167
no tr,id,d13e180
no table,id,d13e1
no math,altimg,math_img/math_1.png
no meta,content,ANSI/NISO_Z39.86-2005
no meta,scheme,http://www.w3.org/1998/Math/MathML
no math,altimg,math_img/math_4.png
no h1,class,title
no math,altimg,math_img/math_10.png
no math,altimg,math_img/math_3.png
no cite,id,d4e2794
no meta,scheme,DOI
no mo,minsize,5ex
no object,data,e057003_1.svg
no meta,name,dc:Format
no a,class,nava
no a,onclick
no a,onclick,ChSize('10')
no a,onclick,ChSize('12')
no a,onclick,ChSize('13')
no a,onclick,ChSize('14')
no a,shape
no a,shape,rect
no a,target
no a,target,_blank
quotation blockquote
no br,class
no br,class,newline
no center
no h3,class
no h3,class,sectionHead
heading4 h4
no h4,class

```

```

no h4,class,subsectionHead
no img,alt,Variable_Star.jpg
no img,src,Variable%20Star.jpg
no link,href,http://purl.org/DC/elements/1.0/
no link,href,root.css
no link,rel,schema.DC
no meta,http-equiv
no meta,http-equiv,Content-Language
no meta,http-equiv,Content-Type
no mo,class
no mo,class,MathClass-close
no mo,class,MathClass-punc
no mo,class,MathClass-rel
no mspace,class
no mspace,class,quad
no mspace,width,1em
no mstyle,class
no mstyle,class,label
no mstyle,id
no mstyle,id,x1-2001r1
no mstyle,id,x1-2002r2
no script
no script,type
no script,type,text/javascript
no span,class,titlemark
no table,class
no table,class,equation
no td,class,eq-no
titlepage titlepage
dedication dedication
attribution attribution
no list
italicx emp
no attrib
no meta,name,generator
no mo,class,MathClass-op
no mo,class,MathClass-open
no mo,class,MathClass-bin
boxline boxline 7
no base
no var
para dd
no dl
para dt
heading4 h5
compbrl code
no base,href

```

```
no hr,title
no tr,valign
no pre,style
no img,width,72
no pre,style,color:_red
no tr,valign,baseline
no base,href,http://www.w3.org/TR/1999/REC-xslt-19991116
no img,height,48
no table,class,scrap
no hr,title,Separator_for_header
no img,alt,W3C
no hr,title,Separator_from_footer
no samp
no th
no dd,id

no h2,id
no table,summary
no li,id
no ol,id
no dl,id
no ul,class
no ul,id
no dt,id
no samp,id
no h1,id
no h3,id
no ul,class,pl
no dl,id,dl_1
no ul,id,ul_1
no dl,id,dl_2
no ul,id,ul_2
no ul,id,ul_3
no ul,id,ul_4
no dl,id,dl_5
no dl,id,dl_6
no h3,id,h3_18
no h2,id,h2_5a
no h1,id,h1_2a
no h3,id,Vote
no dl,id,dl_5a
no samp,id,smp_1
no samp,id,smp_2
no li,id,li_0
no samp,id,smp_3
no li,id,li_1
no samp,id,smp_4
```

```

no li,id,li_2
no samp,id,smp_5
no li,id,li_3
no li,id,li_4
no dd,id,dd_1
no dt,id,dt_1
no dd,id,dd_2
no dt,id,dt_2
no dd,id,dd_3
no dt,id,dt_3
no dd,id,dd_4
no dt,id,dt_4
no dd,id,dd_5
no dt,id,dt_5
no h3,id,h3_8
no h3,id,BoD
no h3,id,h2_5
no ol,id,ol_3gwk
no h1,id,h1_2
no h1,id,h1_3
no h1,id,h1_4
no h2,id,h2_6
no h2,id,h2_7
no h2,id,h2_8
no h2,id,h2_9
no ol,id,ol_2
no h1,id,h1_a
no ol,id,ol_3
no ol,id,ol_4
no table,summary,This_table_lists_each_kind_of_DTB_file__the_requir
no ul,id,ol_1
no base
no var
para dd
para dl
no dt
no h5
code code
no base,href
no hr,title
no tr,valign
no pre,style
no img,width,72
no pre,style,color:_red
no tr,valign,baseline
no base,href,http://www.w3.org/TR/1999/REC-xslt-19991116
no img,height,48

```

