Generation of PDF/X- and PDF/A-compliant PDFs with pdfTEX—pdfx.sty

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QUICK LINKS

[1]label=▶,itemsep=0pt [2]label=▷,itemsep=0pt [1]label=0.,itemsep=0pt

1. Introduction

This package[1] currently supports generation of PDF/X-, PDF/A- and PDF/E-compliant documents, using pdfTEX, in most of their variants; see the complete list in Section ?? below. As of TEX Live 2016 it now also works with LuaLATEX and XeLATEX, when using appropriate command-line options[2], but with some limitations — see Sections ?? and ??. By 'supports', we mean that the package provides correct and sufficient means to declare that a document conforms with a stated PDF variant (PDF/X, PDF/A, PDF/E, PDF/VT, PDF/UA, etc.) along with the version and/or level of conformance. This package also allows appropriate Metadata and Color Profile to be specified, according to the requirements of the PDF variant.

Metadata elements, most of which must ultimately be written as XML using the UTF-8 encoding, is provided via a file named \jobname.xmpdata, for the running LATEX job. Without such a file, providing some required information as well as a large range of optional data, a fully validating PDF file cannot be achieved. The PDF can be created, having the correct visual appearance on all pages, but it will not pass validation checks. Sections ?? and ?? describe how this file should be constructed.

What this package *does not do* is to check for all the details of document structure and type of content that may be required (or restricted) within a PDF variant. For example, PDF/VT [?] requires well-structured parts, using Form XObject sections tagged as '/DPart'. Similarly PDF/A-1a (and 2a and 3a) [?, ?, ?] require a fully 'Tagged PDF', including a detailed structure tagging which envelops the complete contents of the document, as does also PDF/UA [?]. This is beyond the current version of LATEX engines, as commonly shipped. So while this package provides enough to meet the declaration, metadata and font-handling aspects for these PDF/A variants, it is not sufficient to produce fully conforming PDFs. However, with extra pdfTEX-based software or macro coding that *is* capable of producing 'Tagged PDF', this package can be used as part of the overall workflow to produce fully conforming documents.

1.1. PDF standards

PDF/X and PDF/A are umbrella terms used to denote several ISO standards [?, ?, ?, ?, ?, ?, ?, ?] that define different subsets of the PDF standard [?, ?]. The objective of PDF/X is to facilitate graphics exchange between document creator and printer and therefore, has all requirements related to printing. For instance, in PDF/X, all fonts need to be embedded and all images need to be CMYK or spot colors. PDF/X-2 and PDF/X-3 accept calibrated RGB and CIELAB colors along with all other specifications of PDF/X. Since 2005 other variants of PDF/X have emerged, as extra effects (such as layering and transparency) have been supported within the PDF standard itself. The full range of versions and conformance supported in this package is discussed below in Section ??.

PDF/A defines a profile for archiving PDF documents, which ensures the documents can be reproduced in the exact same way in years to come. A key element to achieving this is that PDF/A documents are 100% self-contained. All the information needed to display the document in the same manner every time is embedded in the file. A PDF/A document is not permitted to be reliant on information from external sources. Other restrictions include avoidance of audio/video content, JavaScript and encryption. Mandatory inclusion of fonts, color profile and standards-based metadata are absolutely essential for PDF/A. Later versions allow for use of image compression and file attachments.

PDF/E is an ISO standard [?] intended for documents used in engineering workflows. PDF/VT [?] allows for high-volume customised form printing, such as utility bills. PDF/UA ('Universal Accessibility') has emerged as a standard [?, ?, ?] supporting Assistive Technologies, incorporating web-accessibility guidelines (WCAG) for electronic documents. In future, PDF/H may emerge for health-records and medical-related documents. Other applications can be envisaged. Declarations and Metadata and ‘u’. Level ‘a’ is the strictest, but is not yet fully implemented by the pdfx package. Conformance level ‘u’ has the same requirements as level ‘b’, but with the additional requirement that all text in the document must have a Unicode mapping. However, the pdfx package produces such Unicode mappings even in level ‘b’ files. The standard also has three different versions 1, 2, and 3, which were standardized in 2005, 2011 and 2012, respectively. Earlier versions contain a subset of the features of later versions, so for maximum portability, it is preferable to use a lower-numbered version, when the extra features allowed in higher versions are not used. There is no conformance level ‘u’ in version 1 of the standard. Thus for many typical uses of PDF/A, it is sufficient to use PDF/A-1b.

- a-1a: generate PDF/A-1a. Experimental, not fully implemented.
- a-1b: generate PDF/A-1b.
- a-2a: generate PDF/A-2a. Experimental, not fully implemented.
- a-2b: generate PDF/A-2b.
- a-2u: generate PDF/A-2u.
- a-3a: generate PDF/A-3a. Experimental, not fully implemented.
- a-3b: generate PDF/A-3b.
- a-3u: generate PDF/A-3u.

By ‘Experimental, not fully implemented’ here we mean primarily that the document structure, as required for ‘Tagged PDF’, is not handled by this package. Using other pdfTEX-based software that *is* capable of producing such complete tagging, conforming documents can indeed be produced.

2.1.2. PDF/E options

PDF/E is an ISO standard [?] intended for documents used in engineering workflows. There is only one version of the PDF/E standard so far, and it is called PDF/E-1.

- e-1: generate PDF/E-1.
- e: same as e-1.

2.1.3. PDF/UA options

PDF/UA is an ISO and ANSI standard [?, ?] intended for making structured documents readable and navigable using Assistive Technology; e.g., screen-readers, Braille keyboards and such-like. Documents prepared this way can be easily saved in other formats which preserve the structure, such as XML, HTML, and (Microsoft) Word-based formats.

- ua-1: generate PDF/UA-1.
- ua: same as ua-1.

2.1.4. PDF/VT options

PDF/VT is an ISO standard intended as an exchange format for variable and transactional printing, and is an extension of the PDF/X-4 standard. The standard specifies three PDF/VT conformance levels. Level 1 is for single-file exchange, level 2 is for multi-file exchange, and level 2s is for streamed delivery. Currently, none of the PDF/VT conformance levels are fully implemented by the pdfx package.

- vt-1: generate PDF/VT-1, based on PDF/X-4. Experimental, not fully implemented
- vt-2: generate PDF/VT-2, based on PDF/X-5pg. Experimental, not fully implemented.
- vt-2s: generate PDF/VT-2s. Experimental, not fully implemented.

By 'Experimental, not fully implemented' here we mean primarily that the structuring of a document into '/DPart' sections, as Form XObjects, is not handled by this package. This *is* possible with current pdfTEX software, but not yet in a way that lends itself easily to full automation, due to requirements of knowing the internal object number of certain internal PDF constructs. All the other aspects: PDFInfo declaration, Metadata and Color Profile, of the PDF/VT variants are correctly handled.

2.1.5. PDF/X options

PDF/X is an ISO standard intended for graphics interchange. It emphasizes printing-related requirements, such as embedded fonts and color profiles. The PDF/X standard has a large number of variants and conformance levels. The basic variants are X-1, X-1a, X-3, X-4, and X-5. (Note that a revised version of the X-2 standard was published in 2003 but withdrawn as an ISO standard in 2011, basically due to lack of interest in using it). The PDF/X-1a standard exists in revisions of 2001 and 2003, the PDF/X-3 standard exists in revisions of 2002 and 2003, and the PDF/X-4 and PDF/X-5 standards exist in revisions of 2008 and 2010. Moreover, some of these standards have a 'p' version, which permits the use of an externally supplied color profile (instead of an embedded one), and/or a 'g' version, which permits the use of external graphical content. Moreover, PDF/X-5 has an 'n' version, which extends PDF/X-4p by permitting additional 'Custom' color spaces other than Grayscale, RGB, and CMYK. For many typical uses of PDF/X, it is sufficient to use PDF/X-1a.

- x-1: generate PDF/X-1; now obsolete, doesn't validate.
- x-1a: generate PDF/X-1a. Options x-1a1 and x-1a3 are also available to specify PDF/X-1a:2001 or PDF/X-1a:2003 explicitly.
- x-2: generate PDF/X-2; unpublished, doesn't validate.
- x-3: generate PDF/X-3. Options x-302 and x-303 are also available to specify PDF/X-3:2002 or PDF/X-3:2003 explicitly.
- x-4: generate PDF/X-4. Options x-408 and x-410 are also available to specify PDF/X-4:2008 or PDF/X-4:2010 explicitly.
- x-4p: generate PDF/X-4p. Options x-4p08 and x-4p10 are also available to specify PDF/X-4p:2008 or PDF/X-4p:2010 explicitly.
- x-5g: generate PDF/X-5g. Options x-5g08 and x-5g10 are also available to specify PDF/X-5g:2008 or PDF/X-5g:2010 explicitly.

- x-5n: generate PDF/X-5n. Options x-5n08 and x-5n10 are also available to specify PDF/X-5n:2008 or PDF/X-5n:2010 explicitly. Experimental, not fully implemented.
- x-5pg: generate PDF/X-5pg. Options x-5pg08 and x-5pg10 are also available to specify PDF/X-5pg:2008 or PDF/X-5pg:2010 explicitly.

2.1.6. Other options

These options are experimental and should not normally be used.

- useBOM: generate an explicit UTF-8 byte-order marker in the embedded XMP metadata, and make the XMP packet writable. Neither of these features are required by the PDF/A standard, but there exist some PDF/A validators (reportedly validatepdfa.com) that seem to require them. Note: the implementation of this feature is experimental and may break with future updates to the xmpincl package.
- noBOM: do not generate the optional byte-order marker. (default)
- noerr: avoids stopping when making PDF/X with an RGB profile, and at other unusual situations; e.g., PDF/UA without also PDF/A.
- pdf12: use PDF 1.2, overriding the version specified by the applicable standard. This may produce a non-standard-conforming PDF file.
- pdf13: use PDF 1.3, overriding the version specified by the applicable standard. This may produce a non-standard-conforming PDF file.
- pdf14: use PDF 1.4, overriding the version specified by the applicable standard. This may produce a non-standard-conforming PDF file.
- pdf15: use PDF 1.5, overriding the version specified by the applicable standard. This may produce a non-standard-conforming PDF file.
- pdf16: use PDF 1.6, overriding the version specified by the applicable standard. This may produce a non-standard-conforming PDF file.
- pdf17: use PDF 1.7, overriding the version specified by the applicable standard. This may produce a non-standard-conforming PDF file.
- nocharset: do not generate the Charset entry for fonts (pdfTEX only).
- usecharset: generate the Charset entry for fonts (pdfTEX only).

The latter two options affect the value of the \pdfomitcharset primitive, added to pdfTEX in 2019, due to differing requirements for PDF/A-1 and other PDF/A versions. Indeed use of the /Charset entry for a font is deprecated entirely for PDF 2.0 [?] and later.

2.1.7. XMP language options

These options allow for characters in alphabets other than those used for English and Western European languages to be used within the .xmpdata file (see Section ??), supported through LATEX character representation macros.

- latxmp: extended Latin blocks, Ux0180–Ux024F and Ux1E00–Ux1EFF

- armxmp: armenian letters and ligatures, Ux0530–Ux058F, via macros \armyba, \armfe, \armcomma, etc.
- cyrxmp: cyrillic letters and accents, Ux0400–Ux04FF and Ux0500–Ux0527 via macros \cyra, \CYRN, etc.
- grkxmp: greek letters and diacritics, Ux0370–Ux03FF and Ux1F00–Ux1FFF via macros \textalpha, \textPi, etc.
- hebxmp: some hebrew letters and marks, Ux05C0–Ux05F4 via macros \hebalef, \hebtav, \doubleyod, etc.
- arbxmp: some arabic letters and marks, Ux0600–Ux06FF via macros \hamza, \alef, \sukun, etc.
- vnmxmp: vietnamese letters and accents, Ux1EA0–Ux1EFF via macros \abreve, \uhorn, \ECIRCUMFLEX, etc.
- ipaxmp: phonetic extensions, Ux0250–Ux02AF and Ux1D00–Ux1DFF
- mathxmp: mathematical letters, symbols, operators arrows, alphanumeric forms.
- allxmp: all of the above, as well as those listed next; used primarily for testing compatibility with other packages.

The characters supported by these options include those supported by hyperref.sty via the PDFdoc encodings (PD1 and PU) for inclusion in PDF files. Extra support is provided for math alphabets. For Armenian, the macros defined by ArmTEX are supported.

Further options allow direct (enclosed) input of upper 8-bit characters, from encodings such as Latin-1–Latin-9, KOI8-R, LGR (Greek), ArmSSCI8, and a few more. Use of these requires a carefully controlled parsing regime. Here we list the package options that declare such content may be present in the .xmpdata file. A detailed account of how these are used is given in Section ?? ("Multilingual Metadata").

- LATxmp: support for direct use of the upper-range characters (byte codes 160–255) for input encodings Latin1–Latin9, for Latin-based alphabets as used in European countries and elsewhere. This defines parser macros \textLAT, \textLII, . . . , \textLIX. All support from latxmp is loaded also.
- KOIxmp: support for direct use of cyrillic letters by use of upper-range characters (byte codes 148–255) under input encodings KOI8-R and KOIR8-RU, using \textKOI as parser macro. All support from cyrxmp is loaded also.
- LGRxmp: support for greek letters entered using either the LGR input transliteration of ASCII characters, or the ISO-8859-7 encoding of upper-range characters (byte codes 160–255), or a combination of both, using \textLGR as parser macro. All support from grkxmp is loaded also.
- AR8xmp: support for armenian letters entered using the ArmTEX 2.0 input transliteration of ASCII characters, or the ArmSCII8 encoding of upper-range characters (byte codes 160–255), or a combination of both, using \textARM as parser macro. All support from armxmp is loaded also.
- HEBxmp: support for hebrew letters entered using either LHE input transliteration of ASCII characters, or the CP1255, CP862 or ISO-8859-8 (HE8) encoding of upper-range characters (byte codes 160–255), or a combination of these using \textLHE, \textHEBO, \textHEB as parser macros. All support from hebxmp is loaded also.

These 'parser' options have received limited testing, so please report any mistakes in the UTF-8 output that you may encounter.

2.2. Data file for metadata

As mentioned above, standards-compliant PDF documents require document-level metadata to be included. This, known as an 'XMP packet' [?, ?], is like having a library catalog card included within the PDF itself. It is an unencrypted portion of the PDF file, with data expressed in Extensible Markup Language (XML), using Resource Description Format (RDF [?]) syntax, encoded as UTF-8 so readable by any text editing software on any modern computing platform.

Some advantages of doing this are clear.

- For a librarian: cataloguing information is available within the file itself, without the need to search explicitly in the visual layout of the content or elsewhere;
- All actual libraries cataloguing this PDF can have consistent information; including web-based indexing sites such as Google.
- For the author(s): who can specify the kind of information most appropriate to help readers understand the nature and purpose of the document.

The pdfx package builds the XMP metadata from information supplied via a special data file called \jobname.xmpdata. Here, \jobname is usually the basename of the document's main .tex file. For example, if your document source is in the file main.tex, then the metadata must be in a file called main.xmpdata. None of the individual metadata fields are mandatory, but for most documents, it makes sense to specify at least the title and the author. For more technical aspects of metadata and its uses, consult the work of the Dublin Core Initiative [?] and PRISM [?].

Here is a short .xmpdata file:

```
\Title{Baking through the ages}
\Author{A. Baker\sep C. Kneader}
\Language{en-GB}
\Keywords{cookies\sep muffins\sep cakes}
\Publisher{Baking International}
```

You should note that multiple authors and keywords have been separated by \sep. This \sep macro serves a technical purpose and is permitted within the \Author, \Keywords, and \Publisher fields, as well as some others. See §?? below for a complete listing of the supported author-supplied metadata fields.

After processing, the local directory contains a file named such as pdfa.xmpi or pdfe.xmpi or pdfx.xmpi according to the PDF variant desired. This file is the complete XMP Metadata packet. It can be checked for validity, using an online validator, such as at www.pdflib.com. veraPDF [?] is Open Source software providing validation for PDF/A, and other checkers useful in a PDF/A production setting.

Warning: The \jobname.xmpdata file may be included in the main document source, within a {filecontents*} environment, provided this comes *before* the \documentclass command, as follows.

```
\begin{filecontents*}{\jobname.xmpdata}
  \Title{Baking through the ages}
  \Author{A. Baker\sep C. Kneader}
  \Language{en-GB}
  \Keywords{cookies\sep muffins\sep cakes}
  \Publisher{Baking International}
\end{filecontents*}
\documentclass[11pt,a4paper]{article}
...
```

Including the metadata with the LaTEX source is very convenient. Having it at the top of the file also brings attention to it, placing emphasis on the desirability of including metadata, and keeping it accurate while the main content of the document is subject to changes or revision. Macro definitions can also occur prior to the \documentclass command, including any that may be needed within the metadata. An example of this is apparent in Figure ?? occurring later.

However, this ordering is also extremely important, else any non-ascii UTF-8 byte sequences can become active characters and expand upon data being written out, rather than remaining as inactive bytes. If you edit the metadata supplied this way, remember to remove the existing copy of \jobname.xmpdata file before the next processing run, as LaTEX does not write a new copy of the file when it exists on disk already, within the current working directory or elsewhere that LaTEX may find. In development or testing situations the filename may need to be given as ./\jobname.xmpdata, else an older version may be loaded in error.

Experienced users/programmers can employ the \write18 mechanism [3], together with the --shell-escape command-line option, to automatically execute a shell command that removes \jobname.xmpdata on every (or on selected) processing runs. This is only useful when the metadata changes, for whatever reason.

Other places for the {filecontents*} environment can work, but *only* when it contains *no* non-ascii UTF-8 byte sequences. Since 2018, with default See Section ?? below for more information on the macros that can be safely used within .xmpdata metadata files.

2.3. List of supported metadata fields

Following is a complete list of user-definable metadata fields currently supported, separated into particular groupings. Each command is accompanied by the specific XML tagged field name (with namespace) that is placed into the document-level Metadata packet, as well as the kind of information being conveyed. More may be added in the future. These commands can *only* be used within the .xmpdata file.

Most commands take an optional argument specifying the natural language, using RFC5646 (BCP 47) [?] codes, in which the metadata field is given. Languages for multiple entries can use e.g., \sep[de] .... Only those fields requiring a specific format (e.g. dates) do *not* support language specifiers; these are indicated with $^{\mathrm{f}}$. Fields allowing more than one value are indicated with *. Multiple values may be given as separate instances of the macro, or as a single instance with the values delimited by \sep, as in the example above.

2.3.1. General information:

- *\Author: (dc:creator)
  the document's human author(s). Separate multiple authors with \sep.

[3] If you don't already know what this is, they you probably should not try using it :-).

- *\Title: (dc:title)
  the document's title; multiple language versions are supported.
- ^{*f}\Language: (dc:language)
  list of languages used within the document.
- *\Keywords: (dc:subject)
  list of keywords, separated with \sep.
- *\Publisher: (dc:publisher)
  the publisher(s). Multiple pieces in a publishing chain should be separated with \sep.
- *\Subject: (dc:description)
  the abstract, or short description.

2.3.2. Copyright information:

- \Copyright: (dc:rights)
  a copyright statement.
- ^{f}\CopyrightURL: (xmpRights:WebStatement)
  location of a web page describing the owner and/or rights statement for this document.
- ^{f}\Copyrighted: (xmpRights:Marked)
  'True' if the document is copyrighted, and 'False' if it isn't. This is automatically set to 'True' if either \Copyright or \CopyrightURL is specified, but this can be overridden. For example, if the copyright statement is 'Public Domain', then specify also \Copyrighted{False}.
- *\Owner: (xmpRights:Owner)
  specifies the owner(s) of the document or resource.
- ^{f}\CertificateURL: (xmpRights:Certificate)
  gives the URL to online proof of ownership, if available.

2.3.3. more Dublin Core metadata:

From version 1.6 of pdfx.sty, the following fields can be used to provide a greater range of information to be specified as metadata.

- *\Contributor: (dc:contributor)
  contributor(s) other than author(s) of the PDF document.
- \Coverage: (dc:coverage)
  statement about the extent or scope of the document's contents.
- ^{*f}\Date: (dc:date)
  date(s) when something significant occurred relating to the resource (e.g., version changes); must be in ISO date format YYYY-MM-DD or YYYY-MM.
- ^{f}\PublicationType: (dc:type)
  The type of publication. If specified, must be one of 'book', 'catalog', 'feed', 'journal', 'magazine', 'manual', 'newsletter', 'pamphlet'. This is automatically set to 'journal' if \Journaltitle is specified (see below), but can be overridden.

- *\Relation: (dc:relation)
  how this PDF or resource relates to other document(s) or resources.
- ^{f}\Source: (dc:source)
  specifies a source document from which the PDF is derived.
- ^{f}\Doi: (dc:identifier, prism:doi, prism:url)
  Digital Object Identifier (DOI) for the document, without the leading 'doi:'.
- ^{f}\ISBN: (dc:identifier)
  the ISBN for the PDF itself, or Book/Monograph of which it is part.
- ^{f}\URLlink: (dc:identifier, prism:url)
  gives a URL address for an online copy of the document.

The remaining Dublin Core field (dc:format) is always set to 'application/pdf'.

2.3.4. Publication information:

The following macros allow for inclusion of publication related metadata fields, as specified by PRISM [?] to meet publishing requirements.

- \Journaltitle: (prism:issueName)
  The title of the journal in which the document was published.
- ^{f}\Journalnumber: (prism:issn)
  The ISSN for the journal/series in which the document was published.
- ^{f}\Volume: (prism:volume)
  Journal volume.
- ^{f}\Issue: (prism:number)
  Journal issue/number.
- ^{f}\Firstpage: (prism:startingPage, prism:pageRange)
  First page number of the published version of the document.
- ^{f}\Lastpage: (prism:endingPage, prism:pageRange)
  Last page number of the published version of the document.
- \CoverDisplayDate: (prism:coverDisplayDate)
  Date on the cover of the journal issue, as a human-readable text string.
- ^{f}\CoverDate: (prism:coverDate)
  Date on the cover of the journal issue, in a format suitable for storing in a database field with a 'date' data type; e.g. YYYY-MM, or YYYY-MM-DD.

This is an area which can be expanded, to deal with more kinds of publication and metadata fields. The ExtensionSchema [?] technique is used to add new fields. Examples of this can be found in the template files pdfx.xmp, pdfa.xmp, pdfe.xmp.

2.3.5. Backward Compatibility

The following macros are also recognised, for backward compatibility with earlier versions of the package.

- *\AuthoritativeDomain: (pdfx:AuthoritativeDomain)
  specifies extra names (e.g., of companies) associated to the existence of the PDF or resource.

- \Creator: (xmp:CreatorTool)
  synonymous with \CreatorTool which is usually handled automatically anyway, but can be over-ridden.
- \Org: synonymous with \Publisher.
- \WebStatement: synonymous with \CopyrightURL.

2.3.6. more XMP metadata:

- *\Advisory: (xmp:Advisory)
  noteworthy information; e.g., revision data or changes.
- ^{f}\BaseURL: (xmp:BaseURL)
  base-URL for relative hyperlinks within the PDF.
- *\Identifier: (xmp:Identifier)
  more advance forms than (dc:identifier); see [?, ?].
- \Nickname: (xmp:Nickname)
  a pseudonym or 'nickname' as a colloquial identifier for the resource.
- *\Thumbnails: (xmp:Thumbnails)
  allows small page images to be associated with each page of the PDF. An appropriate XML-compatible representation is required for such images.

2.3.7. PDF standards metadata:

The following metadata fields are generated automatically by the LaTeX engine. Some are dependent on the particular loading options that specify the desired compliance with a PDF standard, and level of conformance. There are no separate user-macros to alter these. The first three dates are usually set to be identical.

- (xmp:CreateDate) : creation date&time of the PDF.
- (xmp:MetadataDate) : creation date&time of the Metadata for the PDF.
- (xmp:ModifyDate) : date&time of latest modifications to the PDF.
- (xmpMM:DocumentID) : unique identifier for the PDF, based on MD5 sum.
- (xmpMM:InstanceID) : unique identifier based on creation date&time.
- (pdf:Producer) : TeX engine used; either 'LuaTeX', 'XeTeX', 'pdfTeX'.
- (pdf:Trapped) : currently always set to 'False'.
- (pdfaid:part) : 1, 2 or 3 for PDF/A-?
- (pdfaid:conformance) : a, b or u for PDF/A-??
- (pdfuaid:part) : currently 1 for PDF/UA-1
- (pdfe:ISO_PDFEVersion) : currently 1 for PDF/E-1
- (pdf:Version) : PDF/X-1, PDF/X-2 or PDF/X-3
- (pdfx:GTS_PDFXVersion) : e.g., PDF/X-1a:2003 up to PDF/X-3 ; but no year for PDF/X-4 and PDF/X-5 variants

- (pdfx:GTS_PDFXConformance) : e.g., PDF/X-1a:2003 up to PDF/X-2
- (pdfxid:GTS_PDFXVersion) : e.g., PDF/X-4p:2008 after PDF/X-3
- (pdfvtid:GTS_PDFVTVersion) : e.g., PDF/VT-2s for PDF/VT
- (pdfvtid:GTS_PDFVTModDate) : same as xmp:ModifyDate

2.4. Symbols permitted in metadata

Within the metadata, all printable ASCII characters except \, {, } and % represent themselves. Also, all printable Unicode characters from the basic multilingual plane (i.e., up to code point U+FFFF) can be used directly with the UTF-8 encoding. (Please note: encodings other than UTF-8 are not supported in the metadata, except as arguments to ‘parser-macros’; see Section ??). Consecutive whitespace characters are combined into a single space. Whitespace after a macro such as \copyright, \backslash, or \sep is ignored. Blank lines are not permitted. Moreover, the following markup can be used:

- “\ ”: a literal space (for example after a macro)
- \%: a literal %
- \{: a literal {
- \}: a literal }
- \backslash: a literal backslash \
- \copyright: the copyright symbol ©

The macro \sep is permitted within \Author, \Keywords, \Publisher, and other macros marked with * above. It’s purpose is to separate multiple authors, keywords, etc. to appear as separate list items appropriately and consistently in the different ways that such information is represented within the PDF file. The package takes care of this when \sep is used. For example, in the XMP metadata, it expands as </rdf:li><rdf:li> tagging.

2.4.1. PDF Info strings

When \sep is not used within its argument, the metadata from \Title, \Author and \Keywords is also included in the PDF /Info dictionary. When this is the case, validation for the declared standard will occur only if the corresponding /Info item and XMP metadata field convert to exactly the same Unicode string. This cannot happen when \sep is used, so the /Info items are then not populated.

Unfortunately not all PDF browsers (in particular, older ones and much Apple software) give ready access to the XMP metadata packet. Some authors want to see everything using e.g., the Unix/Linux command: pdfinfo -enc UTF-8 . In fact there is the -meta option to get the complete metadata packet (in UTF-8 encoding). This can give more than what one wants, so use it as follows:

```
pdfinfo -meta <filename>.pdf | grep 'dc:'
```

to extract just the Dublin Core metadata fields.

Another possibility is to *not* use \sep with multiple authors and/or keywords. Instead replace it with simply ‘, ’. We do not recommend doing this, as more sophisticated metadata tools will see the result as a single value, rather than multiple authors, say. Different language codes cannot be applied when done this way. However, some authors may find this a satisfactory solution that suits their own tools.