```
no table,class,scrap
no hr,title,Separator_for_header
no img,alt,W3C
no hr,title,Separator_from_footer
no samp
no th
no dd,id
no h2,id
no table,summary
no li,id
no ol,id
no dl,id
no ul,class
no ul,id
no dt,id
no samp,id
no h1,id
no h3,id
no ul,class,pl
no dl,id,dl_1
no ul,id,ul_1
no dl,id,dl_2
no ul,id,ul_2
no ul,id,ul_3
no ul,id,ul_4
no dl,id,dl_5
no dl,id,dl_6
no h3,id,h3_18
no h2,id,h2_5a
no h1,id,h1_2a
no h3,id,Vote
no dl,id,dl_5a
no samp,id,smp_1
no samp,id,smp_2
no li,id,li_0
no samp,id,smp_3
no li,id,li_1
no samp,id,smp_4
no li,id,li_2
no samp,id,smp_5
no li,id,li_3
no li,id,li_4
no dd,id,dd_1
no dt,id,dt_1
no dd,id,dd_2
no dt,id,dt_2
no dd,id,dd_3
```

```
no dt,id,dt_3
no dd,id,dd_4
no dt,id,dt_4
no dd,id,dd_5
no dt,id,dt_5
no h3,id,h3_8
no h3,id,BoD
no h3,id,h2_5
no ol,id,ol_3gwk
no h1,id,h1_2
no h1,id,h1_3
no h1,id,h1_4
no h2,id,h2_6
no h2,id,h2_7
no h2,id,h2_8
no h2,id,h2_9
no base,href,http://www.daisy.org/z3986/2005/Z3986-2005.html
no ol,id,ol_2
no h1,id,h1_a
no ol,id,ol_3
no ol,id,ol_4
no table,summary,This_table_lists_each_kind_of_DTB_file__the_requir
no ul,id,ol_1
no form
no input
no select
no label
no noscript
no option
no textarea
no td,valign
no input,border
no textarea,class
no select,class
no img,name
no input,type
no script,language
no select,size
no label,for
no textarea,name
no link,media
no input,name
no textarea,wrap
no td,height
no script,src
no input,width
no input,id
```

```
no form,id
no img,border
no b,class
no option,selected
no li,class
no form,method
no img,align
no table,align
no input,maxlength
no img,class
no input,value
no select,id
no form,name
no textarea,rows
no tr,align
no input,class
no input,src
no textarea,id
no select,name
no pre,class
no span,id
no input,alt
no img,vspace
no textarea,cols
no input,height
no form,action
no tr,class
no option,value
no img,vspace,3
no img,border,0
no input,height,21
no input,width,120
no select,size,1
no input,src,//www.ibm.com/i/v14/buttons/submit.gif
no td,height,18
no input,maxlength,100
no option,value,dW
no pre,class,displaycode
no textarea,cols,35
no form,method,get
no tr,align,right
no table,align,right
no input,id,q
no img,class,display-img
no textarea,rows,5
no form,name,form1
no b,class,related
```

```
no input,name,searchType
no input,border,0
no td,valign,middle
no textarea,class,iform
no select,id,sn
no textarea,id,Comments
no link,media,screen_print
no select,name,searchScope
no textarea,name,Comments
no form,action,//www.ibm.com/developerworks/search/searchResults.
no img,align,left
no input,class,ibm-btn-search
no script,src,/developerworks/js/dwcss14.js
no span,id,ibm-search-scope
no label,for,sn
no script,language,JavaScript
no input,alt,Submit
no img,name,Benoit_Marchal
no tr,class,left-nav-child-highlight
no input,type,hidden
no textarea,wrap,virtual
no li,class,ibm-first
no option,selected,selected
no select,class,input-local
no input,value,1
no form,id,ibm-search-form
no body,link
no h3,align
no body,vlink
no body,alink
no body,bgcolor
no body,text
no h2,align
no font,face
no body,text,black
no body,bgcolor,white
no body,alink,navy
no body,link,red
no h2,align,center
no h3,align,center
no body,vlink,red
no font,face,Arial_Helvetica_sans-serif
no link,rel,SHORTCUT_ICON
no acronym
code cdata-section
no dfn
no kbd
```

```
no ul,compact
no a,accesskey
no ol,start
no small,class
no link,title
no a,rel
no h2,class
no div,align
no ol,start,1
no small,class,dots
no h2,class,unnumbered
no a,rel,next
no div,align,right
no link,title,Top
no ul,compact,
no a,accesskey,n
no h3,class,likesectionHead
no h4,class,likesubsectionHead
no a,class,url
no colgroup
no colgroup,id
no table,rules
no tr,style
no td,style
no li,class
no ol,class
no tr,class
no li,class,enumerate
no ol,class,enumerate1
no tr,style,vertical-align:baseline;
no td,style,text-align:center;_white-space:nowrap;
no colgroup,id,TBL-1-4g
no colgroup,id,TBL-1-5g
no table,rules,groups
no colgroup,id,TBL-1-2g
no colgroup,id,TBL-1-3g
no td,style,text-align:left;_white-space:nowrap;
no colgroup,id,TBL-1-1g
no tr,class,hline
no table,class,tabular
no td,class,td11
no h2,class
no h2,class,likechapterHead
no colgroup,id
no tr,style
no td,style
no tr,class
```

```

no h3,class,likesectionHead
no colgroup,id,TBL-4621-1g
no tr,style,vertical-align:baseline;
no td,style,text-align:center;_white-space:nowrap;
no table,rules,groups
no colgroup,id,TBL-4621-2g
no td,style,text-align:left;_white-space:nowrap;
no h4,class,likesubsectionHead
no tr,class,hline
no table,class,tabular
no td,class,td11

```

A.4 nemeth.sem

```

# Licnsed under LGPL

# Updated 6-18-08 by Mike Sivill <mike.sivill@viewplus.com>

# You must edit this file as explained in the documentation to get
# proper output.

maction maction
maligngroup maligngroup
malignmark malignmark
math math \eb,\*\ee
menclose menclose
mfrac mfrac ^?,/,^#
mfenced mfenced ^(^)
mfenced mfenced,open,{ ^{,^}
mglyph mglyph
mi mi
mlabeledtr mlabeledtr
mmultiscripts mmultiscripts
mn mn
mo mo
mover mover ^",^<,^}
mpadded mpadded
reverse mroot ^<,^>,^}
mrow mrow
ms ms
mspace mspace
msqrt msqrt ^>,^}
mstyle mstyle
msub msub ,^;,^"
msubsup msupsup ,^~,^~^~,^"
msubsup msupsub ,^;,^~,^"
msup msup ,^~,^"

```

```

matrix mtable
mtd mtd \*\ec
mtext mtext
mtr mtr ^'\,^(,\*\^'\,^)\er
munder munder ^",^%,^}
munderover munderover ^",^%,^<,^}
semantics semantics
skip annotation
no annotation,encoding
no maction,actiontype
no maction,actiontype,highli
no maction,actiontype,status
no maction,actiontype,toggle
no maction,dsi:background
no malignmark,edge
no malignmark,edge,right
no math,display
no math,display,block
no math,mode
no math,mode,inline
no math,xmlns
no mfenced,open
no mfenced,separators
no mn,color
no mn,color,green
no mo,stretchy
no mo,stretchy,false
no mo,stretchy,true
no mover,accent
no mover,accent,true
no ms,lquote
no ms,rquote
no ms,rquote,'
no mspace,height
no mspace,width
no mstyle,background
no mstyle,background,lightb
no mstyle,background,red
no mstyle,color
no mstyle,color,blue
no mstyle,displaystyle
no mstyle,displaystyle,true
no mstyle,fontsize
no mstyle,fontstyle
no mstyle,fontstyle,italic
no mstyle,fontstyle,normal
no mstyle,fontweight

```