2.5. Macros permitted in metadata

Other TEX macros actually can be used, provided the author is very careful and not ask for too-complicated TEX or LATEX expansions into internal commands or non-character primitives; basically just accents, macros for Latin-based special characters, and simple textual replacements, perhaps with a simple parameter. A special macro \pdfxEnableCommands{...} is provided to help resolve difficulties that may arise.

Here is an example[4] of the use of \pdfxEnableCommands, which occurs with the name of one of our authors (Hàn Thế Thanh) due to the doubly-accented letter ế. It is usual to define a macro such as: `` \def\thanh{H\`an Th\'{\^e} Thanh} ``. In previous versions of the pdfx package, use of such a macro within the .xmpdata file, in the Copyright information say, could result in the accent macros expanding into internal primitives, such as

```
H\unhbox \voidb@x \bgroup \let \unhbox \voidb@x \setbox \@tempboxa ...
```

going on for many lines. This clearly has no place within the XMP metadata. To get around this, one could try using simplified macro definitions

```
\pdfxEnableCommands{
   \def\`#1{#1^^cc^80}\def\'#1{#1^^cc^81}\def\^#1{#1^^cc^82}}
```

where the ^^cc^80, ^^cc^81, ^^cc^82 cause TEX to generate the correct UTF-8 bytes for ‘combining accent’ characters.

This works fine for metadata fields that appear just in the XMP packet. However, it is not sufficient for the PDF /Author key, which must exactly match with the dc:creator metadata element. What is needed instead is

```
\pdfxEnableCommands{
    \def\thanh{H^^c3^^a0n Th\eee Thanh}\def\eee{^^c3^^aa^^cc^^81 }}
```

or the above with ‘à’ typed directly as UTF-8 instead of ^^c3^^a0 and ‘ê’ in UTF-8 for ^^c3^^aa. The reason for this is due to the \pdfstringdef command, which constructs the accented latin letters as single combined characters à and ê, without resorting to combining accents, wherever possible. If the Metadata does not have the same, irrespective of Unicode normalisation, then validation fails.

With version (1.5.6) of the pdfx package, such difficulties have been overcome, at least for characters used in Western European, Latin-based languages. The input encoding used when reading the .xmpdata file now includes interpretations of TEX’s usual accent commands to produce the required UTF-8 byte sequences.

Since version (1.5.8) this input encoding was extended to include macro definitions covering LATEX’s internal character representation of other alphabets (e.g., extended Latin, Cyrillic, Greek, etc.). However this can become memory intensive, requiring a large number of macro definitions, most of which will never be used. So loading options are provided, enabling a document author to choose only those that may be relevant. Currently these are as in Section **??**.

A significant portion of the Unicode Basic Plane characters can be covered this way. Modules could even be provided for CJK character sets and mathematical symbols, etc. However, as this can become memory intensive, significant testing will be required before these become a standard part of the pdfx package.

[4] Other use cases are discussed with regard to Figures **??** and **??**.

2.6. Color profiles

Most standards compliant PDF documents require a *color profile* to be embedded within the file. In a nutshell, such a profile determines precisely how the colors used in the document will be rendered when printed to a physical medium. This can be used to ensure that the document will look exactly the same, even when it is printed on different printers, with different paper types, etc. The inclusion of a color profile is necessary to make the document completely self-contained.

Since most LaTeX users are not graphics professionals and are not particularly picky about colors, the pdfx package includes default profiles that will be included when nothing else is specified. Therefore, the average user doesn't have to do anything special about color.

For users who have a specific color profile they wish to use, it is possible to do so by including a \setRGBcolorprofile or \setCMYKcolorprofile command in the .xmpdata file. Note that PDF/A and PDF/E require a profile of type 'mnrt' (monitor) which is usually an RGB color profile, while PDF/X and PDF/VT require type 'prtr' (printer) which is usually a CMYK color profile; but valid documents can be created with the correct type designed for the other color space. Use the following commands to specify an RGB or CMYK color profile, respectively:

```
\setRGBcolorprofile{⟨filename⟩}{⟨identifier⟩}{⟨info string⟩}{⟨registry URL⟩}
\setCMYKcolorprofile{⟨filename⟩}{⟨output intent⟩}{⟨identifier⟩}{⟨registry URL⟩}
```

Within the arguments of these macros, the characters <, >, &, ^, _, #, $, and ~ can be used as themselves, but % must be escaped as \%.

From version (1.6) the default RGB and CMYK color profiles are now supplied using the colorprofiles package by Norbert Preining and Ross Moore [?]. Earlier versions of **pdfx.sty** set the defaults via:

```
\setRGBcolorprofile{sRGB_IEC61966-2-1_black_scaled.icc}
                {sRGB_IEC61966-2-1_black_scaled}
                {sRGB IEC61966 v2.1 with black scaling}
                {http://www.color.org}
\setCMYKcolorprofile{coated_FOGRA39L_argl.icc}
                 {Coated FOGRA39}
                 {FOGRA39 (ISO Coated v2 300\% (ECI))}
                 {http://www.argyllcms.com/}
```

These can still be used if the files from earlier version are available on your TeX system, but they will need to be requested, as above. Other color profile files may be obtained from the International Color Consortium. Please take a look at http://www.color.org/iccprofile.xalter.

Alternatively, color profiles are shipped with many Adobe software applications; these are then available for use also with non-Adobe software. Now the pdfx package includes coding to streamline inclusion of these profiles in PDF documents, or to specify them as 'external' profiles, with PDF/X-4p and PDF/X-5pg variants. Two files AdobeColorProfiles.tex and AdobeExternalProfiles.tex are distributed with the pdfx package. The latter is for use with PDF/X-4p and PDF/X-5pg, which do not require color profiles to be embedded, while the former can be used with other PDF/X variants. Both define commands to use Color Profiles as follows.

`\FOGRAXXXIX`	Coated FOGRA39 (ISO 12647-2:2004)
`\SWOPCGATSI`	U.S. Web Coated (SWOP) v2
`\JapanColorMMICoated`	Japan Color 2001 Coated
`\JapanColorMMIUncoated`	Japan Color 2001 Uncoated
`\JapanColorMMIINewspaper`	Japan Color 2002 Newspaper
`\JapanWebCoatedAd`	Japan Web Coated (Ad)
`\CoatedGRACoL`	Coated GRACoL 2006 (ISO 12647-2:2004)
`\SNAPCGATSII`	CGATS TR 002
`\SWOPCGATSIII`	CGATS TR 003
`\SWOPCGATSV`	CGATS TR 005
`\ISOWebCoated`	Web Coated FOGRA28 (ISO 12647-2:2004)
`\ISOCoatedECI`	ISO Coated v2 (ECI)
`\CoatedFOGRA`	Coated FOGRA27 (ISO 12647-2:2004)
`\WebCoatedFOGRA`	Web Coated FOGRA28 (ISO 12647-2:2004)
`\UncoatedFOGRA`	Uncoated FOGRA29 (ISO 12647-2:2004)
`\IFRAXXVI`	ISOnewspaper26v4 ISO/DIS 12647-3:2004
`\IFRAXXX`	ISOnewspaper30v4 ISO/DIS 12647-3:2004

As of the time of first compiling this list, only the first six of these result in PDFs which can validate with external profiles (i.e., for PDF/X-4p and PDF/X-5pg) using the then-current versions of Adobe Acrobat Pro software. It is unclear whether the others (incl. \IFRAXXVI and \IFRAXXX) failed due to incorrect data or problems in the validation software. Since then, with updates to Acrobat Pro, almost all the others have been verified to work, except \IFRAXXX which seems no longer available. Thus these commands come with a 'use at own risk' clause.

For 'external' profiles, there is a command \setEXTERNALprofile, taking 9 arguments, that must be used. Consult AdobeExternalProfiles.tex for examples of its use.

All but the last of the macros listed above can also be used for valid embedded profiles, providing the corresponding files can be found. The following macros are used to set the (absolute or relative) path, on the local operating system, to the location of color profile files.

```
\pdfxSetRGBcolorProfileDir{⟨path to RGB color profiles⟩}
\pdfxSetCMYKcolorProfileDir{⟨path to CMYK profiles⟩}
```

On a Macintosh, there are various places where the color profiles may be found. One can use either a macro \MacOSColordir which expands into the path for system-provided profiles:

```
/System/Library/ColorSync/Profiles/
```

or the macro \MacOSLibraryColordir expanding to:

```
/Library/ColorSync/Profiles/
```

or \AdobeMacOSdir which expands into the path:

```
/Library/Application Support/Adobe/Color/Profiles/Recommended/
```

Under Windows an available macro is \WindowsColordir which expands to:

```
C:\Windows\System32\Spool\Drivers\Color/
```

being the common location for color profiles. Use these within the .xmpdata file as, e.g.,

```
\pdfxSetCMYKcolorProfileDir{\AdobeMacOSdir}
```

Authors may change the paths to suit their own circumstances, either *before* loading pdfx.sty or within the .xmpdata file.

PDF/A and PDF/E usually need an RGB profile, while PDF/X and PDF/VT require a CMYK profile. It is possible to use a CMYK profile with PDF/A or PDF/E by specifying \setRGBcolorprofile{}{}{}{} in the .xmpdata file. Beware however, that with PDF/A any coloured hyperlink annotations can cause a validation problem, as these are interpreted as RGB colours even when 4 components are given. This may be a bug in validators, as PDF specifies that the number of components should match the color space.

2.6.1. ‘Custom’ color spaces

It is also possible to specify ‘Custom’ color spaces, other than RGB or CMYK. Here is an example command \viiIndigoTAC, defined as follows:

```
%% Custom profile: 7C Indigo TAC370 (ColorLogic)
\gdef\viiIndigoTAC{\let\CallasMacOSdir\CallasMacOSpdfaPilotdir
 \setCUSTOMcolorprofile
  {7C Indigo_TAC370_ColorLogic.icc}%
  {\CallasProfilesdir}%
  {7C Indigo TAC370 \string\(ColorLogic\string\)}%  /ProfileName
  {http://www.colorlogic.de}% /RegistryName
  {7CLR}% number of colors specifier
  {02400000}%  ICC version
  {/Cyan /Magenta /Yellow /Black /Orange /Green /Violet}%  colour names
  {48110b8b410ee6be015f3932c3167869}%  CheckSum
}
```

which uses a profile that accompanies the `pdfaPilot` software from Callas Software Gmbh [?]. The macro \CallasMacOSpdfaPilotdir, defined in the file `CallasColorProfiles.tex`, specifies the directory where this Custom profile is located, when installed under MacOS. One needs to \input CallasColorProfiles.tex *before* loading the pdfx package. Macros for other directories are also defined in this file.

2.7. Notes on the internal representation of metadata

Within the PDF file, metadata is deposited in two places: some data goes into the native PDF /Info dictionary, and some data goes into an XMP packet stored separately within the file. XMP is Adobe's Extensible Metadata Platform [?, ?], and is an XML-based format. See Adobe XMP Development Center for more exhaustive information about XMP. An XMP Toolkit SDK which supports the GNU/Linux, Macintosh and Windows operating systems is also available under modified BSD licence.

Some of the metadata, such as the author, title, and keywords, can be stored *both* in the XMP packet and in the /Info dictionary. For the resulting file to be standards-compliant, the two copies of the data must be identical. This is taken care of automatically by the pdfx package, except when \sep is used to handle multiple entries, as discussed above in §??. In such cases the string is not included within the /Info dictionary. Note that this is in accordance with the PDF 2.0 specification [?], which deprecates use of the /Info dictionary for such metadata.

In principle, users can resort to alternate ways to create an XMP file for inclusion in PDF. In this case, one should create a customised template file pdfa.xmp or pdfx.xmp or pdfe.xmp (etc., depending on the PDF flavor) containing the pre-defined data. This can be done by modifying the ones supplied with the pdfx package. However, this is an error-prone process and is *not* recommended for most users. If there is a particular field of metadata that you need and that is not currently supported, please contact the package authors.

pdfx makes use of the xmpincl package to include XMP data into the PDF. The documentation of xmpincl package may help interested users to understand the process of XMP data inclusion.

2.8. Tutorials and technical notes

A tutorial with step-by-step instructions for generating PDF/A files can be found at: `http://www.mathstat.dal.ca/~selinger/pdfa/`.

Some technical notes about production problems the authors have encountered while generating PDF/A compliant documents are available here: `http://support.river-valley.com/wiki/index.php?title=Generating_PDF/A_compliant_PDFs_from_pdftex`. Be aware that this is based on use of an earlier version of the pdfx package, so some of the advice may have been superseded.

3. Installing

The pdfx.dtx package is available on CTAN as usual, via `http://ctan.org/pkg/pdfx`. It is also included in TEX distributions such as MacTEX, TEX Live and MiKTEX. Thus most users will not need to handle installation at all.

For those wishing to do a manual installation, here are some notes. The file pdfx.dtx is a composite document of program code and documentation in LATEX format, in the tradition of *literate programming*. After having installed the package, to get the documentation that you are reading now, run (PDF)LATEX on the file pdfx.dtx. The resulting PDF should be valid as PDF/A-2u. Or better, use the included Makefile, which will also regenerate the index.

To install the package, first extract the program code; i.e., the file pdfx.sty, by running LATEX or TEX on the file pdfx.ins. Create a directory named pdfx under $TEXMF/tex/latex and copy the files pdfx.sty, 8bit.def, glyphtounicode-cmr.tex, glyphtounicode-ntx.tex as well as the other *.tex, l8u*-penc.def and *.xmp files, into it. Then update TEX's file database using the appropriate command for your distribution and operating system (such as texhash or mktexlsr, or similar).

3.1. Limitations and dependencies

The pdfx.sty package works with pdfTEX and also LuaTEX and XeTEX with some minor limitations. It further depends on the following other packages.

1. xmpincl for insertion of metadata into PDF.
2. inputenc to establish input-encoding infrastructure — see Section **??**.
3. hyperref for ensuring data is correctly encoded when being written into the PDF file, and supporting features such as hyperlinking, bookmarks, etc.
4. xcolor for ensuring consistent use of the color model appropriate the PDF variant, within text and hyperlinks (when allowed).
5. glyphtounicode.tex (not XeLATEX) maps glyph names to corresponding Unicode code-points.
6. ifluatex allowing coding specific to LuaLATEX.

7. ifxetex allowing coding specific to XeLATEX.
8. luatex85 or pdftexcmds (LuaTEX only) for access to primitive commands using pdfTEX macro names.
9. stringenc used to help generate proper bookmarks with transliterated input; e.g., with \textLGR or \textARM — see Section ??.

Other files and packages are loaded as sub-packages or as configuration files for these. Since some of these packages may be loaded by existing documents we provide here advice on how to deal with potential loading and option conflicts.

Firstly, it is best if pdfx is the first package loaded; e.g., directly after the \documentclass line. This is not a strict requirement, but it is worthwhile to deal with the metadata at the top of your LATEX source, allowing correct options to be loaded to cope with validation aspects.

Secondly, replace \usepackage[<options>]{hyperref} with \hypersetup{<options>}. This deals with most loading issues with the hyperref package. Note that PDF/X is a format intended for printing. It forbids inclusion of hyperlinks and other actions, including via bookmarks. To produce a validating PDF/X document, pdfx overrides internal macros while keeping colors associated with link anchors. To inhibit these colors also, you could specify options as follows.

```
\hypersetup{colorlinks,allcolors=black}
```

Furthermore, options to set metadata components (such as pdfauthor, pdftitle, pdfsubject, pdfkeywords, etc.) are disabled, since pdfx has already taken care of this information.

Thirdly, conflicts with other packages may be dealt with by simply changing \usepackage to \RequirePackage within the document's preamble. But this may not be possible when the \usepackage or \RequirePackage command occurs within another package, or with a specific set of options, thereby causing processing to stop. Few packages have a command analogous to \hypersetup. Instead \PassOptionsToPackage{<options>}{<package can help. For <options> specify the ones associated with the loading yet to come. This can give a smooth processing run, but you'll need to check whether the results from those options have actually taken effect. Some examples of this can be seen later, in Figures ?? and ??.

3.1.1. Limitations using XeLATEX

To process a file using XeLATEX, to produce a document that can validate to a particular PDF standard, one need to use a command to run the TEX engine, as follows.

```
xelatex -shell-escape -output-driver="xdvipdfmx -z 0" <filename>.tex
```

The -shell-escape option allows a command-line task to be run, which writes the creation-date & time of the running job into a small file on disk. This data, written in a specific format, is then read by the job for inclusion into several metadata fields. This emulates the result of pdfTEX's \pdfcreationdate primitive. As there are security implications in allowing arbitrary commands to be run, this need for -shell-escape must be viewed as imposing a limitation on the work-flows in which this can be safely used.

The -output-driver="xdvipdfmx -z 0" suppresses compression, which is not allowed for the XMP metadata packet. Without this, the resulting PDF may fail to pass validation tests.

XeTEX is designed for processing UTF-8 input only. When presented with LATEX source using a legacy encoding, such as latin2 or koi8-r, the input is accepted and a PDF produced. Yet there will be garbage characters corresponding to each character entered from the upper range (128–255). This is evident in the PDF content and bookmarks; yet pdfx produces the correct XMP metadata packet. So while the techniques explained later in Section **??** are valid, the PDF itself does not contain correct content.

Not all fonts, in particular Open-Type fonts (OTF), naturally come with mappings of the glyphs to Unicode code points. This is a requirement with PDF/A, PDF/E and PDF/UA standards. Use of such fonts can result in validation errors, such as:

- CIDset in subset font is incomplete (font contains glyphs that are not listed).
- Type 2 CID font: CIDToGID map is invalid or missing.

If one has access to Adobe's Acrobat Pro software, then its Preflight utility can rewrite the uncompressed output from XeLATEX into a valid PDF standard, using compression of the contents but not of the XMP packet. Similarly Preflight can sometimes fix the missing font information.

3.1.2. Limitations using LuaLATEX

LuaLATEX can handle the OTF font issues mentioned for XeLATEX, so can produce valid PDF/A documents where XeLATEX fails. However, since LuaTEX expects all input source to be UTF8-encoded, it cannot work at all with documents using older legacy encodings. Instead one gets error messages such as:

```
! String contains an invalid utf-8 sequence.
l.5 \Copyright{\textLII{UWAGA dla recenzent
                                        ïżœw/tÂłumaczy}}
?
```

from a document using latin2 encoded characters. Thus most of Section **??** is just not applicable for LuaLATEX, whereas it is for pdfTEX. This is essentially the same problem as described above for XeTEX, but here LuaTEX advises that there are problems as soon as it encounters an invalid (for UTF-8) character. Some would regard this as better than having the job run to completion, only to later discover garbage content within the PDF.

3.2. Files included

The following files are included in the package. Some can be created from pdfx.dtx, using the Makefile.

3.2.1. Package files

- pdfx.sty — main package file generated from pdfx.dtx.
- pdfa.xmp — specimen xmp template for PDF/A.
- pdfe.xmp — specimen xmp template for PDF/E.
- pdfvt.xmp — specimen xmp template for PDF/VT.
- pdfx.xmp — specimen xmp template for PDF/X.
- 8bit.def — custom input encoding.
- l8u-penc.def — input encoding macro declarations.
- l8uarb-penc.def — input macro declarations for Arabic.

- l8uarm-penc.def — input macro declarations for Armenian.
- armglyphs.dfu — Unicode mapping for Armenian letters.
- l8ucyr-penc.def — input macro declarations for Cyrillic alphabet.
- l8udev-penc.def — input macro declarations for Devanagari.
- l8ugrk-penc.def — input macro declarations for Greek alphabet.
- l8uheb-penc.def — input macro declarations for Hebrew alphabet.
- l8ulat-penc.def — input macro declarations for Latin 1–9 encodings.
- l8umath-penc.def — input macro declarations for mathematical symbols.
- glyphtounicode-cmr.tex, glyphtounicode-ntx.tex — maps glyph names to corresponding Unicode for Computer Modern and other TEX-specific fonts.
- AdobeColorProfiles.tex — macros for inclusion of Adobe-supplied color profiles.
- AdobeExternalProfiles.tex — macros for use of external color profiles.
- CallasColorProfiles.tex — macros for profiles included with Callas pdfaPilot software.

3.2.2. Documentation & Examples

- README — usual top-level information.
- manifest.txt — file list.
- pdfx.pdf — package documentation.
- sample.tex, sample.xmpdata — a sample file with sample metadata.
- small2e-pdfx.tex — sample file with included metadata.

3.2.3. Sources

- src/pdfx.dtx — composite package and documentation.
- src/pdfx.ins — installer batch file.
- src/pdfx.xmpdata — metadata for the documentation.
- src/rvdtx.sty — used by pdfx.dtx.
- src/Makefile — a Makefile for building the documentation.
- src/MANIFEST — list of files in this directory.
- src/text89.def — used with Figure ?? in the documentation.
- src/{arm-start,koi8-example,koi8-example2,latin2-example}.tex — used in the documentation with figures showing example coding.
- src/{TL-POL-meta,TL-RU-LICRs,TL-RU-metadata,TL-RU-toc,Armenian-example-UTF8,
  armtex-meta,usage-meta,math-assign5}.png — screenshot images showing multilingual and other metadata.

3.3. Miscellaneous information

The package is released under the LATEX Project Public Licence. Bug reports, suggestions, feature requests, etc., may be sent to the original authors at cvr@river-valley.org and/or thanh@river-valley.org, or to the more recent contributors at ross.moore@mq.edu.au and/or selinger@mathstat.dal.ca.

4. Multilingual and Technical Considerations

TEX and LATEX have an on-going practice of including metadata within the source files and package documentation. Usually this is done as comments at the beginning of the file; such as the following from the English language version of the 2015 TEX Live documentation[5].

```
$Id: texlive-en.tex 37205 2015-05-05 21:36:33Z karl $
TeX Live documentation.  Originally written by Sebastian Rahtz and
Michel Goossens, now maintained by Karl Berry and others.
Public domain.
```

This provides information, ideally suited for copyright metadata fields, as in Section ??, as well as for \Subject and \CoverDate from Section ??.

Also near the top of the file one finds front-matter content

```
\title{%
 {\huge \textit{The \TeX\ Live Guide---2015}}
}
\author{Karl Berry, editor \\[3mm]
        \url{http://tug.org/texlive/}
       }
\date{May 2015}
```

which supplies metadata information for the commands \Title, \Author, \CoverDisplayDate also from Section ??, and \CopyrightURL.

Most of the hundreds of thousands, if not millions of documents prepared using TEX, LATEX and other TEX-based formats, include similar metadata information, much of which currently does not accompany the resulting PDF. It is becoming increasingly common, if not yet a legal requirement, for PDFs to satisfy a standard that requires inclusion of metadata. This is especially so for government agencies and institutions receiving government funding, in several countries around the world.

It is an aim of the pdfx to simplify the process of capturing and including metadata within LATEX-produced PDFs, from both the author's view and that of archivists. The extra features introduced with version 1.5.8 take a large step in that direction. This includes the ability, described in the next subsection, to reliably include data presented in different text encodings, rather than being restricted to UTF-8 only. It is a role of the software to make the conversion, rather than rely on some 3rd party for a translation.

4.1. Multilingual Metadata

A cursory search of the documentation (.../texmf-dist/doc) subtree of the forthcoming TEX Live 2016 release reveals more than 730 different .tex or .dtx document sources which specify an input encoding, via the \usepackage[...]{inputenc} command. Roughly 380 (a bit more than half) declare UTF-8 as the input encoding. Of the remainder

[5] found at /usr/local/texlive/2016/texmf-dist/doc/texlive/texlive-en/.

there are ≈ 20 other encodings specified, covering a range of languages for at least part of their content. At some point in time, these documents may be required to have accurate accompanying metadata, as part of conformance to a designated PDF (or other) standard. There are libraries and archives that already must meet such standards.

We have shown above, in Section ??, how the .xmpdata file can be inserted into the document source, which then ensures that metadata is reliably transferred along with the source itself. This seems a good strategy, but are there any problems with it, especially in a multi-lingual context?

Modern editing software can require an encoding to be associated with each file. This is what allows the correct characters to be shown, from what is otherwise just a sequence of 8-bit bytes. The flip-side is that arbitrary editing is not permitted. Add some UTF-8 data into a file that is encoded as Latin-2 then try to save it. You may be asked to specify a new encoding, or the application may even crash out entirely. Maybe this happens *accidentally*. It is not hard for a curly quote (‘) or endash (–) to be included; many editors have settings which can do this with normal ascii input. Turn *off* such settings.

The approach that we advocate is that when editing to add metadata, best is to:

1. use the *same encoding* as is specified for the file itself, if known (as is usually the case);
2. even if 1. is not possible, use Copy/Paste *within* the document source (e.g., for authors' names, addresses, affiliations, etc.) and from comments, as in Section ?? above;
3. avoid typing new characters, especially quotes and dashes, and be extra careful with back-spacing to preserve the real meaning of copied content.

Even if the original encoding is not known, use of Copy/Paste from other parts of the document is normally not going to change its encoding. This should not cause the file to become invalid due to mixed content. In some situations it may be necessary to use an ASCII-only representation, such as LATEX's LICR[6] macros [?, § 7.11].

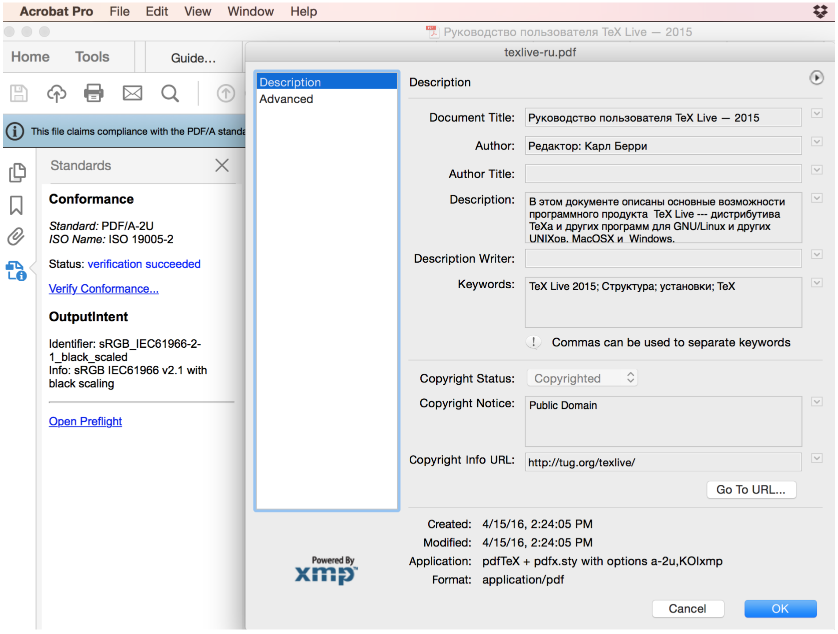
4.1.1. Metadata with Cyrillics

Here is a 'real-world' example, with Figure ?? showing the metadata as could be produced for the Russian language version of the TEX Live documentation, from coding as shown in Figure ??. The source file itself is actually encoded for KOI8-R, as indicated by the presence of the code line \usepackage[koi8-r]{inputenc}, but is deliberately shown here encoded as T1 [?, p. 449]. This difference is immaterial for checking the validity of the metadata. For example, the stream of upper (accents, etc.) characters within \Title{\textKOI{ ... }} is the same as within \title{...\textit{ ... }}. Similarly for \Author{\textKOI{...}} and \author{...}, and \CoverDate and \date. Strings for the \Subject and \Keywords are taken from the first actual paragraph in the document, and from early subsection titles.