```

no mstyle,fontweight,bold
no mstyle,mathsize
no mstyle,mathsize,normal
no mstyle,mathvariant
no mstyle,mathvariant,bold
no mstyle,scriptlevel
no mtable,columnalign
no mtable,columnalign,left
no mtable,equalcolumns
no mtable,equalcolumns,false
no mtable,equalrows
no mtable,equalrows,false
no mtable,frame
no mtable,frame,solid
no mtable,width
no munderover,accent
no munderover,accent,true
skip annotation,encoding,MathType-MTEF
skip merror
skip mphantom
no mo,maxsize
no mo,maxsize,3
no mo,mathsize
no mi,mathvariant
no mo,mathvariant
no munder,accentunder
no mn,mathvariant
no mtext,mathvariant
no mi,mathvariant,italic
no mn,mathvariant,normal
no mo,mathvariant,normal
no munder,accentunder,true
no mtext,mathvariant,normal
no math,display,inline
no mi,mathvariant,normal
no mi,mathvariant,fraktur
no mi,mathvariant,bold-sans

no mi,mathvariant,double-struck
no mi,mathvariant,double-struck
no mi,mathvariant,double-struck
no menclose,notation
no mtd,columnalign
no menclose,notation,longdiv
no mtd,columnalign,right
no mfrac
no mfrac

```

```
no mfrac
no mfrac
no mfrac
no mfrac
no mstyle,scriptlevel,-1
```

A.5 Files for BAUK Maths (ukmaths)

A.5.1 ukmaths.cfg

```
cellsperline 32
braillePages no
mathexprtable us-table.dis,ukmaths.ctb
editTable ukmaths_edit.ctb
internetAccess no
semanticFiles *,ukmaths.sem
```

A.5.2 ukmaths.sem

```
# Licensed under LGPL

maction maction
maligngroup maligngroup
malignmark malignmark
math math \eb,\*\ee
menclose menclose
mfrac mfrac \x0003,@456-34,\x0004
mfenced mfenced @126,@345
mfenced mfenced,open,{ @246,@135
mover mover ,@4-346,@12456
munder munder ,@4-16,@12456
mglyph mglyph
mi mi
mlabeledtr mlabeledtr
mmultiscripts mmultiscripts
mn mn
mo mo
mpadded mpadded
reverse mroot @146
mrow mrow \x0001,\*\x0002
ms ms
mspace mspace \x00a0
msqrt msqrt @146
mstyle mstyle
msub msub ,@16,@12456
msubsup msubsup ,@346,@12456
msup msup ,@346,@12456
```

```
matrix mtable
mtd mtd \*\ec
mtext mtext
mtr mtr @123456,\*@123456\er
munderover munderover ^",^%,^<,^}
semantics semantics
skip annotation
no annotation,encoding
no maction,actiontype
no maction,actiontype,highli
no maction,actiontype,status
no maction,actiontype,toggle
no maction,dsi:background
no malignmark,edge
no malignmark,edge,right
no math,display
no math,display,block
no math,mode
no math,mode,inline
no math,xmlns
no mfenced,open
no mfenced,separators
no mn,color
no mn,color,green
no mo,stretchy
no mo,stretchy,false
no mo,stretchy,true
no mover,accent
no mover,accent,true
no ms,lquote
no ms,rquote
no ms,rquote,'
no mspace,height
no mspace,width
no mstyle,background
no mstyle,background,lightb
no mstyle,background,red
no mstyle,color
no mstyle,color,blue
no mstyle,displaystyle
no mstyle,displaystyle,true
no mstyle,fontsize
no mstyle,fontstyle
no mstyle,fontstyle,italic
no mstyle,fontstyle,normal
no mstyle,fontweight
no mstyle,fontweight,bold
```