It is the 'parser' command/macro \textKOI{ ... } that indicates that the upper range characters (having byte codes 128–255) are to be treated as KOI8-R characters, rather than as part of UTF-8 byte sequences. It works by examining each byte in sequence, and returning the appropriate UTF-8 2-byte sequence for the required cyrillic character. This happens during the processing of data from \jobname.xmpdata for fleshing-out the XMP metadata packet to be included within the final PDF/A document.

The 'parser' macros defined for various encodings, are given in Figure ??. In Section ?? the package options are given for loading the appropriate support for desired

[6] LICR: LATEX Internal Character Representation; or think 'I = Interchange'.



Руководство пользователя TeX Live — 2015

texlive-ru.pdf

This file claims compliance with the PDF/A standa

Conformance

Standard: PDF/A-2U
ISO Name: ISO 19005-2

Status: verification succeeded

Verify Conformance...

OutputIntent

Identifier: sRGB_IEC61966-2-1_black_scaled
Info: sRGB IEC61966 v2.1 with black scaling

Open Preflight

Description

Document Title: Руководство пользователя TeX Live — 2015
Author: Редактор: Карл Берри
Author Title:
Description: В этом документе описаны основные возможности программного продукта TeX Live --- дистрибутива TeXa и других программ для GNU/Linux и других UNIXов. MacOSX и Windows.
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Created: 4/15/16, 2:24:05 PM
Modified: 4/15/16, 2:24:05 PM
Application: pdfTeX + pdfx.sty with options a-2u,KOIxmp
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Figure 1: Metadata generated from the coding shown in Figure ??, viewed using Acrobat Pro's 'Additional Metadata . . . ' panel.

languages or alphabets. Support for other encodings can be added, if there proves to be a need.

With encoded characters marked in this way with a 'parser' macro, it is actually possible to mix UTF-8 metadata with other bytes; provided, of course, you have an editor that allows such a file to be created and saved. On the other hand, if you are unhappy with mixing content having different encodings, then there is another way, based upon LATEX's LICR macros [?, § 7.11] for representing accented and non-latin characters. These are normally hidden away ('I = Internal') but in fact can be seen within auxiliary files, such as .aux and .toc, .lof and .lot. This is how LATEX stores the knowledge of such characters for use in a part of the document processing which may not have the same encoding as the document as a whole, or may require characters generated using several different encodings. Thus LICRs allow for a reliable representation passed to a different context; think 'I = Interchange'.

Figure ?? shows how to see this. The document source in the lower portion clearly shows the cyrillic input, whereas the .log messages in a command-line window above reveal the LICR representation. A command \showLICRs is available with pdfx.sty version 1.5.8, specifically to allow this. Now the LICR representation can be copied directly from the .log file, modulo slight difficulties due to the way long lines are broken. As this representation is entirely with ASCII characters, it should not cause any conflict with any UTF-8 metadata that you want within the same file. The .xmpdata file might now look as in Figure ??. Although very verbose, this should be resistant to any corruption due to character encodings, and produces the same result within the PDF, as in Figure ??.

Alternatively one can exploit the .toc file, using LATEX's command \addtocontents, as shown in Figure ??. After processing the file, you can copy the LICR representations out of the .toc file, taking care to remove anything of a non-character nature (e.g., implementing the size and spacing of the letters in TEX).

Of course once you have harvested the metadata in this format, remove or comment-out those extra \showLICRs to get uninterrupted processing. Similarly comment-out the extra \addtocontents lines, else the real Table-of-Contents will become corrupted with unwanted entries. A couple more LATEX processing runs should restore the PDF to the way you want it.

4.1.2. Metadata with Polish

The next example has upper-range bytes intended to represent Latin-2 encoded characters, as used in Polish. With the LATEX source starting as in Figure **??**, the resulting metadata is shown in Figure **??**.

Here the 'parser macro' is \textLII, which can be seen in Figure **??** to surround either complete metadata entries, or just those parts containing polish accented (or other) characters in entries that also contain english words. The macro \textLF provides a line-feed character for the UTF-8 output.

As a technical note, the \jobname.xmpdata file is read with \obeyspaces in effect. This causes space runs in the input to be replaced by a single 'active space' character, which ultimately expands into a normal space upon output. This is needed to preserve inter-word spaces, which would otherwise get lost during parsing, due to TEX's pattern matching when reading macro arguments. Each byte is examined individually, with normal letters a-zA-Z and most punctuation characters passed through unchanged.

Let's understand better how this example was created. There are three files involved.

- pdfx.dtx, the source for this documentation, open in an editor with encoding declared as UTF-8;
- texlive-pl.tex the Polish documentation for TEX Live, open in the same editor with Latin-2 encoding;
- latin2-example.tex which starts life as an empty file on disk.

This latter file must be opened in the editor, with encoding declared as Latin-2 (ISO-8859-2). Next the preamble is copied from texlive-pl.tex and pasted into latin2-example.tex which is then saved to disk. Further editing is done to latin2-example.tex to add verbatim markers (`|...|`) and adjust line lengths for display within Figure **??**. This file's contents is included as part of the documentation via \input{latin2-example} within an environment that handles presentation aspects, and (since 2018) declares \UseRawInputEncoding.

What *cannot* be done is to paste the preamble content directly into pdfx.dtx. Consider what would then happen, using 'tłumaczy' ('translators', on line 10 following 'UWAGA'). This word shows correctly in the Latin-2 encoded files. It was typeset here using \l for the 'ł' letter, having Unicode code-point Ux0142 (so UTF-8 byte pair "C5 "82). However, it occurs at slot "B3 within Latin-2 encoding. In the T1 font encoding [?, p. 449] the character glyph name for slot "B3 is /scedilla, which is what shows in Figure **??**. When the 'ł' is pasted directly into a UTF-8 file and shown verbatim, the result is the pair of glyphs "C5 (/Aring) and "82 (/Cacute); *viz.* tĆ?umaczy.

As with Figure **??** it is not important that the correct characters are shown here, but that the metadata in \jobname.xmpdata corresponds to what is used on the titlepage of the PDF; e.g., the contents of \Title and \title, \Author and \author, etc.

4.1.3. Metadata with Greek

Prior to proper support for UTF-8 input, a method for preparing document source for the modern Greek language (and also for polytonic Greek), involved the use of LGR encoded fonts. Such a font has Greek (instead of Latin) letters in the slots for a-zA-Z, see [?, §9.4.2]. Thus ordinary ASCII letters are used to produce the Greek characters; the mapping of ASCII to Greek is referred to as a 'transliteration' scheme. It serves as *both* an input encoding, and as a font encoding. Accents and diacritic marks are provided through ligatures built-in to the fonts. Various documents can be found on the web[7] and within TEX Live distributions[8].

Indeed the current maintainer Günther Milde states "The LGR transliteration does not work for PDF metadata". This is because there is no translation of LGR input into LATEX LICRs, as happens with say \usepackage[utf8]{inputenc} for UTF-8 input, or when upper 8-bit characters are present using \usepackage[iso-8859-7]{inputenc}. With these, LICRs such as \textAlpha, \textOmicron, . . . , \textomega are produced, which result in the correct characters for metadata and bookmarks, perhaps employing Unicode 'combining' characters for accented letters. Using pdfx the UTF-8 characters can be put directly into the .xmpdata file; LICRs are interpreted provided the grkxmp loading option has been specified.

Using the methods of pdfx the metadata difficulty is remedied, as can be seen in Figure **??** using coding as shown in Figure **??**. This requires the LGRxmp option and \textLGR 'parser' macro. The original document source, called usage.tex, can be found in the directory specified in the footnote below. As this document is essentially an English description of how to use LGR for Greek, we have used the 'Keywords' field to provide examples of such usage. Since a macro \textgreek can be used for greek portions within such documents, this macro name is aliased to \textLGR within the context where metadata is processed. Furthermore, parsing using \textLGR generates correct pre-composed characters for letters with accents or diacritics. Bookmarks can also be generated from LGR input, using a technique described in Section **??**.

The features available with different loading options are summarised here.

- no option: all metadata in .xmpdata file is in UTF-8 (incl. ASCII)
- grkxmp: LICRs can be present; e.g. \textAlpha, \textOmega, etc.
- LGRxmp: supports LGR-encoded input and ISO-8859-7 upper range characters, using the \textLGR 'parser' macro.

With LGRxmp specified, the features of grkxmp are also available; so any lower-listed option allows data to be mixed with that for higher-listed ones.

The final piece to get validation for PDF/A from LGR input, is to specify a Unicode point for the 'v' used only in the strong 'sv' ligature to obtain a non-final 'sigma' typeset in isolation.

```
\pdfglyphtounicode{internalchar2}{200D}
```

This gives an interpretation as 'zero-width joiner'. There are two instances of this within usage.tex. Copy/Paste works as desired. Using pdfTEX the above command is done automatically. Drivers, such as XeLATEX lacking an implementation of \pdfglyphtounicode, can fail to produce a valid PDF due to this rather minor deficiency.

Greek numerals, using \greeknumeral or \Greeknumeral cannot work directly within a .xmpdata file. However if such is desired, the following technique allows correct LICRs to be found for use in the metadata. At any convenient place within the LATEX source; e.g., near where the required number is used, insert coding such as:

[7] e.g., http://milde.users.sourceforge.net/LGR/

[8] TeXLive: .../2016/texmf-dist/doc/generic/babel-greek/

```
{\pdfxGreeknumeralsHack \textgreek{\edef\num{\greeknumeral{1997}}\show\num}}%
```

Upon processing, the following will be written to the console or .log-window.

```
> \num=macro:
->\LGR\textaristerikeraia \LGR\textalpha \LGR\textsampi \let \protect \LGR\text
dexiakeraia \LGR\textqoppa \let \protect \LGR\textdexiakeraia \LGR\textzeta \le
t \protect \LGR\textdexiakeraia \protect \LGR\textdexiakeraia .
<argument> ...um {\greeknumeral {1997}}\show \num

l.90 ...k{\edef\num{\greeknumeral{1997}}\show\num}
                                                  }
?
```

from which the desired string of LICRs, is extracted; *viz.*

```
\textaristerikeraia\textalpha\textsampi\textqoppa\textzeta\textdexiakeraia
```

The corresponding trick does not work with \Greeknumeral, but the uppercasing can be done manually from the string obtained using \greeknumeral,

```
\textaristerikeraia\textAlpha\textSampi\textQoppa\textZeta\textdexiakeraia
```

leaving the initial and final \text...keraia macros as all lowercase. For smooth processing, remove or comment-out the added line after collecting the LICRs.

4.1.4. Metadata with Armenian

The ArmTeX package[9] provides the method to typeset Armenian, with input being specified in various ways including a transliteration scheme from ASCII input. This transliteration is directed at the use of the OT6 encoding, developed for this purpose. Each way is supported by pdfx.sty with appropriate loading options, similar to the support for Greek (see Section **??**).

- no option: all metadata in .xmpdata file is in UTF-8 (incl. ASCII)
- armxmp: using LICR-like macro names; e.g. \armAyb, \armsha, \armfe etc.
- AR8xmp: using the ArmTeX (OT6) transliteration scheme or with upper-range characters in ArmSCII8 encoding, using the 'parser' macro \textARM.

There are 39 letters in the Armenian alphabet, so the transliteration includes many 2-letter combinations to specify the desired character. Whereas Greek uses punctuation symbols to specify diacritics, Armenian requires either ligatures implemented in the OT6-encoded font, or careful parsing of the input into LICR-like macros. LaTeX source[10] for the ArmTeX documentation is available in both English and Armenian. Figure **??** shows the result of enriching the Armenian version with relevant metadata, using coding as shown in Figure **??**.

As in earlier examples, that metadata has come from the extensive comments at the head of the LaTeX source file (represented by ... in Figure **??**), and other title-page material, such as title and author names in both English and Armenian. Within the keywords are armenian words that are mentioned in the documentation as being slightly

[9] documentation: TeXLive: `.../2016/texmf-dist/doc/generic/armenian/`

[10] TeXLive: `.../2016/texmf-dist/doc/generic/armenian/examples/latex/`

tricky to represent in transliteration, to verify that the required tricks have been correctly implemented.

Also apparent in Figure ?? is the use of Armenian letters in the Bookmarks pane, having been generated from the transliteration source. This requires a 3-step process, as follows.

1. conversion of transliterated source into UTF-8. This is done as the .xmpdata file is processed, using \pdfxEnableCommands to make global definitions; e.g,

   ```
   \xdef\sectAtitle{\textARM{Nerac'uthyun}}
   ```

   capturing the section title in the form supplied in the LATEX source. This can be seen in Figure ??, near the end of the {filecontents*} environment, and at the bottom where the \section command would occur.

2. conversion of the UTF-8 representation into UTF16-be, suitable for bookmark strings within the PDF file. With pdfTEX thishis is done using \StringEncodingConvert from Heiko Oberdiek's stringenc.sty package. LuaLATEX and XeLATEX can use the UTF-8 representation directly.

3. integration of the UTF16-be string (pdfTEX) or UTF-8 string (LuaTEX and XeTEX) into the coding that would normally generate the bookmark from a provided section title, in transliterated form.

These last two steps are combined into a single command, to replace the usual command for a section title; \section, \subsection, etc.

```
\pdfxBookmark{\section}{\sectAtitle}{Nerac'uthyun}
```

Now \pdfxBookmark first checks that the macro passed as the 2nd argument actually exists. If it does not, an error message is given and upon continuation would just do \section{Nerac'uthyun} as normal. When it does exist, then step 2 is done (by pdfTEX) storing the result as \pdfx@temp. With LuaTEX and XeTEX, \pdfx@temp stores a copy of the UTF-8 data. Then the commands needing to be executed are essentially

```
\pdfstringdefDisableCommands{\let\sectAtitle\pdfx@temp}
\def\sectAtitle{Nerac'uthyun}
\section{\sectAtitle}
```

so that the correct section heading is displayed on the page, but when \sectAtitle is processed to create a bookmark it is replaced by the pre-prepared contents of \pdfx@temp. There are some technicalities[11] to make this work cleanly, as just doing these commands would interfere with other uses of \pdfstringdef. In case a long sectioning command has an optional argument, or a ∗-variant is needed, then include it this way.

```
\pdfxBookmark[Ar'avot e'r]{\section*}{\sectAtitle}{Ar'avot e'r, Araratyan dashti ...}
```

4.1.5. Other Languages

There is support for Metadata using characters from other languages, with corresponding loading options, as follows.

[11] In fact a small change is made to how `\@@writetorep` is used.

- arbxmp : Arabic; via LICRs \textarabicalef, \textarabicqaf, \textarabicaleflowerhamza, etc.
- devxmp : Devanagari; via LICRs \textdevanagaria, \textdevanagarivocalicr, \textdevanagaricandrabindu, etc.
- hebxmp : Hebrew; via LICRs \hebalef, \hebsamekh, \hebfinalpe and accent marks \segol, \qubuts, etc.
- vnmxmp : Vietnamese; via LICRs \ABREVE, \OCIRCUMFLEX, \uhorn etc. and the combinations of multiple accents applied as usual via \', \‘, \^, etc.

The LICRs include support mapping accented letters to precomposed glyphs, falling back on ‘combining characters’ only in unusual situations. Special input conventions or methods, such as transliteration schemes, are *not yet* supported. Indeed, these options are largely untested, so any difficulties encountered should be reported to the package authors. Requests to support extra input methods or other language blocks should also be directed to the authors, along with pointers to where the desired input methods are fully described. Sample ‘real-world’ documents would be greatly appreciated.

4.2. L8U pseudo-encoding

To understand how pdfx handles the translation into UTF-8 of input that is not already in that format, we’ll briefly discuss LATEX’s font-encoding mechanism, which is the basis for LICR macros [?, § 7.11]. As an example, consider the macro \textgamma representing the lowercase Greek letter γ. Various LATEX packages declare this as LICR in different ways, for different purposes.

```
greek-fontenc/lgrenc.def:\DeclareTextSymbol{\textgamma}{LGR}{103}
tipa/t3enc.def:\DeclareTextSymbol\textgamma{T3}{71}            % Gamma
greek-fontenc/greek-euenc.def:\DeclareTextCommand{\textgamma}{\LastDeclaredEncoding}{Îł}
hyperref/puenc.def:\DeclareTextCommand{\textgamma}{PU}{\83\263}%* U+03B3
ucs/data/uni-2.def:\uc@dclc{611}{tipa}{\textgamma}%
ucs/data/uni-3.def:\uc@dclc{947}{default}{\textgamma}%
```

Here the \uc@dclc commands associate UTF-8 input of Ux0263 (IPA small letter gamma) and Ux03B3 (Greek small letter gamma) internally with \textgamma, whereas the others deal with output formats[12]. In four of these examples there is a number, which refers to a position in an ‘encoding vector’ for the particular font used to place the character onto the printable page. For example LGR refers to greek fonts, encoded as explained in Section ??. IPA phonetics use the T3 encoding, so \textgamma refers to a character from a different Unicode block.

With two of these cases there is no specific font. For example, PU is used to create bookmark strings, and other PDF string inclusions, using \pdfstringdef from the hyperref package. With greek-euenc.def designed for XeTEX and LuaTEX, the encoding can be variable, with the output bytes being those for the UTF-8 encoding of γ, namely ^^ce^^b3, shown here as the T1-encoded pair Îł. The term ‘pseudo-encoding’ has been coined by the LATEX team. Although there is no actual font to determine the encoding, to an author there is essentially no difference in how corresponding macros can be used to get a character placed into an appropriate structure within the PDF.

[12] Whereas ucs.sty handles UTF-8 input, mapping it to LICRs, with pdfx.sty we need the reverse mapping into UTF-8, not just from LICRs but also from legacy 8-bit encodings and transliteration schemes.

Thus there are 4 output forms for this character, and we've not even considered how γ is used in mathematics! To handle these concurrently, one has internally-defined control-sequence names

```
\LGR\textgamma=\char"67       where 6 × 16 + 7 = 103
\T3\textgamma=\char"47       where 4 × 16 + 7 = 71
\PU\textgamma=\long macro:->\83\263
\L8U\textgamma=\long macro:->Îł
```

where the 2nd '\' is part of the name[13]. The latter macro is explained below. To use the specific version of the macro, LaTeX maintains a 'font-encoding' parameter, set using \fontencoding{...} local to the surrounding environment grouping.

To the above declarations of \textgamma, to deal with conversion to UTF-8, the pdfx package adds the following declarations when the LGRxmp option is used.

```
pdfx/l8ugrk.def:\DeclareTextCommand{\textgamma}{L8U}{Îł}
pdfx/l8ugrk.def:\DeclareTextCompositeCommand{\textLGRenc}{L8U}{\textgamma}{Îł}
pdfx/l8ugrk.def:\DeclareTextCompositeCommand{\textLGRenc}{L8U}{g}{Îł}
pdfx/l8ugrk.def:\DeclareTextCompositeCommand{\textLGRenc}{L8U}{^^e3}{Îł}
```

The pseudo-encoding name L8U indicates **L**ocal conversion into UTF-**8** **U**nicode, as required for metadata, using pdfx.sty. Currently this pseudo-encoding is used in one place only; during the interpretation of information supplied through the \jobname.xmpdata file. This happens as part of the pdfx package, *before* it uses xmpincl.sty. Such specificity justifies being called a 'Local' encoding. However, other tasks may emerge requiring on-the-fly conversion to UTF-8. In this case all the functionality of this pseudo-encoding could be shifted into a separate package, and the name changed to reflect this more general usage. Bookmarks from transliterated input, as described in Section **??**, is possibly a sufficient reason to have a separate package. Another possibility is to generate on-the-fly creation of UTF-8 strings, to be sent to XeTEX or LuaTEX running as a slave process to generate images of string using OTF fonts, which pdfTEX currently cannot handle. The result would then be imported back into the running job as an image. The authors invite suggestions of how this L8U pseudo-encoding functionality can be put to good use.

Accented letters normally use (e.g., from t1enc.def)

```
\DeclareTextComposite{\`}{T1}{A}{192}
```

to get the pre-composed 'À', rather than a composite built from ` and 'A'. The last parameter is an index into a font; however the \DeclareTextCompositeCommand variant allows arbitrary coding as that final parameter, so can be the bytes for the UTF-8 representation of a character. In the above code lines, macros are defined as follows

```
\\L8U\textLGRenc-\textgamma=macro:->Îł
\\L8U\textLGRenc-g=macro:->Îł
\\L8U\textLGRenc-ã=macro:->Îł
```

where now the 2nd and 3rd (and perhaps 4th) '\' are part of the name[14]. This shows how the ascii letter 'g' is associated with the UTF-8 bytes for γ, and how the upper 8-bit character from ^^e3 can be similarly associated, as in ISO-8859-7 encoding.

[13] obtained using `\csname LGR\string\textgamma\endcsname`.

[14] obtained using `\csname\string\LGR\string\textLGRenc-\string\textgamma\endcsname`.

All these associations come together in the 'parser' macro \textLGR which works as follows. Firstly, \textLGR is declared for L8U pseudo-encoding only, where it expands as follows.

```
\L8U\textLGR #1->\textgreekLGRstring {#1}
\L8U\textgreekLGRstring #1->\textgreekLGR@ii #1\@empty \@empty
\textgreekLGR@ii #1#2\@empty -> ...  coding to test what is in #2
 ...  \textLGRenc{#1}\@empty       if #2 is \@empty
 ...  \textLGRenc{#1}\textgreekLGR@i #2\@empty      if #2 has more tokens
\textgreekLGR@i #1->\textgreekLGR@ii #1
```

Thus \textLGRenc is called on each token in the argument of \textLGR. Now \textLGRenc, which is applicable only when L8U pseudo-encoding is in effect, has a default expansion of just passing the character through unchanged; *viz.*

```
\DeclareTextCommand{\textLGRenc}{L8U}[1]{#1}
```

but by using \DeclareTextCompositeCommand{\textLGRenc}{L8U}{...}{...}, alternate expansions apply with specific arguments, as shown above. In particular, that final argument can include coding that 'looks ahead' to find the next character. This is used, for example, with diacritics in Greek, multi-letter sequences for Armenian letters, and other special cases related to ligatures and punctuation symbols. To illustrate this Figure **??** (below) follows the conversion of a specific word, given in the transliteration for Armenian (see Section **??**). This conversion occurs using only TEX's macro-expansion ability. Some details relevant to this example are explained there.

Note how in Figure **??** the ArmTEX user macro \armuh gets aliased to an LICR called \textarmuh. Since \armuh is already defined, not as an LICR, it cannot be declared to be one without creating problems. Instead, within the environment grouping where L8U pseudo-encoding is specified, one uses \let\armuh\textarmuh within a 'rebinding' macro command \LIIXUmaparmenianletters[15] to get LICR functionality from user-commands.

```
\def\LIIXUmaparmenianletters{%
 \let\ArmTeX\textArmTeX
 \let\Armayb\textArmayb
 ...
 \let\armuh\textarmuh
 ...
  \def\armbf{}%
 ... }
```

As well as rebinding each command for a letter, the font style-switching commands are aliased to do nothing, as these are not relevant to creating UTF-8 output. Being localised by the L8U grouping, this causes no problem elsewhere within the document. These are similar to macros \psdaliasnames and \psdmapshortnames from hyperref.sty, which rebind user macros to LICRs, so that PU encoded versions of LICRs can be used.

Several other 'rebinding' commands are defined, mostly with package-loading options.

- \LIIXUmapTeXnames always defined
- \LIIXUscriptcommands handles \textsuperscript, \textsubscript, \t
- \LIIXUtipacommands handles IPA letters and symbols

[15] The start of the macro name is derived from pseudo-Roman numerals: IX = 9, IIX = 8

- \LIIXUmaparabicletters with arbxmp
- \LIIXUmaparmenianletters with armxmp and AR8xmp
- \LIIXUmapdevaccents with devxmp
- \LIIXUmapgreekletters with grkxmp and LGRxmp
- \LIIXUmaphebrewletters with hebxmp and HEBxmp
- \LIIXUmaplatinchars and \LIIXUcancelfontswitches with LATxmp
- \LIIXUmapmathletterlikes always defined
- \LIIXUmapmathspaces always defined
- \LIIXUmapmath... with mathxmp — see Section **??** below.

It may well be that more macro names can be added to some of these commands, to allow macro usage within the metadata. Suggestions for such additions should be sent to the pdfx package authors, along with example documents. Similarly support for more languages can be requested.

4.3. Nested Parsing — Mathematics in Metadata

Macro commands for many mathematical symbols can be used directly in metadata without extra support; e.g., basic arithmetic operations, letter-like symbols, spacing commands. Super- and subscripted letters and numerals can use \textsuperscript and \textsubscript when there is an appropriate Unicode character (digits, comma, +/−/=, parentheses, many letters but not all).

When the mathxmp loading option is specified, many more symbols become available, using 'rebinding' macros. These are necessary, as the macros for mathematical symbols are generally *not* defined as LICRs, but use \mathchar. Thus new LICRs are needed, and existing names bound to these.

\LIIXUmapmathaccents using 'combining' characters from Unicode ranges at Ux0300, Ux1DC0, Ux20D0
\LIIXUmapisomathgreek using Ux0391–Ux03F8 for greek symbols
\LIIXUmapmatharrowsA supporting symbols in the Ux2190–Ux21FF block
\LIIXUmapmathoperatorsA supporting symbols in the Ux2200–Ux227F block
\LIIXUmapmathoperatorsB supporting symbols in the Ux2280–Ux22FF block
\LIIXUmapmiscmathsymbolsA supporting some symbols in the Ux27C0–Ux27EF range
\LIIXUmapsupparrowsA supporting some symbols in the Ux27F0–Ux27FF block
\LIIXUmapsupparrowsB supporting some symbols in the Ux2900-â??Ux297F block
\LIIXUmapmiscmathsymbolsB supporting symbols in the Ux2980–Ux29FF block
\LIIXUmapsuppmathoperators supporting symbols in the Ux2A00–Ux2AFF block
\LIIXUmapunimathgreek using Ux1D6E2–Ux1D71B for greek symbols
\LIIXUmapmathalphabets allows access to symbols in the Ux1D400–Ux1D755 block

The 'parser' macro idea can extends to handle a large class of mathematical expressions.

```
\let\(\textinlinemath
\DeclareTextCommand{\textinlinemath}{L8U}{\liixu@getinlinemath}
\def\liixu@getinlinemath#1\){\space\textmathnormalstring{#1}\space}
\DeclareTextCommand{\textmathnormalstring}{L8U}[1]{\textmathnormal@ii#1\@empty\@empty}
\textmathnormal@ii #1#2\@empty -> ...  coding to test what is in #2
 ... \textmathnormal{#1}\@empty     if #2 is \@empty
 ... \textmathnormal{#1}\textmathnormal@i #2\@empty     if #2 has more tokens
\let\[\textdisplaymath defined similarly to call \textmathnormalstring
```

This allows \textmathnormal to test each token, in particular mapping letters A–Za–z into the Unicode range Ux1D44E–Ux1D467 (except for h). Mathematical styles, such as \mathrm, \mathbf, \mathbb etc. can now be handled using declarations such as:

```
\Dec...positeCommand{\textmathnormal}{L8U}{\mathrm}{\liixu@mathreorder\textmathrmstring}
\Dec...positeCommand{\textmathnormal}{L8U}{\mathbf}{\liixu@mathreorder\textmathbfstring}
```

where \liixu@mathreorder uses some TEX pattern-matching to allow the \textmathrmstring parser macro to work on the argument to \mathrm before allowing \textmathnormal parsing to continue afterwards. We refer to this as 'nested parsing'.