```

no mstyle,mathsize
no mstyle,mathsize,normal
no mstyle,mathvariant
no mstyle,mathvariant,bold
no mstyle,scriptlevel
no mtable,columnalign
no mtable,columnalign,left
no mtable,equalcolumns
no mtable,equalcolumns,false
no mtable,equalrows
no mtable,equalrows,false
no mtable,frame
no mtable,frame,solid
no mtable,width
no munderover,accent
no munderover,accent,true
skip annotation,encoding,MathType-MTEF
skip merror
skip mphantom
no mo,maxsize
no mo,maxsize,3
no mo,mathsize
no mi,mathvariant
no mo,mathvariant
no munder,accentunder
no mn,mathvariant
no mtext,mathvariant
no mi,mathvariant,italic
no mn,mathvariant,normal
no mo,mathvariant,normal
no munder,accentunder,true
no mtext,mathvariant,normal
no math,display,inline
no mi,mathvariant,normal
no mi,mathvariant,fraktur
no mi,mathvariant,bold-sans
no mi,mathvariant,double-struck
no menclose,notation
no mtd,columnalign
no menclose,notation,longdiv
no mtd,columnalign,right
no mstyle,scriptlevel,-1

```

A.5.3 ukmaths.ctb

```

# liblouis: UK Maths Table for mathematics
#

```

```

# Based on the Linux screenreader BRLTTY, copyright (C) 1999-2006 by
# The BRLTTY Team
#
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# to
# the Free Software Foundation, 51 Franklin Street, Fifth Floor,
# Boston, MA 02110-1301, USA.
#
# Maintained by John J. Boyer john.boyer@jjb-software.com
# Updated 6-18-08 by Mike Sivill <mike.sivill@viewplus.com>

include ukmaths_single_cell_defs.cti
include ukmaths_unicode_defs.cti
# grouping definitions are character-definition rules
grouping mrow \x0001\x0002 1e,2e
grouping mfrac \x0003\x0004 3e,4e
grouping brackets \x0005\x0006 126,345

# Braille indicators
numsign 3456
capsign 6
begcaps 6-6
endcaps 6-3
singleletterital 4
singleletterbold 4

# litdigit opcodes must be in this table, not the single-cell table.
litdigit 0 245
litdigit 1 1

```

```

litdigit 2 12
litdigit 3 14
litdigit 4 145
litdigit 5 15
litdigit 6 124
litdigit 7 1245
litdigit 8 125
litdigit 9 24

# No letsign but endnum for letters a-j.
endnum a 56-1
endnum b 56-12
endnum c 56-14
endnum d 56-145
endnum e 56-15
endnum f 56-124
endnum g 56-1245
endnum h 56-125
endnum i 56-24
endnum j 56-245

# Ordinary translation entries
always = a-56-2356
always + a-56-235
always > a-135-a
always < a-246-a
always % 25-1234
always $ 256
always & 4-12346
always ~ 45-156
always ! 6-236
prepunc " 236
postpunc " 356
postpunc ' 3
always '' 36
always ''' 36-3
midnum , 3
postpunc , 6-2
always , 3
always # 35-2345 print number sign before number
always ( 126
always ) 345
pass2 [{mrow}@126/@345}mrow ?
pass2 @126[/{mrow}/]mrow@345 ?
decpoint . 2
always ... 3-3-3
hyphen - 36

```

```

postpunc . 6-256
postpunc ; 6-23
postpunc : 6-25
postpunc ? 6-236
endnum % 4-356
midnum * 4-16
repeated \s 0
repeated \x00a0 a