Similarly 'nested parsing' can be used with superscripts and subscripts using ^{...} and _{...} and to specify linebreaks, and even super-/subscripts within styles; viz.

```
\Declar...CompositeCommand{\textmathnormal}{L8U}{^}{\liixu@mathreorder\textsuperstring}
\DeclareTextCompositeCommand{\textmathnormal}{L8U}{_}{\liixu@mathreorder\textsubstring}
\DeclareTextCompositeCommand{\textmathnormal}{L8U}{\\}{\textLF}
\DeclareTextCompositeCommand{\textmathnormal}{L8U}{\cr}{\textLF}
\DeclareTextCompositeCommand{\textmathrm}{L8U}{^}{\liixu@mathreorder\textsuperstring}
\DeclareTextCompositeCommand{\textmathrm}{L8U}{_}{\liixu@mathreorder\textsubstring}
```

Such 'nested parsing' seems to be quite robust[16], but a great deal more testing is required to uncover cases which may require special handling. An ultimate aim is to be able to just copy the LATEX source for the 'Abstract' of a technical paper into the \Subject{...} field of the .xmpdata file, with a large expectation that it will 'just work', or need only trivial edits to make it so.

4.4. Metadata in a Production Workflow

At Macquarie University, the Mathematics Department produces personalised topmatter or coversheets for student assignments and tutorial papers using LATEX, incorporating information that has been stored in a database. This is done by writing extra definitions at the top of a copy of the LATEX source as prepared by the lecturers. For example information analogous to the following

[16] ... so far, barring multi-line aligned environments.

```
\def\thestudentname{\utext{Moore} Ross}
\def\thestudentid{55507247}
\def\theunitcode{MATH337}
\def\theoffering{S116}
\def\thetaskname{Assignment 5}
\def\theassignmentnumber{5}
\def\theduedate{09/05 2016}
...
```

is prepended to the file shown in Figure **??**, for each student downloading their personalised assignment paper. The LATEX source makes use of this information, including recording some of it within the Metadata. When preparing such documents LATEX's \providecommand is used to supply default values, not drawn from the database; but when actually used, these are ignored as the required information has been supplied using TEX's \def command. The resulting metadata is as in Figure **??**, showing also how the information is displayed at the top of the PDF file that is produced. Notice how a command \utext is included to obtain the underlining of the surname within the produced PDF. This is modified, using \pdfxEnableCommands in the \jobname.xmpdata file, to just place a comma after the surname in the metadata, as it precedes the given name.

Another way that jobs can be customised using essentially the same LATEX source, is via the command used to initiate the job. For example the file sample.tex, accompanying the pdfx distribution, can be used to test the loading options to create PDFs conforming to the various flavours of PDF/A, PDF/E and PDF/X. Consider a shell script containing the following (Unix/Linux) commands.

```
pdflatex "\def\pdfxopt{a-2b}\input sample.tex"
pdflatex "\def\pdfxopt{a-2b}\input sample.tex"
mv sample.pdf sample-a2b.pdf

pdflatex "\def\pdfxopt{a-2u}\input sample.tex"
pdflatex "\def\pdfxopt{a-2u}\input sample.tex"
mv sample.pdf sample-a2u.pdf
...
```

With a 3-line block for each flavour, this produces a corresponding PDF from the same LATEX source, named according to each particular variant. A default \providecommand{\pdfxopt}{a-1b} at the start of sample.tex catches the case of normal typesetting, doing nothing when \pdfxopt already has an expansion value.

4.5. Further Developments

Prospects for further development of the pdfx package are as follows, listed not necessarily in order of perceived importance.

- Support for the dvips driver with Ghostscript as PDF producer; possible since gs v9.21.
- Separate the L8U pseudo-encoding support into a separate package.
- Conformance to multiple PDF standards; e.g. both PDF/A and PDF/E, both PDF/A and PDF/X with RGB or CMYK color profile, other combinations.
- Explore delaying the processing of metadata until \begin{document}, thereby allowing some fields to be set automatically from other information supplied within the document preamble.
- Support for input using other legacy 8-bit encodings and transliterations.
- Support for more mathematical environments within the metadata.
- Support for more PRISM metadata fields, incl. PRISM 3.0 [?].
- Explore ways to overcome incompatibilities that may arise with other packages.
- Full support for PDF/VT; in particular, transparency groups and PDF/VT-2s.
- Support for more aspects of PDF/UA and 'Tagged PDF'.
- Develop ways to usefully use L8U apart from metadata and bookmarks.
- Support emerging standards based on PDF 2.0 [?].

5. Bibliography

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Revised as ISO 14289-1:2014 (December 2014): http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=64599.
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PDF/E: https://en.wikipedia.org/wiki/PDF/E
PDF/VT: https://en.wikipedia.org/wiki/PDF/VT
PDF/UA: https://en.wikipedia.org/wiki/PDF/UA
PDF/X: https://en.wikipedia.org/wiki/PDF/X

6. Implementation

```
\@ifpackageloaded{pdfxmult}{%
 \PackageError{pdfx}%
  {^^JThis package may not be used in conjunction with the \space
   pdfxmult \space package}%
  {Type \space x <return> \space to exit; or just \space <return> \space
   to continue without this package.}%
 \expandafter\let\csname opt@pdfx.sty\endcsname\@empty\endinput
}{}%
\NeedsTeXFormat{LaTeX2e}
\ProvidesPackage{pdfx}
  [2019/02/27 v1.6.3 PDF/X and PDF/A support (CVR/HTH/RRM/PS)]

\newif\ifpdfx@noBOM \pdfx@noBOMfalse   % use a BOM in the XMP packet
\newif\ifpdfx@x \pdfx@xfalse   % PDF/X mode
\newif\ifpdfx@e \pdfx@efalse   % PDF/E mode; not fully implemented yet
\newif\ifpdfx@ua\pdfx@uafalse   % PDF/UA mode; not fully implemented yet
\newif\ifpdfx@vt \pdfx@vtfalse   % PDF/VT mode, extension of  PDF/X
\newif\ifno@iccprofile   % used with PDF/X-4p and PDF/X-5pg
\newif\ifpdfx@noerr   % error messages become just warnings
\newif\ifpdfx@omitcharset % used with  pdfomitcharset  primitive

\DeclareOption{noerr}{\pdfx@noerrtrue}

%% Not all combinations of the following parameters are meaningful.
\def\xmp@Part{1}               % PDF/A part: 1, 2, or 3
\def\xmp@Conformance{B}        % Conformance level: A, B, or U
\def\xmp@ReleaseDate{2005}     % 2001 for PDF/X-1, 2005 for PDF/A-1,
                               % 2010 for PDF/A-2, 2012 for PDF/A-3.

\newcount\pdfx@minorversion
\expandafter\ifx\csname pdfminorversion\endcsname\relax
\else
 \global\pdfx@minorversion=\the\pdfminorversion
\fi

\def\pdfx@ErrorWarning#1#2#3#4{%
 \ifpdfx@noerr \PackageWarning{pdfx}{#1.^^J  #2#3.^^J}%
 \else \PackageError{pdfx}{#1}{#2#4.^^J
    Use option ’noerr’ to avoid this message.^^J}%
 \fi}

\def\pdfx@Xvn@message{%
 \pdfx@ErrorWarning{PDF/X-5n has no default profile}%
   {Provide your own}{; continuing to build a non-valid document}%
   {, else continue to build a non-valid document}%
}

%%  support  pdfomitcharset  primitive, added to pdfTeX in 2019
\DeclareOption{nocharset}{\pdfx@omitcharsettrue}
\DeclareOption{usecharset}{\pdfx@omitcharsetfalse}

%% PDF/A options
%%  default is to create  PDF/A-1b
%%  options can change this for PDF/X or higher levels of PDF/A
\DeclareOption{a-1a}{\global\pdfx@xfalse\def\xmp@Part{1}%
 \def\xmp@Conformance{A}\def\xmp@ReleaseDate{2005}%
 \pdfx@omitcharsetfalse}
\DeclareOption{a-1b}{\global\pdfx@xfalse\def\xmp@Part{1}%
 \def\xmp@Conformance{B}\def\xmp@ReleaseDate{2005}%
 \pdfx@omitcharsetfalse}
\DeclareOption{a-2a}{\global\pdfx@xfalse\def\xmp@Part{2}%
 \def\xmp@Conformance{A}\def\xmp@ReleaseDate{2010}%
 \pdfx@omitcharsettrue}
\DeclareOption{a-2b}{\global\pdfx@xfalse\def\xmp@Part{2}%
 \def\xmp@Conformance{B}\def\xmp@ReleaseDate{2010}%
 \pdfx@omitcharsettrue}
\DeclareOption{a-2u}{\global\pdfx@xfalse\def\xmp@Part{2}%
 \def\xmp@Conformance{U}\def\xmp@ReleaseDate{2010}%
 \pdfx@omitcharsettrue}
\DeclareOption{a-3a}{\global\pdfx@xfalse\def\xmp@Part{3}%
 \def\xmp@Conformance{A}\def\xmp@ReleaseDate{2012}%
 \pdfx@omitcharsettrue}
\DeclareOption{a-3b}{\global\pdfx@xfalse\def\xmp@Part{3}%
 \def\xmp@Conformance{B}\def\xmp@ReleaseDate{2012}%
 \pdfx@omitcharsettrue}
\DeclareOption{a-3u}{\global\pdfx@xfalse\def\xmp@Part{3}%
 \def\xmp@Conformance{U}\def\xmp@ReleaseDate{2012}%
 \pdfx@omitcharsettrue}
%%
%% PDF/X options
%% comments added, using
%% https://www.eci.org/_media/downloads/pdfx/pdfx_faq_english_nov05.pdf
%% https://en.wikipedia.org/wiki/PDF/X#List_of_the_PDF.2FX_standards
%%
\DeclareOption{x-1}{\global\pdfx@xtrue\def\xmp@Part{1}%  obsolete
 \def\xmp@Conformance{a}\def\xmp@ReleaseDate{1999}% CMYK only
 \global\pdfx@minorversion=2\relax
 \pdfx@ErrorWarning{PDF/X-1:1999 is no longer an accepted standard}%
    {Use option  x-1a1 or  x-1a3 }{; continuing to build a non-valid document}%
    {, else continue to build a non-valid document.}%
 }%  effectively same as  x-1a1
\DeclareOption{x-1a}{\global\pdfx@xtrue\def\xmp@Part{1}% CMYK only
 \def\xmp@Conformance{a}\def\xmp@ReleaseDate{2003}%
 \global\pdfx@minorversion=3 }%  same as  x-1a3
\DeclareOption{x-1a1}{\global\pdfx@xtrue\def\xmp@Part{1}%
 \def\xmp@Conformance{a}\def\xmp@ReleaseDate{2001}%  ISO 15930-1:2001
 \global\pdfx@minorversion=3 }
\DeclareOption{x-1a3}{\global\pdfx@xtrue\def\xmp@Part{1}%
 \def\xmp@Conformance{a}\def\xmp@ReleaseDate{2003}%  ISO 15930-4:2003
 \global\pdfx@minorversion=3 }
\DeclareOption{x-2}{\global\pdfx@xtrue\def\xmp@Part{2}%  XMP Metadata
%% \def\xmp@Conformance{}\def\xmp@ReleaseDate{2002}%  ISO 15930-2:2003
 \def\xmp@Conformance{}\def\xmp@ReleaseDate{2003}%   ISO 15930-5, withdrawn 2011
 \global\pdfx@minorversion=4\relax
 \pdfx@ErrorWarning{PDF/X-2:2003 was never published as a standard}%
   {Use option  x-1a or  x-3 }{; continuing to build a non-valid document}%
   {, else continue to build a non-valid document}%
 }%  external OPI workflow, i.e. multiple files involved
```

```
\DeclareOption{x-3}{\global\pdfx@xtrue\def\xmp@Part{3}% RGB allowed, but rare!
 \def\xmp@Conformance{}\def\xmp@ReleaseDate{2003}%
 \global\pdfx@minorversion=4 }%  same as x-303
\DeclareOption{x-302}{\global\pdfx@xtrue\def\xmp@Part{3}%
 \def\xmp@Conformance{}\def\xmp@ReleaseDate{2002}%   ISO 15930-3:2002
 \global\pdfx@minorversion=3 }
\DeclareOption{x-303}{\global\pdfx@xtrue\def\xmp@Part{3}%
 \def\xmp@Conformance{}\def\xmp@ReleaseDate{2003}%  ISO 15930-6:2003
 \global\pdfx@minorversion=4 }
%%%  Later versions, yet to be fully implemented
\DeclareOption{x-4}{\global\pdfx@xtrue\def\xmp@Part{4}%
 \def\xmp@Conformance{}\def\xmp@ReleaseDate{2010}%  ISO 15930-7:2010
 \global\pdfx@minorversion=6 }%  same as  x-410
\DeclareOption{x-4p}{\global\pdfx@xtrue\global\no@iccprofiletrue
  \def\xmp@Part{4}\def\xmp@Conformance{p}\def\xmp@ReleaseDate{2010}%
  \global\pdfx@minorversion=6 }%  same as  x-4p10
\DeclareOption{x-408}{\global\pdfx@xtrue\def\xmp@Part{4}%
 \def\xmp@Conformance{}\def\xmp@ReleaseDate{2008}%  ISO 15930-7:2008
 \global\pdfx@minorversion=6 }
\DeclareOption{x-410}{\global\pdfx@xtrue\def\xmp@Part{4}%
 \def\xmp@Conformance{}\def\xmp@ReleaseDate{2010}%  ISO 15930-7:2010
 \global\pdfx@minorversion=6 }
\DeclareOption{x-4p08}{\global\pdfx@xtrue\global\no@iccprofiletrue
  \def\xmp@Part{4}\def\xmp@Conformance{p}\def\xmp@ReleaseDate{2008}%
  \global\pdfx@minorversion=6 }%   ISO 15930-7:2010
\DeclareOption{x-4p10}{\global\pdfx@xtrue\global\no@iccprofiletrue
  \def\xmp@Part{4}\def\xmp@Conformance{p}\def\xmp@ReleaseDate{2010}%
  \global\pdfx@minorversion=6 }%   ISO 15930-7:2010
\DeclareOption{x-5}{\global\pdfx@xtrue\def\xmp@Part{5}%
 \def\xmp@Conformance{g}\def\xmp@ReleaseDate{2008}%
 \global\pdfx@minorversion=6 }%   ISO 15930-8:2010
\DeclareOption{x-5g}{\global\pdfx@xtrue\def\xmp@Part{5}%
 \def\xmp@Conformance{g}\def\xmp@ReleaseDate{2008}%
 \global\pdfx@minorversion=6 }%   ISO 15930-8:2010
\DeclareOption{x-5n}{\global\pdfx@xtrue %\global\no@iccprofiletrue
 \def\xmp@Part{5}\def\xmp@Conformance{n}\def\xmp@ReleaseDate{2010}%
 \global\pdfx@minorversion=6 \pdfx@Xvn@message}%   ISO 15930-8:2010
\DeclareOption{x-5pg}{\global\pdfx@xtrue\global\no@iccprofiletrue
  \def\xmp@Part{5}\def\xmp@Conformance{pg}\def\xmp@ReleaseDate{2010}%
  \global\pdfx@minorversion=6 }%  ISO 15930-8:2010
\DeclareOption{x-508}{\global\pdfx@xtrue\def\xmp@Part{5}%
 \def\xmp@Conformance{g}\def\xmp@ReleaseDate{2008}%
 \global\pdfx@minorversion=6 }%   ISO 15930-8:2008
\DeclareOption{x-5g08}{\global\pdfx@xtrue\def\xmp@Part{5}%
 \def\xmp@Conformance{g}\def\xmp@ReleaseDate{2008}%
 \global\pdfx@minorversion=6 }%   ISO 15930-8:2008
\DeclareOption{x-5n08}{\global\pdfx@xtrue %\global\no@iccprofiletrue
 \def\xmp@Part{5}\def\xmp@Conformance{n}\def\xmp@ReleaseDate{2008}%
 \global\pdfx@minorversion=6 \pdfx@Xvn@message}%   ISO 15930-8:2008
\DeclareOption{x-5pg08}{\global\pdfx@xtrue\global\no@iccprofiletrue
  \def\xmp@Part{5}\def\xmp@Conformance{pg}\def\xmp@ReleaseDate{2008}%
  \global\pdfx@minorversion=6 }%  ISO 15930-8:2008
```

```
\DeclareOption{x-510}{\global\pdfx@xtrue\def\xmp@Part{5}%
 \def\xmp@Conformance{g}\def\xmp@ReleaseDate{2010}%
 \global\pdfx@minorversion=6 }%  ISO 15930-8:2010
\DeclareOption{x-5g10}{\global\pdfx@xtrue\def\xmp@Part{5}%
 \def\xmp@Conformance{g}\def\xmp@ReleaseDate{2010}%
 \global\pdfx@minorversion=6 }%  ISO 15930-8:2010
\DeclareOption{x-5n10}{\global\pdfx@xtrue %\global\no@iccprofiletrue
 \def\xmp@Part{5}\def\xmp@Conformance{n}\def\xmp@ReleaseDate{2010}%
 \global\pdfx@minorversion=6 \pdfx@Xvn@message}%  ISO 15930-8:2010
\DeclareOption{x-5pg10}{\global\pdfx@xtrue\global\no@iccprofiletrue
  \def\xmp@Part{5}\def\xmp@Conformance{pg}\def\xmp@ReleaseDate{2010}%
  \global\pdfx@minorversion=6 }%  ISO 15930-8:2010
%%
%% PDF/E options
%%
\DeclareOption{e}{\global\pdfx@xfalse\global\pdfx@etrue
  \def\xmp@Part{1}\def\xmp@Conformance{}\def\xmp@ReleaseDate{2008}%
  \gdef\thepdfminorversion{6}%   same as  e-1
  }
\DeclareOption{e-1}{\global\pdfx@xfalse\global\pdfx@etrue
  \def\xmp@Part{1}\def\xmp@Conformance{}\def\xmp@ReleaseDate{2008}%
  \gdef\thepdfminorversion{6}%  ISO 24517-1:2008
  }
%% PDF/UA options
%%
\let\xmp@PDFUA\@empty
\DeclareOption{ua}{\global\pdfx@uatrue % ISO 14289-1:2012, 2014
  \def\xmp@UAlevel{1}\let\xmp@PDFUA\relax}%   same as  ua-1
\DeclareOption{ua-1}{\global\pdfx@uatrue % ISO 14289-1:2012, 2014
  \def\xmp@UAlevel{1}\let\xmp@PDFUA\relax}
%%
%% PDF/VT options
%%
\DeclareOption{vt-1}{\global\pdfx@xtrue\global\pdfx@vttrue
  \def\xmp@Part{4}\def\xmp@vtPart{1}\def\xmp@Conformance{}%
  \def\xmp@vtConformance{}\def\xmp@ReleaseDate{2010}%
  \gdef\xmpMM@VersionID{1}%
  \global\pdfx@minorversion=6 }
\DeclareOption{vt-2}{\global\pdfx@xtrue\global\pdfx@vttrue
  \global\no@iccprofiletrue   \gdef\xmpMM@VersionID{1}%
  \def\xmp@Part{5}\def\xmp@vtPart{2}\def\xmp@Conformance{pg}%
  \def\xmp@vtConformance{}\def\xmp@ReleaseDate{2010}%
  \global\pdfx@minorversion=6 }
\DeclareOption{vt-2s}{\global\pdfx@xtrue\global\pdfx@vttrue
  \global\no@iccprofiletrue   \gdef\xmpMM@VersionID{1}%
  \def\xmp@Part{5}\def\xmp@vtPart{2}\def\xmp@Conformance{pg}%
  \def\xmp@vtConformance{s}\def\xmp@ReleaseDate{2010}%
  \global\pdfx@minorversion=6 }

%% options to alter PDF minor version, in case needed in special circumstances
\DeclareOption{pdf12}{\global\pdfx@minorversion=2 }%  1999
\DeclareOption{pdf13}{\global\pdfx@minorversion=3 }%  2001  Acrobat 4 (ISBN 0-201-61
\DeclareOption{pdf14}{\global\pdfx@minorversion=4 }%  2003  Acrobat 5 (ISBN 0-201-758
\DeclareOption{pdf15}{\global\pdfx@minorversion=5 }%  2005  Acrobat 6
\DeclareOption{pdf16}{\global\pdfx@minorversion=6 }%  2006  Acrobat 7 (ISBN 0-321-304
\DeclareOption{pdf17}{\global\pdfx@minorversion=7 }%  2008  ISO 32000-1:2008

%% inhibits writing the XMP byte-order marker
\DeclareOption{noBOM}{\pdfx@noBOMtrue}
\DeclareOption{useBOM}{\pdfx@noBOMfalse}

%% options for language character macros in XMP metadata
\newif\ifcyrxmp
\newif\ifcyrKOIxmp
\newif\ifgrkxmp
\newif\ifgrkLGRxmp
\newif\ifhebxmp
\newif\ifhebHEBxmp
\newif\ifarbxmp
\newif\ifarmxmp
\newif\ifarmSCIxmp
\newif\ifdevxmp
\newif\ifvnmxmp
\newif\iflatEXTxmp
\newif\iflatLATxmp
\newif\ifipaxmp
\newif\ifmathxmp

\DeclareOption{latxmp}{\global\latEXTxmptrue}
\DeclareOption{LATxmp}{\global\latLATxmptrue\global\latEXTxmptrue}
\DeclareOption{cyrxmp}{\global\cyrxmptrue}
\DeclareOption{KOIxmp}{\global\cyrKOIxmptrue\global\cyrxmptrue}
\DeclareOption{grkxmp}{\global\grkxmptrue}
\DeclareOption{LGRxmp}{\global\grkLGRxmptrue\global\grkxmptrue}
\DeclareOption{hebxmp}{\global\hebxmptrue}
\DeclareOption{HEBxmp}{\global\hebHEBxmptrue\global\hebxmptrue}
\DeclareOption{arbxmp}{\global\arbxmptrue}
\DeclareOption{armxmp}{\global\armxmptrue}
\DeclareOption{AR8xmp}{\global\armSCIxmptrue\global\armxmptrue}
\DeclareOption{devxmp}{\global\devxmptrue}
\DeclareOption{vnmxmp}{\global\vnmxmptrue}
\DeclareOption{ipaxmp}{\global\ipaxmptrue\global\latEXTxmptrue}
\DeclareOption{mathxmp}{\global\mathxmptrue\global\grkxmptrue}

%% all the above
\DeclareOption{allxmp}{%
 \global\cyrxmptrue
 \global\cyrKOIxmptrue
 \global\grkxmptrue
 \global\grkLGRxmptrue
 \global\hebxmptrue
 \global\hebHEBxmptrue
 \global\arbxmptrue
 \global\armxmptrue
 \global\armSCIxmptrue
 \global\devxmptrue
 \global\vnmxmptrue
 \global\latEXTxmptrue
 \global\latLATxmptrue
 \global\vnmxmptrue
 \global\ipaxmptrue
 \global\mathxmptrue
 \global\let\pdfx@useactivespacestrue\pdfx@useactivespacesfalse
}

\newif\ifpdfx@useactivespaces

\ExecuteOptions{noBOM,a-1b}
\ProcessOptions

\ifpdfx@ua\ifpdfx@x\else
 \expandafter\if\xmp@Conformance A\else
 \pdfx@ErrorWarning{PDF/UA requires 'Tagged PDF' for any structure.^^J
  Then PDF/A Conformance must be 'a'}%
  {Use option 'a-\xmp@Part a'}%
  {; continuing with a likely invalid document}%
  {, or continue for a likely invalid document}%
%%%  \gdef\xmp@Conformance{A}%   do we want this?
\fi\fi\fi

\expandafter\ifx\csname pdflastobj\endcsname\relax
\else
 \ifnum\pdflastobj >\z@ % pdftex  has already written objects
  \ifnum\pdfx@minorversion=\pdfminorversion\else
   \PackageError{pdfx}%
    {^^J(pdfx)    Cannot change the \string\pdfminorversion^^J%
     (pdfx)   PDF version remains at 1.\the\pdfminorversion.^^J%
     (pdfx)   Use \string\pdfminorversion=\the\pdfx@minorversion\space
      before \string\documentclass}%
    {(pdfx)   Another package or document-class has written objects into the PDF.^^J
     (pdfx)   Hit return to continue with PDF version 1.\the\pdfminorversion.%
    }%
   \global\pdfx@minorversion=\the\pdfminorversion
  \fi
 \else
  \global\pdfminorversion\pdfx@minorversion
 \fi
\fi

\expandafter\ifx\csname thepdfminorversion\endcsname\relax
 \expandafter\ifx\csname pdfminorversion\endcsname\relax
 \else
  \xdef\thepdfminorversion{\the\pdfminorversion}
\fi\fi

\expandafter\ifx\csname pdfminorversion\endcsname\relax
```

```
 \gdef\thepdfminorversion{4}% assumed with XeTeX
 \def\pdf@minorversion@xetex=#1{\gdef\thepdfminorversion{#1}}%
 \let\pdfminorversion\pdf@minorversion@xetex
\else
 \ifnum\pdfminorversion < 4\relax
  \ifpdfx@x
    % more testing needed with PDF/X
  \else
   \pdfminorversion=4\relax %  assumed for PDF/A ;  options may change this for  PDF/
   \gdef\thepdfminorversion{4}%
  \fi
 \else
  \ifnum\pdfminorversion<\thepdfminorversion\relax
   \global\pdfminorversion=\thepdfminorversion\relax
  \fi
 \fi
\fi
\expandafter\ifx\csname pdfresetpageorigin\endcsname\relax\else
 \pdfresetpageorigin=0
\fi

\expandafter\ifx\csname pdfomitcharset\endcsname\relax\else
 \ifpdfx@omitcharset
  \pdfomitcharset = 1 %
  %%  do not create /Charset listings of font glyphs;
  %%  optional for PDF/A-2,3 and PDF 2.x
 \else
  \pdfomitcharset = 0 %
  %%  create the /Charset listings of font glyphs, required with PDF/A-1
 \fi
\fi

\newif\ifpdfx@nopdfinfo
\ifmathxmp\pdfx@nopdfinfotrue
\else
 \iflatLATxmp\pdfx@nopdfinfotrue
\else
 \ifgrkLGRxmp\pdfx@nopdfinfotrue
\else
 \ifhebHEBxmp\pdfx@nopdfinfotrue
\else
 \ifcyrKOIxmp\pdfx@nopdfinfotrue
\else
 \ifarmSCIxmp\pdfx@nopdfinfotrue
\fi\fi\fi\fi\fi\fi

\iflatLATxmp\pdfx@useactivespacestrue\fi
\ifgrkLGRxmp\pdfx@useactivespacestrue\fi
\ifhebHEBxmp\pdfx@useactivespacestrue\fi
\ifcyrKOIxmp\pdfx@useactivespacestrue\fi
\ifarmSCIxmp\pdfx@useactivespacestrue\fi

```

```
\newif\ifpdfx@transliterated
\ifgrkLGRxmp\pdfx@transliteratedtrue\fi
\ifhebHEBxmp\pdfx@transliteratedtrue\fi
\ifarmSCIxmp\pdfx@transliteratedtrue\fi

\RequirePackage{iftex}
\RequirePackage{ifpdf}
%% Support for pdfTeX primitives when using XeTeX:
\RequirePackage{ifxetex}
\ifxetex
 \def\pdfx@pages@xetex#1{\special{pdf:put @pages <<#1>>}}
 \def\pdfx@pageattr@xetex#1{\special{pdf:put @thispage <<#1>>}}
 \def\pdfx@docinfo@xetex#1{\special{pdf:put @docinfo <<#1>>}}
 \def\pdfx@catalog@xetex#1{\special{pdf:put @catalog <<#1>>}}
 \def\pdfx@mapline@xetex#1{\special{pdf:mapline #1}}%% does this work ??
%% \def\pdfx@mapline@xetex#1{}
 \def\pdf@compress@xetex=#1{}
%%
 \let\pdfpagesattr\pdfx@pages@xetex
 \let\pdfinfo\pdfx@docinfo@xetex
 \let\pdfcatalog\pdfx@catalog@xetex
 \let\pdfmapline\pdfx@mapline@xetex
 \let\pdfcompresslevel\pdf@compress@xetex
 \let\pdfobjcompresslevel\pdf@compress@xetex
\fi

%%\newif\ifpdfx@pdfmark  %  control future support for  dvips

\RequirePackage{everyshi}
\RequirePackage{ifluatex}
\ifluatex
 \IfFileExists{luatex85.sty}{% 2016+
  \RequirePackage{luatex85}%
  \edef\pdfcreationdate{\pdfcreationdate}%
 }{%  earlier versions
 }%
 \RequirePackage{pdftexcmds}%
 \let\pdfx@mdfivesum\pdf@mdfivesum
 \let\pdfescapestring\pdf@escapestring
\else
 \ifxetex
  \expandafter\ifx\csname mdfivesum\endcsname\relax
   %  too early a version of  XeTeX
   \let\pdfx@mdfivesum\relax
  \else
   %  since mid-2015
   \let\pdfx@mdfivesum\mdfivesum
  \fi
 \else
  \let\pdfx@mdfivesum\pdfmdfivesum
 \fi
\fi
```

```
\def\pdfx@encodingfile{l8u-penc.def}

\expandafter\ifx\csname pdftexbanner\endcsname\relax
 \expandafter\ifx\csname luatexbanner\endcsname\relax
 \else %  luatex85
  \let\pdftexbanner\luatexbanner
 \fi
\else %  pdfTeX, but which version ???
 {\endlinechar=-1
  \everyeof{\noexpand}%
  \xdef\pdfx@bannerstring{\expandafter\scantokens\expandafter{\pdftexbanner}}
 }%
 \def\pdfx@testbannerstr{%
  This is pdfTeX, Version 3.14159265-2.6-1.40.15 (TeX Live 2014/dev)
  kpathsea version 6.2.0dev}%
 \ifx\pdfx@bannerstring\pdfx@testbannerstr
  \typeout{This version of pdfTeX cannot write out upper-range character bytes,
   128-255.}%
  \typeout{Any UTF-8 Unicode characters in the Metadata will not be written
   correctly.}%
  \typeout{Please update to a more stable version of pdfTeX.^^J}%
 \fi
\fi

%% How to support XeTeX here ?
\ifpdfx@x
 \pdfobjcompresslevel=0 \relax
 \expandafter\ifx\csname pdfinterwordspaceoff\endcsname\relax\else
  \pdfinterwordspaceoff
  \let\pdfinterwordspaceon\pdfinterwordspaceoff
  \let\pdfinterwordspace\relax
 \fi
 \expandafter\ifx\csname pdfgeninterwordspace\endcsname\relax\else
  \pdfgeninterwordspace=0 \relax
 \fi
 \begingroup
  \dimen0=0.996264009963\paperwidth\relax
  \edef\pdfx@mwidth{\strip@pt\dimen0}%
  \advance\dimen0 -25\p@
  \edef\pdfx@twidth{\strip@pt\dimen0}%
  \dimen0=0.996264009963\paperheight\relax
  \edef\pdfx@mheight{\strip@pt\dimen0}%
  \advance\dimen0 -20\p@
  \edef\pdfx@theight{\strip@pt\dimen0}%
  \ifxetex
   \xdef\pdfx@everypage@xetex{%
     /MediaBox[0 0 \pdfx@mwidth\space \pdfx@mheight]^^J
     /BleedBox[0 0 \pdfx@mwidth\space \pdfx@mheight]^^J
     /CropBox[0 0 \pdfx@mwidth\space \pdfx@mheight]^^J
     /TrimBox[25 20 \pdfx@twidth\space \pdfx@theight]%
   }%
  \fi
  \edef\next{\endgroup\pdfpagesattr{%
    /MediaBox[0 0 \pdfx@mwidth\space \pdfx@mheight]^^J
%%    /ArtBox[0 0 \pdfx@mwidth\space \pdfx@mheight]^^J
    /BleedBox[0 0 \pdfx@mwidth\space \pdfx@mheight]^^J
    /CropBox[0 0 \pdfx@mwidth\space \pdfx@mheight]^^J
    /TrimBox[25 20 \pdfx@twidth\space \pdfx@theight]}
  }\next
 \ifxetex
  \AtBeginDvi{%
   \expandafter\immediate\pdfx@pageattr@xetex{\pdfx@everypage@xetex}}%
  \EveryShipout{%
   \expandafter\immediate\pdfx@pageattr@xetex{\pdfx@everypage@xetex}}%
 \else
   \EveryShipout{%
    \expandafter\ifx\expandafter\relax\the\pdfpageattr\relax
     \immediate\pdfpageattr\expandafter{\the\pdfpagesattr}%
    \fi }%
 \fi
\else
%%  PDF/A-1b  doesn't allow object compression
 \ifnum\xmp@ReleaseDate=2005\relax
  \expandafter\ifx\csname pdfobjcompresslevel\endcsname\relax
  \else
   \pdfobjcompresslevel=0\relax
 \fi \fi
\fi
\ifxetex
%% How to support XeTeX here ?
\else
 \ifnum\thepdfminorversion >3 \relax
  \expandafter\ifx\csname pdfsuppresswarningdupmap\endcsname\relax
   \expandafter\ifx\csname pdfmapline\endcsname\relax\else
    \pdfmapline{+dummy-space <dummy-space.pfb}
   \fi
  \else
   \advance\pdfsuppresswarningdupmap 1
   \pdfmapline{+dummy-space <dummy-space.pfb}
   \advance\pdfsuppresswarningdupmap -1
  \fi
  \expandafter\ifx\csname pdfgeninterwordspace\endcsname\relax\else
   \pdfgeninterwordspace=1 \relax
  \fi
 \fi
\fi

\ifluatex\else\ifxetex\else
 \@ifpackageloaded{inputenc}{%
 }{%
  \RequirePackage{inputenc}
 % allow this to be loaded again cleanly
 \expandafter\let\csname ver@inputenc.sty\endcsname\relax
 }
```

```
\fi\fi

%% pseudo-declare the L8U encoding
\expandafter\let\csname L8U-cmd\expandafter\endcsname\csname OT1-cmd\endcsname
\@namedef{T@L8U}{}%
\@namedef{D@L8U}{}%
\@namedef{M@L8U}{}%

%% adjust to LaTeX’s 2018 change to the default encoding
\expandafter\ifx\csname inputencodingname\endcsname\relax
\else
 \def\pdfx@restoreencoding#1{%
   \@tempcnta=128
   \loop
    \catcode\@tempcnta=13
    \advance\@tempcnta\@ne
   \ifnum\@tempcnta<256
   \repeat
  \inputencoding{#1}%
  \let\LastDeclaredEncoding\pdfx@LastDeclaredEncoding
  \let\DeclareFontEncoding@\pdfx@DeclareFontEncoding@
  \let\DeclareUnicodeCharacter\pdfx@DeclareUnicodeCharacter
  }%
  \AtEndOfPackage{\pdfx@restoreencoding\pdfx@inputencodingname}%
  \let\pdfx@inputencodingname\inputencodingname
  \global\let\pdfx@DeclareUnicodeCharacter\DeclareUnicodeCharacter
  \global\let\pdfx@DeclareFontEncoding@\DeclareFontEncoding@
  \UseRawInputEncoding
\fi
\InputIfFileExists{\pdfx@encodingfile}{}{}
\expandafter\ifx\csname pdfx@inputencodingname\endcsname\relax
\else
  \let\inputencodingname\pdfx@inputencodingname
%%  \global\let\DeclareUnicodeCharacter\pdfx@DeclareUnicodeCharacter
%%  \global\let\DeclareFontEncoding@\DeclareFontEncoding@saved
  \global\let\pdfx@LastDeclaredEncoding\LastDeclaredEncoding
  \expandafter\inputencoding\expandafter{\inputencodingname}%
\fi

%%----------------------------------------------------------------------
%% Macros for reading XMP data with special catcodes. Usage:
%%
%% \xmp@parse{continuation}{data}
%%
%% The effect is to read the data with special catcodes: ’<’, ’>’, and
%% ’&’ are "active", and ’^’, ’_’, ’#’, ’$’, ’~’ are "other". The data
%% is then bound to the locally scoped name \@this, and the
%% continuation is called.
\def\xmp@parse#1{%
 \begingroup
 \catcode‘\<=13\catcode‘\>=13\catcode‘\&=13\catcode‘\^=12
 \catcode‘\_=12\catcode‘\#=12\catcode‘\$=12\catcode‘\~=12
 \ifpdfx@useactivespaces\obeyspaces\fi % capture spaces as active characters
 \xmp@doparse{#1}%
}
\def\afterxmp@parse{}% methods may change this
\def\xmp@doparse#1#2{%
 \def\@this{#2}#1
 \endgroup
 % do any post-processing
 \afterxmp@parse
 \def\afterxmp@parse{}%
}

%%----------------------------------------------------------------------
%% Local commands. They are only brought into scope during the reading
%% of xmpdata. Some fields can have a ’xml:lang’ attribute; others must have.
%%  LANG values as in:  (BCP 47)  https://tools.ietf.org/html/rfc5646#appendix-A
%%
\def\xmp@lang@Default{x-default}
\let\xmp@lang@Title\xmp@lang@Default
\let\xmp@lang@Author\xmp@lang@Default
\let\xmp@lang@Keywords\xmp@lang@Default
\let\xmp@lang@Subject\xmp@lang@Default
%%\def\xmp@lang@CreatorTool{\xmp@lang@Default}
\let\xmp@lang@Producer\xmp@lang@Default
%%\def\xmp@lang@Volume{\xmp@lang@Default}
%%\def\xmp@lang@Issue{\xmp@lang@Default}
\let\xmp@lang@Copyright\xmp@lang@Default
\let\xmp@lang@PublicationType\xmp@lang@Default
\let\xmp@lang@Publisher\xmp@lang@Default
\let\xmp@lang@Coverage\xmp@lang@Default
\let\xmp@lang@Contributor\xmp@lang@Default
\let\xmp@lang@Relation\xmp@lang@Default
%%%  PRISM fields
\let\xmp@lang@CoverDisplayDate\xmp@lang@Default
\let\xmp@lang@JournalTitle\xmp@lang@Default
%%\def\xmp@lang@JournalNumber{\xmp@lang@Default}
%%%  xmp:  &  xmpRights:  fields
\let\xmp@lang@Advisory\xmp@lang@Default
\let\xmp@lang@Identifier\xmp@lang@Default
\let\xmp@lang@Nickname\xmp@lang@Default
\let\xmp@lang@Owner\xmp@lang@Default

%% some validators require a language attribute for
%%   dc:title                 set via  \Title
%%   dc:description   set via  \Subject
%%   dc:rights              set via  \Copyright
%%   xmpRights:UsageTerms   set via \Copyright
%%
{\catcode ‘\" 12 \catcode‘\: 12 \catcode‘\= 12
 \gdef\pdfx@xmp@checklang#1{%
  \ifx #1\xmp@lang@Default\else\space xml:lang="#1"\fi}
 \gdef\pdfx@xmp@strictlang#1{\space xml:lang="#1"}
```

```
}%  end of  \catcodes
\let\xmp@checklang\pdfx@xmp@checklang
\let\xmp@strictlang\pdfx@xmp@strictlang

\newcommand{\pdfx@Title}[1][]{%
 \ifx\relax#1\relax\else\gdef\xmp@lang@Title{#1}\fi
 \xmp@parse{\global\let\xmp@Title\@this}}

%% allow for multiple authors, keywords and languages
%%  also:  contributor, date, relation, type, thumbnails
%%  and  AuthoritativeDomain, Advisory, Identifier, Owner
\newcommand{\pdfx@Author}[1][]{%
 \ifx\relax#1\relax\else\gdef\xmp@lang@Author{#1}\fi
 \def\afterxmp@parse{\let\Author\pdfx@extraAuthor}%
 \xmp@parse{\global\let\xmp@Author\@this}}
\newcommand{\pdfx@Keywords}[1][]{%
 \ifx\relax#1\relax\else\gdef\xmp@lang@Keywords{#1}\fi
 \def\afterxmp@parse{\let\Keywords\pdfx@extraKeywords}%
 \xmp@parse{\global\let\xmp@Keywords\@this}}
\newcommand{\pdfx@Language}{%
 \def\afterxmp@parse{\let\Language\pdfx@extraLanguages}%
 \xmp@parse{\global\let\xmp@Language\@this}}

\newcommand{\pdfx@AuthoritativeDomain}{%
 \def\afterxmp@parse{\let\AuthoritativeDomain\pdfx@extraAuthoritativeDomain}%
 \xmp@parse{\global\let\xmp@AuthoritativeDomain\@this}}
\newcommand{\pdfx@Date}{%
 \def\afterxmp@parse{\let\Date\pdfx@extraDate}%
 \xmp@parse{\global\let\xmp@Date\@this}}
\newcommand{\pdfx@Contributor}[1][]{%
 \ifx\relax#1\relax\else\gdef\xmp@lang@Contributor{#1}\fi
 \def\afterxmp@parse{\let\Contributor\pdfx@extraContributor}%
 \xmp@parse{\global\let\xmp@Contributor\@this}}
\newcommand{\pdfx@Relation}[1][]{%
 \ifx\relax#1\relax\else\gdef\xmp@lang@Relation{#1}\fi
 \def\afterxmp@parse{\let\Relation\pdfx@extraRelation}%
 \xmp@parse{\global\let\xmp@Relation\@this}}
%%\newcommand{\pdfx@Type}[1][]{%
%% \ifx\relax#1\relax\else\gdef\xmp@lang@Type{#1}\fi
%% \def\afterxmp@parse{\let\Type\pdfx@extraType}%
%% \xmp@parse{\global\let\xmp@Type\@this}}

\newcommand{\pdfx@Advisory}[1][]{%
 \ifx\relax#1\relax\else\gdef\xmp@lang@Advisory{#1}\fi
 \def\afterxmp@parse{\let\Advisory\pdfx@extraAdvisory}%
 \xmp@parse{\global\let\xmp@Advisory\@this}}
\newcommand{\pdfx@Identifier}[1][]{%
 \ifx\relax#1\relax\else\gdef\xmp@lang@Identifier{#1}\fi
 \def\afterxmp@parse{\let\Identifier\pdfx@extraIdentifier}%
 \xmp@parse{\global\let\xmp@Identifier\@this}}
\newcommand{\pdfx@Thumbnails}{%
 \def\afterxmp@parse{\let\Thumbnails\pdfx@extraThumbnails}%
 \xmp@parse{\global\let\xmp@Thumbnails\@this}}

\newcommand{\pdfx@Owner}[1][]{%
 \ifx\relax#1\relax\else\gdef\xmp@lang@Owner{#1}\fi
 \def\afterxmp@parse{\let\Owner\pdfx@extraOwner}%
 \xmp@parse{\global\let\xmp@Owner\@this}}

{\obeyspaces%
 \ifpdfx@useactivespaces\gdef\pdfx@insert@sep{\sep }%
 \else\gdef\pdfx@insert@sep{\sep}\fi%
}
\newcommand{\pdfx@extraAuthor}[1][]{%
 \ifx\relax#1\relax
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@Author
    \expandafter\expandafter\expandafter{%
     \expandafter\xmp@Author\pdfx@insert@sep}%
 \else
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@Author
    \expandafter\expandafter\expandafter{%
     \expandafter\xmp@Author\pdfx@insert@sep[#1]}%
 \fi
 \def\afterxmp@parse{%
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@Author
   \expandafter\expandafter\expandafter{%
    \expandafter\xmp@Author\xmp@extraAuthor}%
   }%
 \xmp@parse{\global\let\xmp@extraAuthor\@this}%
 }%
\newcommand{\pdfx@extraKeywords}[1][]{%
 \ifx\relax#1\relax
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@Keywords
    \expandafter\expandafter\expandafter{%
     \expandafter\xmp@Keywords\pdfx@insert@sep}%
 \else%
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@Keywords
    \expandafter\expandafter\expandafter{%
     \expandafter\xmp@Keywords\pdfx@insert@sep[#1]}%
 \fi%
 \def\afterxmp@parse{%
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@Keywords
   \expandafter\expandafter\expandafter{%
    \expandafter\xmp@Keywords\xmp@extraKeywords}}%
 \xmp@parse{\global\let\xmp@extraKeywords\@this}%
 }%
\newcommand{\pdfx@extraLanguages}{%
  \expandafter\expandafter\expandafter\gdef
```

```
   \expandafter\expandafter\expandafter\xmp@Language
    \expandafter\expandafter\expandafter{%
     \expandafter\xmp@Language\pdfx@insert@sep}%
 \def\afterxmp@parse{%
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@Language
   \expandafter\expandafter\expandafter{%
    \expandafter\xmp@Language\xmp@extraLanguages}}%
 \xmp@parse{\global\let\xmp@extraLanguages\@this}%
 }%

\newcommand{\pdfx@extraContributor}[1][]{%
 \ifx\relax#1\relax
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@Contributor
    \expandafter\expandafter\expandafter{%
     \expandafter\xmp@Contributor\pdfx@insert@sep}%
 \else
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@Contributor
    \expandafter\expandafter\expandafter{%
     \expandafter\xmp@Contributor\pdfx@insert@sep[#1]}%
 \fi
 \def\afterxmp@parse{%
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@Contributor
   \expandafter\expandafter\expandafter{%
    \expandafter\xmp@Contributor\xmp@extraContributor}%
   }%
 \xmp@parse{\global\let\xmp@extraContributor\@this}%
 }%

\newcommand{\pdfx@extraAuthoritativeDomain}{%
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@AuthoritativeDomain
    \expandafter\expandafter\expandafter{%
     \expandafter\xmp@AuthoritativeDomain\pdfx@insert@sep}%
 \def\afterxmp@parse{%
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@AuthoritativeDomain
   \expandafter\expandafter\expandafter{%
    \expandafter\xmp@AuthoritativeDomain\xmp@extraAuthoritativeDomain}%
   }%
 \xmp@parse{\global\let\xmp@extraAuthoritativeDomain\@this}%
 }%

\newcommand{\pdfx@extraDate}{%
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@Date
    \expandafter\expandafter\expandafter{%
     \expandafter\xmp@Date\pdfx@insert@sep}%
 \def\afterxmp@parse{%
```

```
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@Date
   \expandafter\expandafter\expandafter{%
    \expandafter\xmp@Date\xmp@extraDate}%
   }%
 \xmp@parse{\global\let\xmp@extraDate\@this}%
 }%

\newcommand{\pdfx@extraRelation}[1][]{%
 \ifx\relax#1\relax
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@Relation
    \expandafter\expandafter\expandafter{%
     \expandafter\xmp@Relation\pdfx@insert@sep}%
 \else
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@Relation
    \expandafter\expandafter\expandafter{%
     \expandafter\xmp@Relation\pdfx@insert@sep[#1]}%
 \fi
 \def\afterxmp@parse{%
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@Relation
   \expandafter\expandafter\expandafter{%
    \expandafter\xmp@Relation\xmp@extraRelation}%
   }%
 \xmp@parse{\global\let\xmp@extraRelation\@this}%
 }%

%%\newcommand{\pdfx@extraType}[1][]{%
%%% \show\xmp@Type
%% \ifx\relax#1\relax
%%  \expandafter\expandafter\expandafter\gdef
%%   \expandafter\expandafter\expandafter\xmp@Type
%%    \expandafter\expandafter\expandafter{%
%%     \expandafter\xmp@Type\pdfx@insert@sep}%
%% \else
%%  \expandafter\expandafter\expandafter\gdef
%%   \expandafter\expandafter\expandafter\xmp@Type
%%    \expandafter\expandafter\expandafter{%
%%     \expandafter\xmp@Type\pdfx@insert@sep[#1]}%
%% \fi
%% \def\afterxmp@parse{%
%%  \expandafter\expandafter\expandafter\gdef
%%   \expandafter\expandafter\expandafter\xmp@Type
%%   \expandafter\expandafter\expandafter{%
%%    \expandafter\xmp@Type\xmp@extraType}%
%%   %\show\xmp@Type
%%   }%
%% \xmp@parse{\global\let\xmp@extraType\@this}%
%% }%