# swap opcodes for replacement and testing.
swapcd dropped 0123456789 356,2,23,25,456,26,235,2356,236,35
swapdd upnum 245,1,12,14,145,15,124,1245,125,24 0,0,0,0,0,0,0,0,0,0
swapdd lownum 356,2,23,25,256,26,235,2356,236,35 0,0,0,0,0,0,0,0,0,0

# now we start doing the real work

# Correction rules
correct {mrow$d1-20[]mrow} ?
correct "\eb" [{mrow}/]mrow"\ee" ?
context "\eb" []$1"\ee" @56
context "\eb" []", "$1"\ee" @56
context []"@456-34"$d1-10}mfrac #1=1
# context []"@456-34"$d1-10}mfrac #1=1
context []"@346"$d1-10"@12456" #1=1
context []"@16"$d1-10"@12456" #1=1
# context []"@146"$d1-10 #1=1
context #1=1$d1-10 #1=0%dropped

# exactdots opcodes for dot patterns in ukmaths.sem
exactdots @126
exactdots @345
exactdots @123456
exactdots @346
exactdots @16
exactdots @23456
exactdots @34
exactdots @456-34
exactdots @12456
exactdots @146

# Function names and abbreviations
word cos 1246-14
word grad 1246-1245
word cosh 1246-125-14
word sinh 1246-125-234
word tanh 1246-125-2345
word cosech 1246-125-126

```

```

word coth 1246-125-1256
word sech 1246-125-36
word log 1246-123
word sin 1246-234
word tan 1246-2345
word cosec 1246-126
word curl 1246-146
word div 1246-1456
word cot 1246-1256
word arccosh 1246-236-14
word arcsinh 1246-236-234
word arctanh 1246-236-2345
word arccosech 1246-236-126
word arccoth 1246-236-1256
word arcsech 1246-236-36
word sec 1246-36
word arccos 1246-4-14
word antilog 1246-4-123
word arcsin 1246-4-234
word arctan 1246-4-2345
word arccosec 1246-4-126
word arccot 1246-4-1256
word arcsec 1246-4-25
word colog 1246-45-123

# pass2 processing
pass2 [@3456]%lownum1-10 ?
pass2 [@456-34-3456]%lownum1-10 ?

# pass3 processing
pass3 @346%lownum1-10[@12456] ?
pass3 @16[%lownum1-10]@12456 *
pass3 {mfrac[@3456%upnum1-10%lownum1-10]}mfrac *
```

A.5.4 ukmaths_edit.ctb

```

# liblouis Table for Post-Translation Editing
#
# Based on the Linux screenreader BRLTTY, copyright (C) 1999-2006 by
# The BRLTTY Team
#
# Copyright (C) 2004, 2005, 2006
# ViewPlus Technologies, Inc. www.viewplus.com
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#
```

```

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# License along with this program; see the file COPYING. If not, write
# to
# the Free Software Foundation, 51 Franklin Street, Fifth Floor,
# Boston, MA 02110-1301, USA.
#
# Maintained by John J. Boyer john.boyer@jjb-software.com
# Updated 6-18-08 by Mike Sivill <mike.sivill@viewplus.com>
include ukmaths_single_cell_defs.cti

```

```

math \x0001 56
math \x0002 45
math \x0003 56
math \x0004 45
repeated \s 0
always \ee\s'4 6-256
always \ee\s'1 6
always \ee\s'3 6-25
always \ee\s'2 6-23
always '7\s\eb 12356
always \ee\s'7 23456
always "\s 0
always \s,\s 6-0
# context "\eb"[]$1"\ee" @56
# context "\eb"["",$1"\ee" @56

```

```

pass2 @1b-12 ?
pass2 @1b-15 ?
pass2 @1b-12-4-4 @4

```


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mn	24
mo	24
mover	24
mpadded	24
mphantom	24
mprescripts	24
mroot	24
mrow	24
ms	24
mspace	24
msqrt	24
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msub	24
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msup	24
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mtr	24
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