```

```
\newcommand{\pdfx@extraAdvisory}[1][]{%
 \ifx\relax#1\relax
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@Advisory
    \expandafter\expandafter\expandafter{%
     \expandafter\xmp@Advisory\pdfx@insert@sep}%
 \else
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@Advisory
    \expandafter\expandafter\expandafter{%
     \expandafter\xmp@Advisory\pdfx@insert@sep[#1]}%
 \fi
 \def\afterxmp@parse{%
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@Advisory
   \expandafter\expandafter\expandafter{%
    \expandafter\xmp@Advisory\xmp@extraAdvisory}%
   }%
 \xmp@parse{\global\let\xmp@extraAdvisory\@this}%
 }%

\newcommand{\pdfx@extraIdentifier}[1][]{%
 \ifx\relax#1\relax
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@Identifier
    \expandafter\expandafter\expandafter{%
     \expandafter\xmp@Identifier\pdfx@insert@sep}%
 \else
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@Identifier
    \expandafter\expandafter\expandafter{%
     \expandafter\xmp@Identifier\pdfx@insert@sep[#1]}%
 \fi
 \def\afterxmp@parse{%
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@Identifier
   \expandafter\expandafter\expandafter{%
    \expandafter\xmp@Identifier\xmp@extraIdentifier}%
   }%
 \xmp@parse{\global\let\xmp@extraIdentifier\@this}%
 }%

\newcommand{\pdfx@extraThumbnails}[1][]{%
 \ifx\relax#1\relax
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@Thumbnails
    \expandafter\expandafter\expandafter{%
     \expandafter\xmp@Thumbnails\pdfx@insert@sep}%
 \else
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@Thumbnails
    \expandafter\expandafter\expandafter{%
```

```
     \expandafter\xmp@Thumbnails\pdfx@insert@sep[#1]}%
 \fi
 \def\afterxmp@parse{%
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@Thumbnails
   \expandafter\expandafter\expandafter{%
    \expandafter\xmp@Thumbnails\xmp@extraThumbnails}%
   }%
 \xmp@parse{\global\let\xmp@extraThumbnails\@this}%
 }%

\newcommand{\pdfx@extraOwner}[1][]{%
 \ifx\relax#1\relax
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@Owner
    \expandafter\expandafter\expandafter{%
     \expandafter\xmp@Owner\pdfx@insert@sep}%
 \else
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@Owner
    \expandafter\expandafter\expandafter{%
     \expandafter\xmp@Owner\pdfx@insert@sep[#1]}%
 \fi
 \def\afterxmp@parse{%
  \expandafter\expandafter\expandafter\gdef
   \expandafter\expandafter\expandafter\xmp@Owner
   \expandafter\expandafter\expandafter{%
    \expandafter\xmp@Owner\xmp@extraOwner}%
   }%
 \xmp@parse{\global\let\xmp@extraOwner\@this}%
 }%

\newcommand{\pdfx@Subject}[1][]{%
 \ifx\relax#1\relax\else\gdef\xmp@lang@Subject{#1}\fi
 \xmp@parse{\global\let\xmp@Subject\@this}}
\newcommand{\pdfx@Producer}[1][]{%
 \ifx\relax#1\relax\else\gdef\xmp@lang@Producer{#1}\fi
 \xmp@parse{\global\let\xmp@Producer\@this}}
\newcommand{\pdfx@Publisher}[1][]{%
 \ifx\relax#1\relax\else\gdef\xmp@lang@Publisher{#1}\fi
 \xmp@parse{\global\let\xmp@Publisher\@this}}
\newcommand{\pdfx@Copyright}[1][]{%
 \ifx\relax#1\relax\else\gdef\xmp@lang@Copyright{#1}\fi
 \xmp@parse{\global\let\xmp@Copyright\@this%
  \ifx\xmp@Copyrighted\@empty\gdef\xmp@Copyrighted{True}\fi}}

\newcommand{\pdfx@Coverage}[1][]{%
 \ifx\relax#1\relax\else\gdef\xmp@lang@Coverage{#1}\fi
 \xmp@parse{\global\let\xmp@Coverage\@this}}

%%  PRISM Text fields
\newcommand{\pdfx@CoverDisplayDate}[1][]{%
```

```
 \ifx\relax#1\relax\else\gdef\xmp@lang@CoverDisplayDate{#1}\fi
 \xmp@parse{\global\let\xmp@CoverDisplayDate\@this}}
\newcommand{\pdfx@JournalTitle}[1][]{%
 \ifx\relax#1\relax\else\gdef\xmp@lang@JournalTitle{#1}\fi
 \ifx\xmp@PublicationType\@empty\gdef\xmp@PublicationType{journal}\fi
 \xmp@parse{\global\let\xmp@JournalTitle\@this}}

%%  Uses PRISM Controlled Vocabulary:
%%    http://prismstandard.org/vocabularies/3.0/aggregationtype.xml
%%  blog, book, bookazine, catalog, feed, journal, magazine, manual
%%  newsletter, newspaper, other, report, pamphlet, vook, whitepaper
%%
\newcommand{\pdfx@PublicationType}[1][]{%
 \ifx\relax#1\relax\else\gdef\xmp@lang@PublicationType{#1}\fi
 \xmp@parse{\global\let\xmp@PublicationType\@this}}

\def\pdfx@localcommands{
 \let\Title\pdfx@Title
 \let\Author\pdfx@Author
 \let\Keywords\pdfx@Keywords
 \let\Subject\pdfx@Subject
 \let\Language\pdfx@Language
 \def\CreatorTool{\xmp@parse{\global\let\xmp@CreatorTool\@this}}
 \let\Producer\pdfx@Producer
 \def\Volume{\xmp@parse{\global\let\xmp@Volume\@this}}
 \def\Issue{\xmp@parse{\global\let\xmp@Issue\@this}}
 \let\CoverDisplayDate\pdfx@CoverDisplayDate
 \def\CoverDate{\xmp@parse{\global\let\xmp@CoverDate\@this}}
 \let\Copyright\pdfx@Copyright
 \def\CopyrightURL{\xmp@parse{\global\let\xmp@CopyrightURL\@this%
   \ifx\xmp@Copyrighted\@empty\gdef\xmp@Copyrighted{True}\fi}}
 \def\Copyrighted{\xmp@parse{\global\let\xmp@Copyrighted\@this}}
 \def\Doi{\xmp@parse{\global\let\xmp@Doi\@this}}
 \def\ISBN{\xmp@parse{\global\let\xmp@ISBN\@this}}
 \def\URLlink{\xmp@parse{\global\let\xmp@URL\@this}}
 \def\Lastpage{\xmp@parse{\global\let\xmp@Lastpage\@this}}
 \def\Firstpage{\xmp@parse{\global\let\xmp@Firstpage\@this}}
 \let\PublicationType\pdfx@PublicationType
 \let\Journaltitle\pdfx@JournalTitle
 \def\Journalnumber{\xmp@parse{\global\let\xmp@Journalnumber\@this}}
 \let\Publisher\pdfx@Publisher
 \let\Coverage\pdfx@Coverage
 \def\Source{\xmp@parse{\global\let\xmp@Source\@this}}
 \let\Contributor\pdfx@Contributor
 \let\Date\pdfx@Date
 \let\Relation\pdfx@Relation
 \let\Advisory\pdfx@Advisory
 \def\BaseURL{\xmp@parse{\global\let\xmp@BaseURL\@this}}
 \let\Identifier\pdfx@Identifier
 \let\Nickname\pdfx@Nickname
 \let\Thumbnails\pdfx@Thumbnails
 \let\Owner\pdfx@Owner
 \def\CertificateURL{\xmp@parse{\global\let\xmp@CertificateURL\@this}}
 \def\MMversionID{\xmp@parse{\global\let\xmpMM@versionID\@this}}
%% \let\Type\pdfx@Type
%%
%% currently unused; for backward compatibility only
 \let\AuthoritativeDomain\pdfx@AuthoritativeDomain
 \let\Creator\CreatorTool  % for backward compatibility
 \let\Org\Publisher        % for backward compatibility
 \let\WebStatement\CopyrightURL  % for backward compatibility
}

%%----------------------------------------------------------------------
%% The following characters and markup can be used within the XMP data
%% defined by \Author, \Title, and so on.
%%
%% * All printable non-whitespace ASCII characters except
%%   '%', '{', '}', '\' can be used as themselves.
%%
%% * All printable non-whitespace UTF-8 encoded Unicode characters
%%   from the basic multilingual plane can be used as themselves.
%%
%% * As usual, consecutive whitespace characters are contracted to a
%%   single space. Whitespace after a macro such as \copyright is
%%   ignored. Blank lines are not permitted.
%%
%% * The following markup can be used:
%%   '\ '        - a literal space  (for example after a macro)
%%   \%          - a literal '%'
%%   \{          - a literal '{'
%%   \}          - a literal '}'
%%   \backslash  - a literal '\'
%%   \copyright  - the (c) copyright symbol
%%
%%   \sep        - only permitted within \Author, \Keywords, \Publisher.
%%
%% * For backward compatibility, \& and \TextCopyright are also
%%   provided. Their use is deprecated.

%%----------------------------------------------------------------------
%% The macro \pdfx@actives binds the active characters
%% '&', '<', and '>' to \pdfx@amp, \pdfx@lt, and \pdfx@gt,
%% respectively, without actually making them active.
\begingroup
 \catcode`\<=13
 \catcode`\>=13
 \catcode`\&=13
 \gdef\pdfx@actives{
  \def&{\pdfx@amp}
  \def<{\pdfx@lt}
  \def>{\pdfx@gt}
 }
\endgroup
```

```

%%-----------------------------------------------------------------------
%% Markup bindings to be used during XMP generation.

{%
 \catcode`\<=12 \catcode`\>=12 \catcode`\/=12 \catcode`\:=12 \catcode`\"=12
\obeyspaces\ifpdfx@useactivespaces%
 \gdef\pdfx@sep {\pdfx@check@lang}%
\else%
 \gdef\pdfx@sep{\pdfx@check@lang}%
\fi%
 \xdef\pdfx@sep@nolang{</rdf:li>^^J     <rdf:li>}%
 \xdef\pdfx@sep@lang[#1]{</rdf:li>^^J     <rdf:li xml:lang="#1">}%
}% end of \obeyspaces and \catcode ....

\def\pdfx@check@lang#1{%
 \ifx[#1\expandafter\@firstoftwo
 \else\expandafter\@secondoftwo\fi
 {\pdfx@sep@lang#1}{\pdfx@sep@nolang#1}}

\def\pdfx@xmpmarkup{%
 \pdfx@actives
 \edef\@amp{\expandafter\@gobble\string\&}%
 \edef\@hash{\expandafter\@gobble\string\#}%
 \edef\ {\expandafter\@gobble\string\ }%
 \edef\%{\expandafter\@gobble\string\%}%
 \edef\{{\expandafter\@gobble\string\{}%
 \edef\}{\expandafter\@gobble\string\}}%
 \edef\backslash{\expandafter\@gobble\string\\}%
 \def\@unicode##1{\@amp\@hash x##1;}%
 \def\pdfx@amp{\@unicode{0026}}%
 \def\pdfx@lt{\@unicode{003c}}%
 \def\pdfx@gt{\@unicode{003e}}%
 \def\copyright{\@unicode{00A9}}%
 \let\&\pdfx@amp               % for backward compatibility
 \let\TextCopyright\copyright   % for backward compatibility
 \let\sep\pdfx@sep
 \pdfx@xmpunimarkup   % only need this when writing XMP
 \the\pdfxsafeforxmp@toks
}

%% cope with active spaces with LGR encoding
%% and the spaces written out with \IeC in KOI8-r
%% It's possible to have both together.
\def\liixu@IeC#1#{\liixu@IeCi}
\def\liixu@IeCi#1{\liixu@IeCii#1}
\def\liixu@IeCii#1#2{#1}
\def\liixu@enableIeC{\ifpdfx@useactivespaces
 \let\IeC\liixu@IeC\else\def\IeC##1{##1}\fi}
\def\liixu@numberline#1#{\liixu@numberlinei}
\def\liixu@numberlinei#1{\liixu@numberlineii#1}
\def\liixu@numberlineii#1{\textLF #1. }
```

```
\def\liixu@enablenumberline{\ifpdfx@useactivespaces
 \let\numberline\liixu@numberline
 \else\def\numberline##1{\textLF ##1. }\fi}

\def\pdfx@xmpunimarkup{%
 \liixu@enableIeC
 \liixu@enablenumberline
 \def\empty{}% used in LICR patterns
 \LIIXUscriptcommands
 \LIIXUtipacommands
 \LIIXUmapTeXnames
%%  from Hyperref's  psdextra.def
 \csname psdmapshortnames\endcsname
 \csname psdaliasnames\endcsname
%% from  lu8enc.def
 \csname LIIXUmapmathletterlikes\endcsname
 \csname LIIXUmapmathspaces\endcsname
 \iflatLATxmp
  \LIIXUmaplatinchars
  \LIIXUcancelfontswitches
 \fi
 \ifmathxmp
  \let\(\textinlinemath
  \let\[\textdisplaymath
  \LIIXUmapmathaccents
  \LIIXUmapisomathgreek
  \LIIXUmapmatharrowsA
  \LIIXUmapmathoperatorsA
  \LIIXUmapmathoperatorsB
  \LIIXUmapmiscmathsymbolsA
  \LIIXUmapsupparrowsA
  \LIIXUmapsupparrowsB
  \LIIXUmapmiscmathsymbolsB
  \LIIXUmapsuppmathoperators
  \LIIXUmapunimathgreek
  \LIIXUmapmathalphabets
 \fi
 \ifarbxmp \LIIXUmaparabicletters\fi
 \ifarmxmp \LIIXUmaparmenianletters\fi
 \ifdevxmp\LIIXUmapdevaccents\fi
 \ifgrkxmp \LIIXUmapgreekletters\fi
 \ifhebxmp \LIIXUmaphebrewletters\fi
}

%% In case macros are used in XMP Metadata, need a way to map these
%% to simple text, rather than specific font characters, or whatever:
\newtoks\pdfxsafeforxmp@toks
\def\pdfxEnableCommands{%   user command
 \begingroup
  \ifpdfx@useactivespaces\obeyspaces\fi
  \pdfx@EnableCommands
}
```

```
\def\pdfx@EnableCommands#1{%   internal command
 \expandafter\global\expandafter\pdfxsafeforxmp@toks
  \expandafter{\the\pdfxsafeforxmp@toks#1}%
 \endgroup
}

%%-------------------------------------------------------------------
%% Markup bindings to be used during PDF string generation.

\def\pdfx@pdfmarkup{%
 \pdfx@actives
 \edef\%{\expandafter\@gobble\string\%}%
 \edef\{{\expandafter\@gobble\string\{}%
 \edef\}{\expandafter\@gobble\string\}}%
 \edef\pdfx@backslash{\expandafter\@gobble\string\\}%
 \def\backslash{\pdfx@backslash000\pdfx@backslash134}%
 \edef\pdfx@amp{\expandafter\@gobble\string\&}%
 \edef\pdfx@lt{\expandafter\@gobble\string\<}%
 \edef\pdfx@gt{\expandafter\@gobble\string\>}%
 \let\TextCopyright\copyright  % for backward compatibility
 \def\sep{; }%
 %\let\sep\pdfx@sep
%% Note: '\ ', \&, \copyright are already predefined by hyperref.
%% allow LICRs to expand into PDF strings
 \def\cf@encoding{PU}%
 \def\9##1{\ifcase##1\string\0\or\string\1\or\string\2\or\string\3\fi}%
 \def\8{\string\00}%
 \def\0{\string\0}\def\1{\string\1}\def\2{\string\2}\def\3{\string\3}%
 \pdfx@xmpunimarkup
 \the\pdfxsafeforxmp@toks
}

%%-------------------------------------------------------------------
%% Defaults
\ifxetex
 \def\xmp@Producer{XeTeX}
\else\ifluatex
 \def\xmp@Producer{LuaTeX}
\else
 \def\xmp@Producer{pdfTeX}
\fi\fi
\global\let\pdfxProducer\xmp@Producer

\global\let\xmp@CreatorTool\@empty
\global\let\xmp@Title\@empty
\global\let\xmp@Author\@empty
\global\let\xmp@Keywords\@empty
\global\let\xmp@Subject\@empty
\global\let\xmp@Language\@empty
\global\let\xmp@Volume\@empty
\global\let\xmp@Issue\@empty
\global\let\xmp@CoverDisplayDate\@empty
```

```
\global\let\xmp@CoverDate\@empty
\global\let\xmp@Copyright\@empty
\global\let\xmp@Copyrighted\@empty
\global\let\xmp@CopyrightURL\@empty
\gdef\xmp@WebStatement{\xmp@CopyrightURL}
\global\let\xmp@Doi\@empty
\global\let\xmp@ISBN\@empty
\global\let\xmp@URL\@empty
\global\let\xmp@Lastpage\@empty
\global\let\xmp@Firstpage\@empty
\global\let\xmp@PublicationType\@empty
\global\let\xmp@Journaltitle\@empty
\global\let\xmp@Journalnumber\@empty
%%\global\let\xmp@Type\@empty
\global\let\xmp@Contributor\@empty
\global\let\xmp@Coverage\@empty
\global\let\xmp@Date\@empty
\global\let\xmp@Relation\@empty
\global\let\xmp@Source\@empty
\global\let\xmp@Publisher\@empty
\gdef\xmp@Org{\xmp@Publisher}
\global\let\xmp@AuthoritativeDomain\@empty
\global\let\xmp@Advisory\@empty
\global\let\xmp@BaseURL\@empty
\global\let\xmp@Identifier\@empty
\global\let\xmp@Nickname\@empty
\global\let\xmp@Thumbnails\@empty
\global\let\xmp@Owner\@empty
\global\let\xmp@CertificateURL\@empty

%%----------------------------------------------------------------------
%%  Alternative way to get the CreationDate using Lua  for XeTeX
\ifdefined\pdfcreationdate\else
 \begingroup  %% ensure correct catcodes, not done by \dospecials
 \catcode`\:=12 \catcode`\.=12
\begin{filecontents*}{creationdate.lua}
 os.remove("creationdate.timestamp")
 io.output("creationdate.timestamp"):write(os.date("\\edef\\tempa{\\string D:%Y%m%d%
\end{filecontents*}
 \endgroup
 \ifnum\shellescape=1
  \begingroup  %% ensure correct catcodes when file is read in
   \catcode`\'=12 \catcode`\.=12 \catcode`\:=12 \catcode`\+=12
   \immediate\write18{texlua creationdate.lua}
   \input{creationdate.timestamp}
   \def\tempc#1#2#3#4#5{#1#2#3'#4#5'}
   \edef\tempb{\expandafter\tempc\tempb}
   \edef\x{\endgroup\def\noexpand\pdfcreationdate{\tempa\tempb}}\x
 \else
  \begingroup  %% ensure correct catcodes in the error/warning messages
  \catcode`\<=12 \catcode`\>=12 \catcode`\"=12 \catcode`\-=12
  \catcode`\: 12 \catcode`\' 12 \catcode`\= 12
  \ifpdfx@noerr
   \PackageWarning{pdfx}{%
    CreationDate is not properly supported;^^J
    PDF validation may fail. To avoid this problem use:^^J
     xelatex -shell-escape  -output-driver="xdvipdfmx -z 0" <filename>^^J}
  \else
   \PackageError{pdfx}{%
    CreationDate is not properly supported;^^J
    PDF validation may fail.}{To avoid this problem use:^^J
     xelatex -shell-escape  -output-driver="xdvipdfmx -z 0" <filename> }
  \fi
  %% Using a constant date, to allow processing to finish smoothly.
  \edef\x{\endgroup
   \def\noexpand\pdfcreationdate{\string D:20181028075445+10'00'}}%
   \x
 \fi
\fi

%%-----------------------------------------------------------------------
\def\pdfx@findUUID#1{\edef\pdfx@tmpstring{\pdfx@mdfivesum{#1}}
     \expandafter\pdfx@eightofnine\pdfx@tmpstring\end}
\def\pdfx@eightofnine#1#2#3#4#5#6#7#8#9\end{%
     \xdef\pdfx@eightchars{#1#2#3#4#5#6#7#8}
     \pdfx@fouroffive#9\end}
\def\pdfx@fouroffive#1#2#3#4#5\end{\xdef\pdfx@ffourchars{#1#2#3#4}
     \pdfx@sfouroffive#5\end}
\def\pdfx@sfouroffive#1#2#3#4#5\end{\xdef\pdfx@sfourchars{#1#2#3#4}
     \pdfx@tfouroffive#5\end}
\def\pdfx@tfouroffive#1#2#3#4#5\end{\xdef\pdfx@tfourchars{#1#2#3#4}
     \xdef\pdfx@laststring{#5}}

\def\pdfx@uuid{\pdfx@eightchars-%
          \pdfx@ffourchars-%
          \pdfx@sfourchars-%
          \pdfx@tfourchars-%
          \pdfx@laststring}

\expandafter\ifx\csname pdfx@mdfivesum\endcsname\relax
  \PackageError{pdfx}{%
    No implementation for \string\pdfx@mdfivesum.^^J
    \ifxetex XeTeX needs to be 2015 or later\fi
   }{%
    Continue without, but the PDF will not validate.
   }%
 \def\xmp@docid{}%
 \def\pdfx@findUUID#1{}%
 \def\pdfx@uuid{}%
\else
 \pdfx@findUUID{\jobname.pdf}
 \edef\xmp@docid{\pdfx@uuid}
\fi

```

```
\expandafter\ifx\csname pdfcreationdate\endcsname\relax\relax
  \PackageWarning{pdfx}{%
   No implementation for \string\pdfxcreation .
  }%
 \def\xmp@instid{}%
%%
\else   %% use the MD5 sum methods
%%
 \pdfx@findUUID{\pdfcreationdate}%
 \edef\xmp@instid{\pdfx@uuid}
\fi

%%----------------------------------------------------------------------
%% load  xcolor  before  hyperref  to get the link colors correct
%%
\PassOptionsToPackage{nosetpagesize}{color}
\PassOptionsToPackage{nosetpagesize}{graphics}
\@ifpackageloaded{xcolor}{%
 % Beamer will have already loaded  xcolor
 % need to understand what options it used
}{
\ifpdfx@x
 \RequirePackage[cmyk,hyperref]{xcolor}
\else
 \RequirePackage[rgb,hyperref]{xcolor}
\fi
}%

%%  loading  puenc.def  will kill a lot of what  mathtext.sty  established
\@ifpackageloaded{mathtext}{%
 \PackageWarningNoLine{pdfx}{pdfx.sty  and hyperref.sty should be loaded^^J
  before mathtext.sty , otherwise text symbols may not show in math mode.}%
}{}

\newif\ifpdfx@hluatex
\IfFileExists{hluatex.def}{\pdfx@hluatextrue}{\pdfx@hluatexfalse}

%% the "pdftex" option seems to work fine with LuaTeX
\def\pdfx@luatest{\ifpdfx@hluatex luatex\else pdftex \fi}

%% Hyperref options for PDF/X
\edef\pdfx@pdfX@opts@pdftex{%
   draft,pdftex,pdfpagemode=UseNone,bookmarks=false,%
   pdfversion=1.\thepdfminorversion,pdfstartview=}
\edef\pdfx@pdfX@opts@xetex{%
   draft,xetex,pdfpagemode=UseNone,bookmarks=false,%
   pdfversion=1.\thepdfminorversion,pdfstartview=}
 \edef\pdfx@pdfX@opts@luatex{%
   draft,\pdfx@luatest,pdfpagemode=UseNone,bookmarks=false,%
   pdfversion=1.\thepdfminorversion,pdfstartview=}%

\newif\ifpdfx@hyperrefloaded
```

```
\expandafter\ifx\csname ifHy@pdfa\endcsname\relax\else\pdfx@hyperrefloadedtrue\fi

%% Hyperref options for PDF/A and PDF/E
\newtoks\pdfx@tmptoks
\pdfx@tmptoks{%
\ifHy@pdfa
   \edef\pdfx@pdfAE@opts@pdftex{pdftex}%
   \edef\pdfx@pdfAE@opts@xetex{xetex,pdfversion=1.\thepdfminorversion}%
   \edef\pdfx@pdfAE@opts@luatex{\pdfx@luatest,pdfversion=1.\thepdfminorversion}%
   \edef\pdfx@pdfAE@opts@pdfmark{pdfmark,pdfversion=1.\thepdfminorversion}%
  \else
   \edef\pdfx@pdfAE@opts@pdftex{pdftex,pdfa}%
   \edef\pdfx@pdfAE@opts@xetex{xetex,pdfa,pdfversion=1.\thepdfminorversion}%
   \edef\pdfx@pdfAE@opts@luatex{\pdfx@luatest,pdfa,pdfversion=1.\thepdfminorversion}
   \edef\pdfx@pdfAE@opts@pdfmark{pdfmark,pdfa,pdfversion=1.\thepdfminorversion}%
  \fi
}
\ifpdfx@hyperrefloaded
 \the\pdfx@tmptoks\relax
\else
 \edef\pdfx@pdfAE@opts@pdftex{pdftex,pdfa}%
 \edef\pdfx@pdfAE@opts@xetex{xetex,pdfa,pdfversion=1.\thepdfminorversion}%
 \edef\pdfx@pdfAE@opts@luatex{\pdfx@luatest,pdfa,pdfversion=1.\thepdfminorversion}%
 \edef\pdfx@pdfAE@opts@pdfmark{pdfmark,pdfa,pdfversion=1.\thepdfminorversion}%
\fi
\pdfx@tmptoks{}%

\ifpdfx@x
 \@ifpackageloaded{hyperref}{%
  \ifxetex
   \expandafter\hypersetup\expandafter{\pdfx@pdfX@opts@xetex}
  \else\ifluatex
   \expandafter\hypersetup\expandafter{\pdfx@pdfX@opts@luatex}
  \else
   \expandafter\hypersetup\expandafter{\pdfx@pdfX@opts@pdftex}
  \fi\fi
 }{%
  \ifxetex
   \expandafter\RequirePackage\expandafter[\pdfx@pdfX@opts@xetex]{hyperref}
  \else\ifluatex
   \expandafter\RequirePackage\expandafter[\pdfx@pdfX@opts@luatex]{hyperref}
  \else
   \expandafter\RequirePackage\expandafter[\pdfx@pdfX@opts@pdftex]{hyperref}
  \fi\fi
 }%
\else
 \ifpdfx@e
  \@ifpackageloaded{hyperref}{%
   \ifxetex
    \expandafter\hypersetup\expandafter{\pdfx@pdfAE@opts@xetex}
   \else\ifluatex
    \expandafter\hypersetup\expandafter{\pdfx@pdfAE@opts@luatex}
   \else
    \expandafter\hypersetup\expandafter{\pdfx@pdfAE@opts@pdftex}
   \fi\fi
  }{%
   \ifxetex
    \expandafter\RequirePackage\expandafter[\pdfx@pdfAE@opts@xetex]{hyperref}
   \else\ifluatex
    \expandafter\RequirePackage\expandafter[\pdfx@pdfAE@opts@luatex]{hyperref}
   \else
    \expandafter\RequirePackage\expandafter[\pdfx@pdfAE@opts@pdftex]{hyperref}
   \fi\fi
  }%
 \else % generating PDF/A or ...
  \@ifpackageloaded{hyperref}{%
   \ifxetex
    \expandafter\hypersetup\expandafter{\pdfx@pdfAE@opts@xetex}%
   \else\ifluatex
    \expandafter\hypersetup\expandafter{\pdfx@pdfAE@opts@luatex}%
   \else
    \expandafter\hypersetup\expandafter{\pdfx@pdfAE@opts@pdftex}%
   \fi\fi
  }{%
   \ifxetex
    \expandafter\RequirePackage\expandafter[\pdfx@pdfAE@opts@xetex]{hyperref}
   \else\ifluatex
    \expandafter\RequirePackage\expandafter[\pdfx@pdfAE@opts@luatex]{hyperref}
   \else
    \expandafter\RequirePackage\expandafter[\pdfx@pdfAE@opts@pdftex]{hyperref}
   \fi\fi
 }%
\fi\fi
\hypersetup{pdfencoding=auto}%  unicode
\expandafter\ifx\csname KV@Hyp@psdextra\endcsname\relax\else
 \hypersetup{psdextra}
\fi

%% hyperref doesn’t set the minor version for XeTeX
\ifxetex
 \special{pdf:minorversion \thepdfminorversion}
\fi

\ifx\xmp@CreatorTool\@empty
 \edef\xmp@CreatorTool{\@pdfcreator}
\fi

\newif\ifpdfx@cmyk
\newif\ifpdfx@custom
\ifpdfx@x   %  PDF/X  normally needs a CMYK color profile for printing
 \global\pdfx@cmyktrue
\fi
%%-----------------------------------------------------------------------
%% -----   Color Profiles   -------
%% Define how to specify the profile, so the default
%% can be over-ridden in the  .xmpdata  file.
%%
%%   --- user-command ---   RGB profile needed with  PDF/A-??
%% \setRGBcolorprofile{<filename>}{<identifier>}
%%    {<info string>}{<registry URL>}
\def\setRGBcolorprofile{%
 \begingroup
  \catcode`\_ 11\relax\catcode`\& 11\relax\catcode`\~ 11\relax
  \catcode`\% 11\relax
  \edef\({\string\(}\edef\){\string\)}%
  \pdfx@setrgbprofile}
%%
%%  --- user-command ---   CMYK profile needed with  PDF/X-??
%% \setCMYKcolorprofile{<filename>}{<output intent>}
%%    {<identifier>}{<registry URL>}
\def\setCMYKcolorprofile{%
 \begingroup
  \catcode`\_ 11\relax\catcode`\& 11\relax\catcode`\~ 11\relax
  \catcode`\% 11\relax
  \edef\({\string\(}\edef\){\string\)}%
  \pdfx@setcmykprofile}
%%
%%  --- user-command ---   DeviceGray profile needed with  PDF/E-1
%% \setGRAYcolorprofile{<filename>}{<output intent>}
%%    {<identifier>}{<registry URL>}
\def\setGRAYcolorprofile{%
 \begingroup
  \catcode`\_ 11\relax\catcode`\& 11\relax\catcode`\~ 11\relax
  \catcode`\% 11\relax
  \edef\({\string\(}\edef\){\string\)}%
  \pdfx@setgrayprofile}
%%
%%  --- user-command ---  External profile with  PDF/X-4p and PDF/X-5pg
%% \setEXTERNALprofile{<profilename>}{<output intent>}
%%    {<identifier>}{<registry URL>}{<color-space>}%
%%    {<ICC Version>}{<provider URL>}{<extra info>}{<Check Sum>}
\def\setEXTERNALprofile{%
 \begingroup
  \catcode`\_ 11\relax\catcode`\& 11\relax\catcode`\~ 11\relax
  \catcode`\% 11\relax
  \edef\({\string\(}\edef\){\string\)}%
  \ifno@iccprofile
   \expandafter\pdfx@externalprofile
   \else
    \expandafter\pdfx@externalprofile@gobble
   \fi
  }
%%
%%
\def\pdfx@setRGBcolorprofiledir#1{%
 \xdef\pdfx@RGBcolorprofiledir{#1}%
```

```
}
\def\pdfx@setCMYKcolorprofiledir#1{%
 \xdef\pdfx@CMYKcolorprofiledir{#1}%
}
\pdfx@setRGBcolorprofiledir{}
\pdfx@setCMYKcolorprofiledir{}

%% This does indeed work!  Use it in  .xmpdata  files
\providecommand{\MacOSColordir}{/System/Library/ColorSync/Profiles/}
\providecommand{\MacOSLibraryColordir}{/Library/ColorSync/Profiles/}
\providecommand{\AdobeMacOSdir}%
  {/Library/Application Support/Adobe/Color/Profiles/Recommended/}
\edef\pdfx@tmp{C:\string\Windows\string\System32\string\Spool%
  \string\Drivers\string\Color\string/}
\expandafter\providecommand\expandafter
  {\expandafter\WindowsColordir\expandafter}\expandafter{\pdfx@tmp}
%%\pdfx@setcolorprofiledir{\AdobeMacOSdir}

%% overide that value using the following commands:
\let\pdfxSetCMYKcolorProfileDir\pdfx@setCMYKcolorprofiledir
\let\pdfxSetRGBcolorProfileDir\pdfx@setRGBcolorprofiledir
%%  for back-compatibility
\let\pdfxSetColorProfileDir\pdfxSetCMYKcolorProfileDir
%%
\def\pdfx@setrgbprofile#1#2#3#4{%
 \xdef\pdfx@rgb@profile{\pdfx@RGBcolorprofiledir#1}%  valid file path/name
 \xdef\pdfx@rgb@profilename{#1}%  valid file name
 \gdef\pdfx@rgb@identifier{#2}%
 \gdef\pdfx@rgb@info{#3}%
 \pdfstringdef\pdfx@rgb@registry{#4}%  valid URL
 \endgroup
 \global\pdfx@cmykfalse
 }%  closes-off  \setRGBcolorprofile
%%
\def\pdfx@setcmykprofile#1#2#3#4{%
 \xdef\pdfx@cmyk@profile{\pdfx@CMYKcolorprofiledir#1}%  valid file path/name
 \xdef\pdfx@cmyk@profilename{#1}%  valid file name
%% \expandafter\gdef\expandafter\pdfx@cmyk@profile\expandafter
%%    {\pdfx@colorprofiledir#1}%  valid file name
 \gdef\pdfx@cmyk@intent{#2}%
%% \pdfstringdef\pdfx@cmyk@intent{#2}%  color intent
 \gdef\pdfx@cmyk@identifier{#3}%
%% \pdfstringdef\pdfx@cmyk@identifier{#3}%  text string identifier
 \gdef\pdfx@cmyk@registry{#4}%
%% \pdfstringdef\pdfx@cmyk@registry{#4}%  valid URL
 \endgroup
 \global\pdfx@cmyktrue
 }%  closes-off  \setcmykcolorprofile
%%
\def\setCUSTOMcolorprofile{%
 \begingroup
  \catcode`\_ 11\relax\catcode`\& 11\relax\catcode`\~ 11\relax
  \catcode`\% 11\relax
  \edef\({\string\(}\edef\){\string\)}%
  \pdfx@setcustomprofile
}
\def\pdfx@setcustomprofile#1#2#3#4#5#6#7#8{%
 \xdef\pdfx@customcolorprofiledir{#2}% valid directory location
 \xdef\pdfx@custom@profile{#1}%  valid file name
 \gdef\pdfx@custom@identifier{#3}%
 \gdef\pdfx@custom@registry{#4}%
 \gdef\pdfx@custom@numcolors{#5}% num-colors specifier
 \gdef\pdfx@iccversion{#6}%  Hex string for /ICCVersion < ... >
 \gdef\pdfx@custom@colornames{#7}%
 \gdef\pdfx@profile@checksum{#8}%  Hex string for /CheckSum < ... >
\endgroup
 \global\pdfx@cmykfalse
 \global\pdfx@customtrue
 }%  closes-off  \pdfx@setcustomprofile
%%
\def\pdfx@setgrayprofile#1#2#3#4{%
 \gdef\pdfx@gray@profile{#1}%  valid file name
 \gdef\pdfx@gray@intent{#2}%
 \gdef\pdfx@gray@identifier{#3}%
 \pdfstringdef\pdfx@gray@registry{#4}%  valid URL
 \endgroup}%  closes-off  \setGRAYcolorprofile
%%
\def\pdfx@externalprofile#1#2#3#4#5#6#7#8#9{%
 \gdef\pdfx@extprofile{#1}% PDF string for /ProfileName
 \gdef\pdfx@cmyk@intent{#2}% PDF string for /OutputCondition
 \gdef\pdfx@cmyk@identifier{#3}% PDF string for /OutputConditionIdentifier
 \gdef\pdfx@cmyk@registry{#4}% {http://www.color.org}%
 \gdef\pdfx@profileCS{#5}%  4 bytes for /ProfileCS
 \gdef\pdfx@iccversion{#6}%  Hex string for /ICCVersion < ... >
 \gdef\pdfx@colorURL{#7}%  URL
 \gdef\pdfx@cmyk@info{#8}%  for /Info
 \gdef\pdfx@profile@checksum{#9}%  Hex string for /CheckSum < ... >
 \endgroup}%  closes-off  \setEXTERNALprofile
\def\pdfx@externalprofile@gobble#1#2#3#4#5#6#7#8#9{%
  \PackageError{pdfx}{Wrong option for using an External Color profile}%
   {Use one of the options: x-4p , x-4p08 , x-4p10 or  x-5pg .}%
 \endgroup}
%%
%% default color profiles

{\catcode`\_ 12 \catcode`\& 12 \catcode`\~ 12
 \gdef\pdfx@xprofile@cmykdefault{coated_FOGRA39L_argl.icc}
 \gdef\pdfx@aprofile@rgbdefault{sRGB_IEC61966-2-1_black_scaled.icc}
 \gdef\pdfx@eprofile@graydefault{Gray_linear.icc}
 \gdef\pdfx@pprofile@externaldefault{FOGRA39}
}% end of \catcode
\xdef\pdfx@rgb@profile{\pdfx@aprofile@rgbdefault}
\xdef\pdfx@cmyk@profile{\pdfx@xprofile@cmykdefault}
\xdef\pdfx@gray@profile{\pdfx@eprofile@graydefault}
```

```
\xdef\pdfx@external@profile{\pdfx@pprofile@externaldefault}

%%-----------------------------------------------------------------------
%% License for the file  sRGB_IEC61966-2-1_black_scaled.icc :
%%
%% Copyright International Color Consortium, 2009  -- http://www.color.org/
%%
%% It is hereby acknowledged that the file "sRGB_IEC61966-2-1_black_scaled.icc"
%% is provided "AS IS" WITH NO EXPRESS OR IMPLIED WARRANTY.
%%
%% Licensing
%%
%% This profile is made available by the International Color Consortium,
%% and may be copied, distributed, embedded, made, used, and sold without
%% restriction. Altered versions of this profile shall have the original
%% identification and copyright information removed and shall not be
%% misrepresented as the original profile.
%%
%% Terms of use
%%
%% To anyone who acknowledges that the file "sRGB_IEC61966-2-1_black_scaled.icc"
%% is provided "AS IS" WITH NO EXPRESS OR IMPLIED WARRANTY, permission to use,
%% copy and distribute these file for any purpose is hereby granted without fee,
%% provided that the file is not changed including the ICC copyright notice tag,
%% and that the name of ICC shall not be used in advertising or publicity
%% pertaining to distribution of the software without specific, written prior
%% permission. ICC makes no representations about the suitability of this
%% software for any purpose.
%%
%%-----------------------------------------------------------------------

\newif\ifpdfx@tryoldprofiles

%%  The  colorprofiles package was added to  TeXLive  in October 2018.
%%  It allows the default Color Profiles to be maintained independent
%%  of the  pdfx  package.
%%  In particular  sRGB_IEC61966-2-1_black_scaled.icc  is no longer
%%  distributed with TeXLive 2018 and later.
%%  Older versions still have this file.
%%
\IfFileExists{colorprofiles.tex}{%
  \RequirePackage{colorprofiles}[2018/11/01]%
  \ifx\colorpro@rgb@profile\relax
    \expandafter\pdfx@tryoldprofilestrue
   \else
    \begingroup %%  \endgroup occurs within the macro expansion
     \pdfx@setrgbprofile{\colorpro@rgb@profile
     }{\colorpro@rgb@identifier
     }{\colorpro@rgb@info
     }{\colorpro@rgb@registry
     }%
    \begingroup %%  \endgroup occurs within the macro expansion
    \pdfx@setcmykprofile{\colorpro@cmyk@profile
     }{\colorpro@cmyk@intent
     }{\colorpro@cmyk@identifier
     }{\colorpro@cmyk@registry
     }%
    \expandafter\pdfx@tryoldprofilesfalse
   \fi
}{%
 \PackageWarning{pdfx}{%
   The ’colorprofiles’ package is not installed correctly.^^J
   File  ’colorprofiles.tex’  is missing. Proceeding without it.
 }%
 \pdfx@tryoldprofilestrue
}

{\catcode‘\| 14 \catcode‘\% 12 \catcode‘\_ 12 \catcode‘\: 12
 \catcode‘\. 12 \catcode‘\- 12 \catcode‘\/ 12
 \edef\@bchar{\expandafter\@gobble\string\\}|
 \edef\({\string\(}\edef\){\string\)}|
\ifpdfx@tryoldprofiles
 || this will be used by TeXLive installations up to 2017.
 \begingroup | \endgroup occurs within the macro expansion
\expandafter\pdfx@setrgbprofile\expandafter
 {sRGB_IEC61966-2-1_black_scaled.icc}|
 {sRGB_IEC61966-2-1_black_scaled}|
 {sRGB IEC61966 v2.1 with black scaling}|
 {http://www.color.org}|
 \begingroup | \endgroup occurs within the macro expansion
\pdfx@setcmykprofile{coated_FOGRA39L_argl.icc}| coated_FOGRA39L_argl.icc
 {Coated FOGRA39}|
 {FOGRA39 \string\(ISO Coated v2 300%\space \string\(ECI\string\)\string\)}|
 {http://www.argyllcms.com/}|{http://www.color.org}|
\fi  ||  end of   \ifpdfx@tryoldprofiles
 \begingroup | \endgroup occurs within the macro expansion
\pdfx@setgrayprofile{Gray_linear.icc}|
 {}|
 {Custom}|
 {http://www.freedesktop.org/wiki/OpenIcc}|
\ifno@iccprofile
 \begingroup | \endgroup occurs within the macro expansion
  \pdfx@externalprofile{Coated FOGRA39 \(ISO 12647-2:2004\)}|
   {Offset commercial and specialty printing according to ISO 12647-2:2004 |
    / Amd 1, paper type 1 or 2 \(gloss or matte coated offset, 115 g/m2\), |
    screen frequency 60/cm.}|
   {FOGRA39}{http://www.color.org}{CMYK}{02100000}{http://www.adobe.com}|
   {Coated FOGRA39 \(ISO 12647-2:2004\)}{74FF62F330BF0DBE4495B5720542D511}|
\fi
}% end of \catcode

%%
%%----------------------------------------------------------------------
%% License for the file  coated_FOGRA39L_argl.icc :
```

```
%%
%% The zlib/libpng License
%%
%% Copyright (c) 2008 Kai-Uwe Behrmann
%%
%% This software is provided 'as-is', without any express or implied
%% warranty. In no event will the authors be held liable for any damages
%% arising from the use of this software.
%%
%% Permission is granted to anyone to use this software for any purpose,
%% including commercial applications, and to alter it and redistribute
%% it freely, subject to the following restrictions:
%%
%%    1. The origin of this software must not be misrepresented; you
%%    must not claim that you wrote the original software. If you use
%%    this software in a product, an acknowledgment in the product
%%    documentation would be appreciated but is not required.
%%
%%    2. Altered source versions must be plainly marked as such, and
%%    must not be misrepresented as being the original software.
%%
%%    3. This notice may not be removed or altered from any source
%%    distribution.
%%----------------------------------------------------------------------

\newif\ifexternalICCprofiles
\newif\ifpdfx@noXMPdata

\begingroup
%% override unneeded color-profile specifier
 \ifpdfx@x
  \ifno@iccprofile %  PDF/X-4p and PDF/X-5pg  PDF/VT-2
   \begingroup
    \def\pdfx@extprofiles@store{AdobeExternalProfiles.tex}%
    \InputIfFileExists{\pdfx@extprofiles@store}%
     {\global\externalICCprofilestrue \catcode `\# 12\relax}%
     {\typeout{** pdfx: No file \pdfx@extprofiles@store\space
       found for PDF/X-4p or PDF/X-5pg}}%
   \endgroup
  \else
   \begingroup
    \def\pdfx@profiles@store{AdobeColorProfiles.tex}%
    \InputIfFileExists{\pdfx@profiles@store}%
     {\global\externalICCprofilesfalse \catcode `\# 12\relax}%
     {\typeout{** pdfx: No file \pdfx@profiles@store\space
       found for PDF/X variants}}%
   \endgroup
%%   \def\setRGBcolorprofile#1#2#3#4{%
%%    \PackageError{pdfx}{PDF/X requires a CMYK color profile}%
%%     {Just continue using the default CMYK profile.^^J}}%
  \fi
 \else
```

```
%% load it, in case the macros are used in .xmpdata
  \InputIfFileExists{AdobeColorProfiles.tex}{}{}%
  \ifpdfx@e
  \else
   \def\setCMYKcolorprofile#1#2#3#4{}%
   \def\setGRAYcolorprofile#1#2#3#4{}%
 \fi\fi
%%
 \ifluatex\else\ifxetex\else
  \inputencoding{8bit}%
 \fi\fi
 \makeatletter
 \pdfx@localcommands
%% Do this in a box, so any stray characters don't get into TeX's lists.
\setbox0\hbox{%
 \InputIfFileExists{\jobname.xmpdata}%
  {\typeout{** pdfx: Metadata file \jobname.xmpdata  read successfully.}}%
  {\typeout{** pdfx: No file  \jobname.xmpdata .
    Metadata will be incomplete!}\aftergroup\pdfx@noXMPdatatrue}}
\endgroup
%% ----------------------------------------------------------------------

\def\pdfx@LanguageSpec{}
\def\pdfx@mainLanguage{en-US}%  absolute default
\def\pdfx@checkfor@sep#1#2\sep#3\pdfx@endparse{\def#1{#2}}
\ifx\@empty\xmp@Language\else
 \expandafter\pdfx@checkfor@sep\expandafter\pdfx@mainLanguage\xmp@Language
  \sep\pdfx@endparse
\fi
\edef\pdfx@LanguageSpec{/Lang (\pdfx@mainLanguage)}

%% ----------------------------------------------------------------------
\begingroup
 \catcode`\_ 12 \catcode`\" 12 \catcode`\' 12
 \catcode`\< 12 \catcode`\> 12 \catcode`\/ 12 \catcode`\[ 12 \catcode`\] 12
 \edef\@pctchar{\expandafter\@gobble\string\%}
 \edef\@bchar{\expandafter\@gobble\string\\}
 \edef\0{\string\0}
 \edef\({\string\(}
 \edef\){\string\)}
%%
 \def\pdfx@outcatalog@dict{%
  \pdfx@LanguageSpec
  /ViewerPreferences <</DisplayDocTitle true >>
  /OutputIntents \pdfx@outintents % needs appropriate expansion
 }%
\ifpdfx@x   %  PDF/X  needs a CMYK or RGB color profile for printing
 \ifno@iccprofile %  PDF/X-4p and PDF/X-5pg
%%
%% URL and metadata for the desired external Color Profile
%%
  \edef\pdfx@colorURL@dict{<</FS/URL/F(\pdfx@colorURL)>>}
  \def\pdfx@colorprofile@dict{<< %
     /CheckSum <\pdfx@profile@checksum>^^J%
     /ICCVersion <\pdfx@iccversion>%
     /ProfileCS (\pdfx@profileCS)^^J%
     /ProfileName (\pdfx@extprofile)^^J%
     /URLs [\OBJ@URLs] >>
  }
%% How to specify the PDF objects with different drivers
  \ifxetex
   \def\OBJ@URLs{ @colorURL }%
   \def\OBJ@ICC{ @colorprofile }%
   \immediate\special{pdf:obj \OBJ@URLs \pdfx@colorURL@dict }%
   \immediate\special{pdf:obj \OBJ@ICC \pdfx@colorprofile@dict }%
  \else %  pdfTeX & LuaTeX
   \immediate\pdfobj{\pdfx@colorURL@dict}%
   \edef\OBJ@URLs{\the\pdflastobj\space 0 R}%
   \immediate\pdfobj{\pdfx@colorprofile@dict}%
   \edef\OBJ@ICC{\the\pdflastobj\space 0 R}%
  \fi
%%  Output Intent dictionary, with object reference
  \edef\pdfx@outintent@dict{%
    /Type/OutputIntent
    /S/GTS_PDFX^^J
    /OutputCondition (\pdfx@cmyk@intent)^^J
    /OutputConditionIdentifier (\pdfx@cmyk@identifier)^^J
    /Info(\pdfx@cmyk@intent)^^J
    /RegistryName(\pdfx@cmyk@registry)^^J
%% extra dictionary required for  PDF/X-4p and PDF/X-5pg
    /DestOutputProfileRef \OBJ@ICC
  }%
%%
 \else   %  PDF/X-1 , PDF/X-1a , PDF/X-3 , PDF/X-4 , PDF/X-5g
%%
  \ifpdfx@cmyk
   \IfFileExists{"\pdfx@cmyk@profile"}{%
  %  embedded CMYK color profile
  %%
  %%  Output Intent dictionary, with object reference
  \def\pdfx@outintent@dict{%
    /Type/OutputIntent
    /S/GTS_PDFX^^J
    /OutputCondition (\pdfx@cmyk@intent)^^J
    /OutputConditionIdentifier (\pdfx@cmyk@identifier)^^J
    /Info(\pdfx@cmyk@intent)^^J
    /RegistryName(\pdfx@cmyk@registry)
    /DestOutputProfile \OBJ@CMYK
   }%
  \def\pdfx@numcoords{/N 4}%
%%
  \ifxetex
   \def\OBJ@CMYK{@colorprofile}%
   \immediate\special{%
```

```
     pdf:fstream \OBJ@CMYK (\pdfx@cmyk@profile) <<\pdfx@numcoords >>}%
  \else % pdfTeX
   \immediate\pdfobj stream attr{\pdfx@numcoords} file {\pdfx@cmyk@profile}%
   \edef\OBJ@CMYK{\the\pdflastobj\space 0 R}%
  \fi
  \pdfcatalog{%
   \pdfx@LanguageSpec
   /OutputIntents [ <<
   /Type/OutputIntent
   /S/GTS_PDFX
   /OutputCondition (\pdfx@cmyk@intent)%
   /OutputConditionIdentifier (\pdfx@cmyk@identifier)%
   /Info(\pdfx@cmyk@intent)%
   /RegistryName(\pdfx@cmyk@registry)
   /DestOutputProfile \OBJ@CMYK
   >> ]}%
  }{%
   \PackageError{pdfx}{No color profile \pdfx@cmyk@profilename\space found
     to use for CMYK printing colors.}%
     {Is this the correct directory: \pdfx@CMYKcolorprofiledir\space  ?}%
  }% end of \IfFileExists for CMYK
  \else\ifpdfx@custom
%%  allow Custom profile with PDF/X-5n
   \IfFileExists{"\pdfx@customcolorprofiledir\pdfx@custom@profile"}{%
%%  embedded Custom color profile
%%
  %%  Output Intent dictionary, with object reference
  \def\pdfx@outintent@dict{%
    /Type/OutputIntent
    /S/GTS_PDFX^^J
    /OutputConditionIdentifier (Custom)^^J
    /OutputCondition (\pdfx@custom@identifier)^^J
    /Info(\pdfx@custom@profile)^^J
    /RegistryName(\pdfx@custom@registry)
    /Registry(\pdfx@custom@registry)
    /DestOutputProfileRef \OBJ@CustomDir
   }%
 \def\OBJ@CustomDir{<<
   \pdfx@numcoords^^J
    /URLs [ << /Type /Filespec ^^J/EF \OBJ@CustomFile^^J
     /F (\pdfx@custom@profile) /UF (\pdfx@custom@profile)  >>]^^J
    >>}
%% need more attributes:
  \def\pdfx@numcoords{%
    /CheckSum <\pdfx@profile@checksum>^^J%
    /ICCVersion <\pdfx@iccversion>%
    /ProfileName (\pdfx@custom@profile)^^J%
    /ProfileCS (\pdfx@custom@numcolors)^^J%
    /ColorantTable [\pdfx@custom@colornames]
   }%
  \def\pdfx@custom@filespec{%
      /Type /EmbeddedFile >>^^J
      /Subtype (application/vnd.iccprofile )
  }%
%%
  \ifxetex
   \def\OBJ@CustomFile{@colorprofile}%
   \immediate\special{pdf:fstream \OBJ@CustomFile
     (\pdfx@customcolorprofiledir\pdfx@custom@profile) <<\pdfx@custom@filespec >>}%
  \else % pdfTeX
   \immediate\pdfobj stream attr{\pdfx@custom@filespec} file %
     {\pdfx@customcolorprofiledir\pdfx@custom@profile}%
   \edef\OBJ@CustomFile{\the\pdflastobj\space 0 R}%
  \fi
  \pdfcatalog{%
   \pdfx@LanguageSpec
   /OutputIntents [ << \pdfx@outintent@dict >>]}%
  }{%
    \PackageError{pdfx}%
     {No color profile \pdfx@custom@profile\space found to use for Custom printing c
     {Is this the correct directory: \pdfx@customcolorprofiledir\space  ?}%
  }% end of \IfFileExists for Custom
  \global\pdfx@cmyktrue  % for TeX coloring
%%
  \else  % allow RGB profile with PDF/X   ???
   \ifpdfx@noerr
    \PackageWarning{pdfx}{PDF/X normally requires a CMYK color profile.^^J
      Assuming RGB profile is of type 'prtr' not 'mntr'.^^J^^J}%
   \else
    \PackageError{pdfx}{PDF/X normally requires a CMYK color profile.}%
      {To use RGB ensure profile is of type 'prtr' not 'mntr'.^^J^^J}%
   \fi
   %  embedded RGB color profile
   %%
   %%  Output Intent dictionary, with object reference
   \def\pdfx@outintent@dict{%
     /Type /OutputIntent
     /S/GTS_PDFX^^J
     /OutputConditionIdentifier (\pdfx@rgb@identifier)^^J
     /DestOutputProfile \OBJ@RGB^^J
     /Info(\pdfx@rgb@info)^^J
     /RegistryName(\pdfx@rgb@registry)
   }%
   \IfFileExists{"\pdfx@rgb@profile"}{%
    \def\pdfx@numcoords{/N 3 /Alternate/DeviceRGB}
    \ifxetex
     \immediate\special{%
      pdf:fstream @colorprofile (\pdfx@rgb@profile) << \pdfx@numcoords >>}
     \def\OBJ@RGB{@colorprofile}%
    \else
     \immediate\pdfobj stream attr{\pdfx@numcoords} file{\pdfx@rgb@profile}%
     \edef\OBJ@RGB{\the\pdflastobj\space 0 R}%
    \fi
    \edef\pdfx@outintent@dict{%
```

```
      /Type /OutputIntent
      /S/GTS_PDFX
      /OutputConditionIdentifier (\pdfx@rgb@identifier)%
      /DestOutputProfile \OBJ@RGB
      /Info(\pdfx@rgb@info)
      /RegistryName(\pdfx@rgb@registry)
    }%
    \ifxetex
     \def\OBJ@RGB{ @colorprofile }%
     \immediate\special{%
       pdf:fstream @colorprofile (\pdfx@rgb@profile) <<\pdfx@numcoords >>}
    \else  %%     pdfTeX or LuaTeX
      \immediate\pdfobj stream attr{\pdfx@numcoords} file{\pdfx@rgb@profile}%
      \edef\OBJ@RGB{\the\pdflastobj\space 0 R}%
     \fi
   }{%
    \PackageError{pdfx}%
     {No color profile \pdfx@rgb@profilename\space found to use for RGB screen color
     {Is this the correct directory: \pdfx@RGBcolorprofiledir\space  ?}%
   }% end of \IfFileExists for RGB
   \fi % end of \ifpdfx@custom
  \fi % end of \ifpdfx@cmyk
 \fi % end of  \ifno@iccprofile
%%  end of PDF/X
\else
%%  PDF/A and PDF/E  can specify a CMYK profile
 \expandafter\ifx\expandafter\relax\pdfx@rgb@profile\relax
  \global\pdfx@cmyktrue
  \IfFileExists{"\pdfx@cmyk@profile"}{%
   \def\pdfx@numcoords{/N 4}
  %  embedded CMYK color profile
   \ifxetex
    \def\OBJ@CMYK{@colorprofile}%
    \special{pdf:fstream @colorprofile (\pdfx@cmyk@profile) <<\pdfx@numcoords >>}
   \else  %% pdfTeX or LuaTeX
    \immediate\pdfobj stream attr{\pdfx@numcoords} file{\pdfx@cmyk@profile}%
    \edef\OBJ@CMYK{\the\pdflastobj\space 0 R}%
   \fi
   \edef\pdfx@outintent@dict{%
     /Type /OutputIntent
    \ifpdfx@e
     /S/ISO_PDFE1
    \else
     /S/GTS_PDFA1
    \fi
    /OutputCondition (\pdfx@cmyk@intent)%  use this or  /Info ?
    /OutputConditionIdentifier (\pdfx@cmyk@identifier)%
    /DestOutputProfile \OBJ@CMYK
    /Info(\pdfx@cmyk@intent)%
    /RegistryName(\pdfx@cmyk@registry)
  }%
 }{%
```

```
   \PackageError{pdfx}{No color profile \pdfx@cmyk@profilename\space found
     to use for CMYK printing colors.}%
     {Is this the correct directory: \pdfx@CMYKcolorprofiledir\space  ?}%
 }% end of \IfFileExists for CMYK
 \else
%%  PDF/A and PDF/E  usually need an RGB color profile for on-screen rendering
 \global\pdfx@cmykfalse
  \expandafter\IfFileExists\expandafter{\pdfx@rgb@profile}{%
   \def\pdfx@numcoords{/N 3 /Alternate/DeviceRGB}
  \ifxetex
    \def\OBJ@RGB{ @colorprofile }%
    \immediate\special{pdf:fstream @colorprofile (\pdfx@rgb@profile) <<\pdfx@numcoor
  \else
    \immediate\pdfobj stream attr{\pdfx@numcoords} file{\pdfx@rgb@profile}%
    \edef\OBJ@RGB{\the\pdflastobj\space 0 R}%
  \fi
  \edef\pdfx@outintent@dict{%
    /Type /OutputIntent
   \ifpdfx@e
    /S/ISO_PDFE1
   \else
    /S/GTS_PDFA1
   \fi
    /OutputConditionIdentifier (\pdfx@rgb@identifier)%
    /DestOutputProfile \OBJ@RGB
    /Info(\pdfx@rgb@info)
    /RegistryName(\pdfx@rgb@registry)
  }%
 }{%
   \PackageError{pdfx}%
    {No color profile \pdfx@rgb@profilename\space found to use for RGB screen colors
    {Is this the correct directory: \pdfx@RGBcolorprofiledir\space  ?}%
 }% end of \IfFileExists for RGB
 \fi % end of ifx  for PDF/A or PDF/E
\fi % end of  ifpdfx@x
%%
 \expandafter\ifx\csname pdfx@outintent@dict\endcsname\relax
 \else
%%
%% build the OutputIntent array
%%
  \ifxetex
   \def\pdfx@outintents{ @outintentsarray }%
   \def\pdfx@outintentref{ @outintent@dict }%
   \immediate\special{pdf:obj \pdfx@outintentref << \pdfx@outintent@dict >>}
   \immediate\special{pdf:obj \pdfx@outintents [ ]}%
   \immediate\special{pdf:put \pdfx@outintents \pdfx@outintentref }%
  \else
   \immediate\pdfobj{<<\pdfx@outintent@dict>>}%
   \edef\pdfx@outintents{[\the\pdflastobj\space 0 R]}%
  \fi
%%
```

```
%% make the Catalog entry, if not already done
%%
  \ifx\pdfx@outcatalog@dict\relax
  \else
   \pdfcatalog{\pdfx@outcatalog@dict}%
  \fi
\fi  % end of  OutputIntent array and Catalog entry
\endgroup

%% ---------------------------------------------------------------------
%% Make a version of \xmp@Keywords and \xmp@Author where \sep has been
%% replaced by a comma. The first is for the pdf:Keywords property,
%% which accepts a comma-separated string of keywords, and seems to be
%% mandatory for PDF/A-1 compliance. The second is for the dc:creator
%% property. Although it is defined to be a sequence of authors, Adobe
%% Acrobat will in fact ignore and delete all except the first author.
%% Therefore, it’s safer to always separate authors by commas.

\begingroup
 \let\pdfx@xmpunimarkup\relax
 \pdfx@xmpmarkup
 \ifluatex\else\ifxetex\else
  \inputencoding{8bit}%
 \fi\fi
 \makeatletter
 \IfFileExists{\pdfx@encodingfile}{%
  \def\cf@encoding{L8U}\fontencoding{L8U}%
 }{}%
 \let\protect\@typeset@protect
 \pdfx@xmpmarkup %%  !!!!! no longer needed
%% \xdef\xmp@@Author{\xmp@Author}% no need to expand
 \global\let\xmp@@Author\xmp@Author
 \def\sep{; }%  expand to replace \sep   !!!  no longer needed
%% \xdef\xmp@@Copyright{\xmp@Copyright}%
 \global\let\xmp@@Copyright\xmp@Copyright
%% \xdef\xmp@@Keywords{\xmp@Keywords}%
%% \global\let\xmp@@Keywords\xmp@Keywords
%% \global\let\xmp@Keywords\@empty %
 \global\let\xmp@@Keywords\@empty % don’t use  pdf:Keywords
\endgroup

%% ---------------------------------------------------------------------
\def\xmp@convertDate{\pdfx@getYear}
{\catcode‘\D=12 \catcode‘\:=12
 \gdef\pdfx@getYear D:#1#2#3#4{\edef\pdfx@xYear{#1#2#3#4}\pdfx@getMonth}
}
\def\pdfx@getMonth#1#2{\edef\pdfx@xMonth{#1#2}\pdfx@getDay}
\def\pdfx@getDay#1#2{\edef\pdfx@xDay{#1#2}\pdfx@getHour}
\def\pdfx@getHour#1#2{\edef\pdfx@xHour{#1#2}\pdfx@getMin}
\def\pdfx@getMin#1#2{\edef\pdfx@xMin{#1#2}\pdfx@getSec}
\def\pdfx@getSec#1#2{\edef\pdfx@xSec{#1#2}\pdfx@getTZh}
\def\pdfx@getTZh{\futurelet\pdfx@next\pdfx@getTzh@branches}
```

```

{\catcode‘\@=11 \catcode‘\Z=12 \catcode‘\+=12 \catcode‘\-=12
\gdef\pdfx@getTzh@branches{%
 \ifx\pdfx@next Z\let\pdfx@getTzbranch\pdfx@getTznozone
 \else\ifx\pdfx@next +\let\pdfx@getTzbranch\pdfx@getTzplus
 \else\ifx\pdfx@next -\let\pdfx@getTzbranch\pdfx@getTzminus
 \else\let\pdfx@getTzbranch\pdfx@getTzerror
 \fi\fi\fi \pdfx@getTzbranch }

\catcode‘\0=12
\gdef\pdfx@getTznozone Z#1\pdfx@getTzend{%
 \edef\pdfx@xTzh{+00}\edef\pdfx@xTzm{00}}
\gdef\pdfx@getTzplus +#1’#2’#3\pdfx@getTzend{%
 \edef\pdfx@xTzh{+#1}\edef\pdfx@xTzm{#2}%
 \ifx\relax#2\relax\def\pdfx@xTzm{00}\fi}
\gdef\pdfx@getTzminus -#1’#2’#3\pdfx@getTzend{%
 \edef\pdfx@xTzh{-#1}\edef\pdfx@xTzm{#2}%
 \ifx\relax#2\relax\def\pdfx@xTzm{00}\fi}
%%
%% How to support XeTeX here ?
\expandafter\ifx\csname pdfcreationdate\endcsname\relax
%% \xdef\pdfx@convDate{2016-04-01}%  April fool!
%% \xdef\xmp@convDate{2016-04-01}%  April fool!
\else
 \expandafter\expandafter\expandafter\xmp@convertDate\pdfcreationdate’’\pdfx@getTzen
 \xdef\pdfx@convDate{\pdfx@xYear\pdfx@xMonth\pdfx@xDay\pdfx@xHour
  \pdfx@xMin\pdfx@xSec\pdfx@xTzh’\pdfx@xTzm’}%
 \xdef\xmp@convDate{\pdfx@xYear-\pdfx@xMonth-\pdfx@xDay
  T\pdfx@xHour:\pdfx@xMin:\pdfx@xSec\pdfx@xTzh:\pdfx@xTzm}%
\fi
}% end of \catcode

%% ---------------------------------------------------------------------
%% \pdfx@topdfstring\toka\tokb: Convert the string in \tokb to a format
%% appropriate for PDF /Info strings, i.e., PDFDoc encoding or UTF-16
%% encoding, and store the result in \toka As a special case, if \tokb
%% is \@empty, set \toka to \@empty.

\def\pdfx@topdfstring#1#2{%
 \ifx#2\@empty
  \global\let#1\empty
 \else
  \begingroup
   \ifluatex\else\ifxetex\else
    \inputencoding{utf8}%
   \fi\fi
   \hypersetup{pdfencoding=auto}%
   \pdfstringdef#1{#2}%
  \endgroup
 \fi
}

```

```
%% ----------------------------------------------------------------------
%% if high-bit characters are already encoded as active
%% then  \pdfstringdef  probably changes their meaning
%% so save these for later reversion.
%%
\newif\ifpdf@activechars
{\ifnum\catcode`^^c0 = 13\relax \aftergroup\pdf@activecharstrue\fi}%
%%
%% normally not used with XeTeX or LuaTeX
%%

\ifpdf@activechars
 \global\let\pdfx@save@co ^^c0\relax
 \global\let\pdfx@save@ci ^^c1\relax
 \global\let\pdfx@save@cii ^^c2\relax
 \global\let\pdfx@save@ciii ^^c3\relax
 \global\let\pdfx@save@civ ^^c4\relax
 \global\let\pdfx@save@cv ^^c5\relax
 \global\let\pdfx@save@cvi ^^c6\relax
 \global\let\pdfx@save@cvii ^^c7\relax
 \global\let\pdfx@save@cviii ^^c8\relax
 \global\let\pdfx@save@cix ^^c9\relax
 \global\let\pdfx@save@ca ^^ca\relax
 \global\let\pdfx@save@cb ^^cb\relax
 \global\let\pdfx@save@cc ^^cc\relax
 \global\let\pdfx@save@cd ^^cd\relax
 \global\let\pdfx@save@ce ^^ce\relax
 \global\let\pdfx@save@cf ^^cf\relax
 \global\let\pdfx@save@do ^^d0\relax
 \global\let\pdfx@save@di ^^d1\relax
 \global\let\pdfx@save@dii ^^d2\relax
 \global\let\pdfx@save@diii ^^d3\relax
 \global\let\pdfx@save@div ^^d4\relax
 \global\let\pdfx@save@dv ^^d5\relax
 \global\let\pdfx@save@dvi ^^d6\relax
 \global\let\pdfx@save@dvii ^^d7\relax
 \global\let\pdfx@save@dviii ^^d8\relax
 \global\let\pdfx@save@dix ^^d9\relax
 \global\let\pdfx@save@da ^^da\relax
 \global\let\pdfx@save@db ^^db\relax
 \global\let\pdfx@save@dc ^^dc\relax
 \global\let\pdfx@save@dd ^^dd\relax
 \global\let\pdfx@save@de ^^de\relax
 \global\let\pdfx@save@df ^^df\relax
 \global\let\pdfx@save@eo ^^e0\relax
 \global\let\pdfx@save@ei ^^e1\relax
 \global\let\pdfx@save@eii ^^e2\relax
 \global\let\pdfx@save@eiii ^^e3\relax
 \global\let\pdfx@save@eiv ^^e4\relax
 \global\let\pdfx@save@ev ^^e5\relax
 \global\let\pdfx@save@evi ^^e6\relax
 \global\let\pdfx@save@evii ^^e7\relax
 \global\let\pdfx@save@eviii ^^e8\relax
 \global\let\pdfx@save@eix ^^e9\relax
 \global\let\pdfx@save@ea ^^ea\relax
 \global\let\pdfx@save@eb ^^eb\relax
 \global\let\pdfx@save@ec ^^ec\relax
 \global\let\pdfx@save@ed ^^ed\relax
 \global\let\pdfx@save@ee ^^ee\relax
 \global\let\pdfx@save@ef ^^ef\relax
 \global\let\pdfx@save@fo ^^f0\relax
 \global\let\pdfx@save@fi ^^f1\relax
 \global\let\pdfx@save@fii ^^f2\relax
 \global\let\pdfx@save@fiii ^^f3\relax
\fi

%% ---------------------------------------------------------------------
%% detect when \sep is used for multiple authors
%% then suppress the /Author field in PDF /Info
\newif\ifpdfx@sep@infield@
\let\pdfx@endparse\relax
\def\pdfx@parseforsep#1\sep#2\pdfx@endparse{%
 \pdfx@sep@infield@false
 \ifx\relax#2\relax\else\pdfx@sep@infield@true\fi
}

\begingroup
 \let\CATCODE\catcode
 \let\ENDGROUP\endgroup
 \let\GDEF\gdef
 \CATCODE‘\m 12 \CATCODE‘\a 12 \CATCODE‘\c 12 \CATCODE‘\r 12 \CATCODE‘\o 12
 \CATCODE‘\: 12 \CATCODE‘\- 12 \CATCODE‘\> 12
 \GDEF\pdfx@DOSTRIP@MACRO macro:->#1\@{#1}%
\ENDGROUP
\def\pdfx@strip@macro#1{%
  \expandafter\edef\expandafter#1\expandafter{%
    \expandafter\pdfx@DOSTRIP@MACRO\meaning#1\@}%
}

%% Convert the relevant XMP properties to PDF strings, expanding markup
%% (such as \sep, \&, \copyright, etc) in an appropriate way.
%% These PDF strings are actually not always necessary, but if supplied they
%% must match exactly what is in the XMP version. This may be impossible
%% if math symbols are used; e.g. Plane-1 alphanumerics.
%% Generally, it is better to *not* provide PDF-info strings;
%% instead just providing metadata through XMP.
%% This is not always enough â?? a driver may add it by default!
%%
%% But some PDF readers don’t support XMP, so it is nice to have
%%  /Info fields, when this can be done reliably.
%%
%%  2018-12-16:   load package outside the grouping
\RequirePackage{stringenc}%
\begingroup
```

```
 \catcode`\| 0
 \catcode `\\ 12
 |gdef |pdfx@parsebackslash#1{%
  |begingroup
   |def |pdfx@parsemacro{#1}%
   |def |pdfx@parseout{}%
   |expandafter |pdfx@doparsebackslash#1\|pdfx@endparse
 }
 |gdef |pdfx@doparsebackslash#1\#2|pdfx@endparse{%
  |edef |pdfx@parseout{|pdfx@parseout#1}%
  |ifx |relax#2|relax
   |let |next |pdfx@parseend
  |else
   |edef |pdfx@parseout{|pdfx@parseout \\}%
   |def |next{|pdfx@doparsebackslash#2|pdfx@endparse}%
  |fi |next
  }
|endgroup
\def\pdfx@parseend{%
 \edef\next{\endgroup\def\expandafter\noexpand\pdfx@parsemacro{\pdfx@parseout}}%
 \next
}%
\begingroup
%% \expandafter\ifx\csname pdf@escapehex\endcsname\relax
%%  \PackageWarning{pdfx}{%
%%   Missing an implementation of \string\pdf@escapehex ^^J
%%   Translated Metadata cannot be generated as PDF strings.^^J}%
%%  \def\pdfx@GeneratePdfString#1#2{}%
%%  \def\pdfx@ConvertUTFtoBE#1#2{}%
%% \fi %%\else
 \gdef\pdfx@GeneratePdfString#1#2{%
   % converts a UTF-8 string to UTF-16be
   \StringEncodingConvert{#1}{#2}{utf8}{utf16be}%
   \edef\pdfx@tempii{#1}\relax
   \xdef#1{\string\376\string\377\pdfescapestring{\pdfx@tempii}}%
  }%
 \gdef\pdfx@ConvertUTFtoBE#1#2{%
   \setbox0=\hbox{% catch any rubbish escaping to the MVL
    \def\cf@encoding{L8U}\fontencoding{L8U}%
    \ifluatex
%%     \let\pdfescapestring\luaescapestring
    \else\ifxetex\else
     \inputencoding{8bit}%
    \fi\fi
%%    \pdfx@xmpmarkup %% don't want some things
    \pdfx@xmpunimarkup
    \let\backslash\textbackslash
    \edef\pdfx@temp{#2}% ensure XMP expands to UTF8
    \ifluatex
     \pdfx@parsebackslash\pdfx@temp
     \pdfstringdef{#1}{\pdfx@temp}%
    \else\ifxetex
```

```
      \pdfx@parsebackslash\pdfx@temp
      \pdfstringdef{#1}{\pdfx@temp}%
     \else
      \pdfx@GeneratePdfString{#1}{\pdfx@temp}%
    \fi\fi
   }% end of  \setbox
  }%
%% \fi
 \pdfx@pdfmarkup
 \global\let\pdfx@pdfAuthor\@empty
 \global\let\pdfx@pdfTitle\@empty
 \global\let\pdfx@pdfSubject\@empty
 \global\let\pdfx@pdfKeywords\@empty
 \ifpdfx@nopdfinfo  %  transliterated strings present
%% RRM: this may still work with parser macros   ???
  \expandafter\ifx\expandafter\relax\xmp@Title\relax\else
   \pdfx@ConvertUTFtoBE{\pdfx@pdfTitle}{\xmp@Title}%
  \fi
  \expandafter\ifx\expandafter\relax\xmp@Subject\relax\else
   \pdfx@ConvertUTFtoBE{\pdfx@pdfSubject}{\xmp@Subject}%
  \fi
\else %%  pdfx@nopdfinfofalse
  \expandafter\ifx\expandafter\relax\xmp@Title\relax\else
   \ifluatex
    \pdfx@ConvertUTFtoBE\pdfx@pdfTitle\xmp@Title
   \else\ifxetex
    \pdfx@ConvertUTFtoBE\pdfx@pdfTitle\xmp@Title
   \else
%%     \pdfx@GeneratePdfString\pdfx@pdfTitle\xmp@Title %  why does this fail ???
    \pdfx@ConvertUTFtoBE{\pdfx@pdfTitle}{\xmp@Title}%  ???  RRM 2019-02-17
   \fi\fi
  \fi
  \expandafter\ifx\expandafter\relax\xmp@Subject\relax\else
   \ifluatex
    \pdfx@ConvertUTFtoBE\pdfx@pdfSubject\xmp@Subject
   \else\ifxetex
    \pdfx@ConvertUTFtoBE\pdfx@pdfSubject\xmp@Subject
   \else
%%    \pdfx@GeneratePdfString\pdfx@pdfSubject\xmp@Subject %  why does this fail ???
    \pdfx@ConvertUTFtoBE{\pdfx@pdfSubject}{\xmp@Subject}% 2019-02-17
   \fi\fi
  \fi
 \fi  % end of  \ifpdfx@nopdfinfo
 \pdfx@topdfstring\pdfx@CreatorTool\xmp@CreatorTool
 \pdfx@topdfstring\pdfx@Producer\xmp@Producer
%%  \pdfescapestring  needed
%% \expandafter\ifx\csname pdfescapestring\endcsname\relax
%%  \else
    \expandafter\ifx\expandafter\relax\xmp@Author\relax
    \else
%%  check for multiple authors with parser macro
     \expandafter\pdfx@parseforsep\xmp@Author\sep\pdfx@endparse
     \ifpdfx@sep@infield@
     \else
       \pdfx@ConvertUTFtoBE{\pdfx@pdfAuthor}{\xmp@Author}%
     \fi %% end of  \ifpdfx@sep@infield@
    \fi  %%  end of  \xmp@Author    test
    \expandafter\ifx\expandafter\relax\xmp@Keywords\relax
    \else
%%  check for multiple keywords with parser macro
     \expandafter\pdfx@parseforsep\xmp@Keywords\sep\pdfx@endparse
     \ifpdfx@sep@infield@
     \else
       \pdfx@ConvertUTFtoBE{\pdfx@pdfKeywords}{\xmp@Keywords}%
     \fi %% end of  \ifpdfx@sep@infield@
    \fi  %%  end of  \xmp@Keywords  test
%%
%%  \fi  %%  end of \pdfescapestring  test
\endgroup

%% Affects CMap creation for certain fonts, according to glyph names
%%  How to support XeTeX here ?
%%  Maybe it's best to be using an updated  mmap.sty  ?
\ifxetex
\else
 \input glyphtounicode.tex
 \input glyphtounicode-cmr.tex
 \input glyphtounicode-ntx.tex
 \pdfgentounicode=1
\fi
\ifgrkLGRxmp
 \ifxetex\else
  \pdfglyphtounicode{internalchar2}{200D}%
\fi \fi

%% patch to place accents *after* the base character, rather than before
%%  based on coding from  mmap.sty  by RRM
\newif\ifPDFX@inaccent
\let\LTX@add@accent\add@accent
\def\PDFX@add@accent#1#2{%
 \hmode@bgroup
  \let \hmode@start@before@group \@firstofone
  \setbox\@tempboxa\hbox{\PDFX@inaccenttrue
   #2\global\mathchardef\accent@spacefactor\spacefactor}%
  #2\kern-\wd\@tempboxa
%%  \ifdim\ht\@tempboxa>1ex\relax
   \dimen@=\ht\@tempboxa\advance\dimen@-1ex\relax
%%% reduce how much a nested accent is raised
   \ifPDFX@inaccent\advance\dimen@-.2ex\relax\fi
   \raise\dimen@\hbox to\wd\@tempboxa{\hss
    \accent#1{\vphantom{#2}}\hss}%
%%  \else
%%  \accent#1{%\vphantom{#2}
%%   \vrule width\z@ height\ht\@tempboxa depth\dp\@tempboxa}%
%% \fi
 \egroup
 \spacefactor\accent@spacefactor
}
%% same for named accents in math-mode
\def\pdfx@mathaccentV#1#2#3#4#5{%
 #5{\mathsurround=\z@\relax
  \everymath{}%
  \mathchoice
   {\setbox\z@\hbox{$\displaystyle #5$}\kern-\wd\z@}%
   {\setbox\z@\hbox{$\textstyle #5$}\kern-\wd\z@}%
   {\setbox\z@\hbox{$\scriptstyle #5$}\kern-\wd\z@}%
   {\setbox\z@\hbox{$\scriptscriptstyle #5$}\kern-\wd\z@}%
 }%
 \AMS@mathaccentV{#1}{#2}{#3}{#4}{\phantom{#5}}%
}
\AtBeginDocument{%
 \@ifpackageloaded{amsmath}{%
  \let\AMS@mathaccentV\mathaccentV
  \let\mathaccentV\pdfx@mathaccentV}%
}%

%% How to support XeTeX here ?
%%%%%  adjust accent characters to the Unicode Combining variant  %%%%
\def\PDFX@combiningchars@unicode{%
 \pdfglyphtounicode{grave}{0300}%
 \pdfglyphtounicode{acute}{0301}%
 \pdfglyphtounicode{circumflex}{0302}%
 \pdfglyphtounicode{tilde}{0303}%
 \pdfglyphtounicode{macron}{0304}%
 \pdfglyphtounicode{Macronsmall}{0304}%
 \pdfglyphtounicode{breve}{0306}%
 \pdfglyphtounicode{dotaccent}{0307}%
 \pdfglyphtounicode{Dotaccent}{0307}%
 \pdfglyphtounicode{Dotaccentsmall}{0307}%
 \pdfglyphtounicode{dieresis}{0308}%
 \pdfglyphtounicode{ogonek}{0309}%
 \pdfglyphtounicode{ring}{030A}%
 \pdfglyphtounicode{hungarumlaut}{030B}%
 \pdfglyphtounicode{caron}{030C}%
 \pdfglyphtounicode{cedilla}{0327}%
 \pdfglyphtounicode{commaaccent}{0326}%   droid
 %  tie accents in  berenisadf  lm  stix  and others
 \pdfglyphtounicode{tieaccentlowercase}{0311}%
 \pdfglyphtounicode{tieaccentcapital}{0361}%
 \pdfglyphtounicode{newtieaccentlowercase}{0311}%
 \pdfglyphtounicode{newtieaccentcapital}{0361}%
 % cm-unicode
 \pdfglyphtounicode{space_uni030D}{030D}%
 \pdfglyphtounicode{space_uni030E}{030E}%
 \pdfglyphtounicode{space_uni030F}{030F}%
 \pdfglyphtounicode{space_uni0311}{0311}%
 \pdfglyphtounicode{space_uni0321}{0321}%
 \pdfglyphtounicode{space_uni0322}{0322}%
 \pdfglyphtounicode{space_uni032A}{032A}%
 \pdfglyphtounicode{space_uni032B}{032B}%
 \pdfglyphtounicode{space_uni0335}{0335}%
 \pdfglyphtounicode{space_uni0337}{0337}%
 \pdfglyphtounicode{space_uni033A}{033A}%
 \pdfglyphtounicode{space_uni033B}{033B}%
 \pdfglyphtounicode{space_uni033C}{033C}%
 \pdfglyphtounicode{space_uni034D}{034D}%
}

\def\pdfx@check@accents{%
 \ifx\add@accent\LTX@add@accent
  \let\add@accent\PDFX@add@accent
 \else
  \expandafter\ifx\csname MT@orig@add@accent\endcsname\relax
  \@ifpackageloaded{mmap}{}{%
  \pdfx@ErrorWarning{another package has patched \string\add@accent }%
   {Hit <return> to continue}{}{}}%
   \else
   \expandafter\let\csname MT@orig@add@accent\endcsname\PDFX@add@accent
 \fi\fi
 \ifxetex
 \else
  \PDFX@combiningchars@unicode
%%  this is now handled by  glyphtounicode-ntx.tex
%%  \@ifpackageloaded{newtxmath}{%
%%   \pdfglyphtounicode{vec}{20D7}%
%%    \pdfglyphtounicode{rvec}{20D6}%
%%    \pdfglyphtounicode{lrvec}{20E1}%
%%   }{}%
  \fi %  end of   \ifxetex
  \let\pdfx@check@accents\unDefiNeD
}
\AtBeginDocument{\pdfx@check@accents}

%%  suppress hyperlinks when generating  PDF/X
\def\pdfx@linkfile@pdfX#1#2#3{%
 \Hy@colorlink\@filecolor#1\Hy@xspace@end}
\def\pdfx@linkstart@pdfX#1#2#3{%
 \Hy@colorlink\@linkcolor#3\endgroup\Hy@xspace@end}
\def\pdfx@linkurl@pdfX#1#2{%
 \Hy@colorlink\@urlcolor#1\endgroup\Hy@xspace@end}
\def\pdfx@StartlinkName@pdfX#1#2{}
\def\pdfx@close@pdflink{\Hy@VerboseLinkStop\Hy@endcolorlink}%
\def\pdfx@Acrobatmenu@noaction#1#2{#2}

\ifpdfx@x
 \let\hyper@linkfile\pdfx@linkfile@pdfX
 \let\hyper@linkurl\pdfx@linkurl@pdfX
 \let\hyper@linkstart\pdfx@linkstart@pdfX
 \let\hyper@linkend\relax
 \let\Hy@StartlinkName\pdfx@StartlinkName@pdfX
 \let\close@pdflink\pdfx@close@pdflink
 \let\AcrobatMenu\pdfx@Acrobatmenu@noaction
 \Hy@bookmarksfalse
%% {\def\sep{;}% should not be needed, but just in case
  \AtBeginDocument{%
   % cancel annotations and links
   %
   \def\PDF@FinishDoc{%  ??? What uses this ???
    \begingroup
     \def\sep{; }% should not be needed, but just in case
     \pdfinfo{%
      \ifx\pdfx@pdfTitle\@empty\else /Title(\pdfx@pdfTitle)^^J\fi
      \ifx\pdfx@pdfAuthor\@empty\else /Author(\pdfx@pdfAuthor)^^J\fi
      \ifx\pdfx@pdfSubject\@empty\else /Subject(\pdfx@pdfSubject)^^J\fi
      \ifx\pdfx@pdfKeywords\@empty\else /Keywords(\pdfx@pdfKeywords)^^J\fi
       /Creator(\pdfx@CreatorTool)^^J%
      \ifx\@pdfcreationdate\@empty
       /CreationDate(D:\pdfx@convDate)%
      \else
       \ifxetex\else
        /CreationDate(\@pdfcreationdate)%
      \fi\fi
      \ifx\@pdfmoddate\@empty
       /ModDate(D:\pdfx@convDate)%
      \else
       /ModDate(\@pdfmoddate)%
      \fi
      ^^J/Producer(\pdfx@Producer)%
      /Trapped/False^^J%
      \ifnum\xmp@Part=1
       /GTS_PDFXVersion(PDF/X-1\ifnum\xmp@ReleaseDate>2001
        \xmp@Conformance\fi:\xmp@ReleaseDate)%
      \else
       /GTS_PDFXVersion(PDF/X-\xmp@Part\xmp@Conformance
        \ifnum\xmp@Part< 4 :\xmp@ReleaseDate\fi)%
      \fi
      \ifnum\xmp@Part < 3
        /GTS_PDFXConformance(PDF/X-\xmp@Part\xmp@Conformance
          :\xmp@ReleaseDate)%
      \fi
      \ifpdfx@vt
%%   support for PDF/VT extensions of  PDF/X-4 and PDF/X-5
       /GTS_PDFVTVersion(PDF/VT-\xmp@vtPart\xmp@vtConformance)%
      \fi
     }%%  end of  PDF/X  info
    \endgroup   %%  end of scope for  \sep
   }%% end of  \PDF@FinishDoc
  }% end of  \AtBeginDocument
%%  \pdfinfo{%   order of these dictionary keys should not matter
%%   \ifx\pdfx@Author\@empty\else /Author(\pdfx@Author)\fi
%%   /CreationDate(D:\pdfx@convDate)%
%%   /Creator(\pdfx@CreatorTool)%
%%   \ifnum\xmp@Part=1
%%     /GTS_PDFXVersion(PDF/X-1\ifnum\xmp@ReleaseDate>2001
%%      \xmp@Conformance\fi:\xmp@ReleaseDate)%
%%   \else
%%    /GTS_PDFXVersion(PDF/X-\xmp@Part\xmp@Conformance
%%     \ifnum\xmp@Part< 4 :\xmp@ReleaseDate\fi)%
%%   \fi
%%   \ifnum\xmp@Part < 3
%%      /GTS_PDFXConformance(PDF/X-\xmp@Part\xmp@Conformance
%%        :\xmp@ReleaseDate)%
%%   \fi
%%
%%   \ifpdfx@vt
%%%   support for PDF/VT extensions of  PDF/X-4 and PDF/X-5
%%     /GTS_PDFVTVersion(PDF/VT-\xmp@vtPart\xmp@vtConformance)%
%%   \fi
%%   \ifx\pdfx@Keywords\@empty\else /Keywords(\pdfx@Keywords)\fi
%%   /ModDate(D:\pdfx@convDate)%
%%   /Producer(\pdfx@Producer)%
%%   \ifx\pdfx@Subject\@empty\else /Subject(\pdfx@Subject)\fi
%%   \ifx\pdfx@Title\@empty\else /Title(\pdfx@Title)\fi
%%   /Trapped/False%
%%  }%  end of  PDF/X  info
%% }% end of scope for  \sep
\else
 \ifpdfx@e   %% PDF/E
  \AtBeginDocument{%
   \def\PDF@FinishDoc{%  ??? What uses this ???
    \begingroup
     \def\sep{; }% should not be needed, but just in case
     \pdfinfo{%
      \ifx\pdfx@pdfTitle\@empty\else /Title(\pdfx@pdfTitle)^^J\fi
      \ifx\pdfx@pdfAuthor\@empty\else /Author(\pdfx@pdfAuthor)^^J\fi
      \ifx\pdfx@pdfSubject\@empty\else /Subject(\pdfx@pdfSubject)^^J\fi
      \ifx\pdfx@pdfKeywords\@empty\else /Keywords(\pdfx@pdfKeywords)^^J\fi
       /Creator(\pdfx@CreatorTool)^^J%
      \ifx\@pdfcreationdate\@empty
       /CreationDate(D:\pdfx@convDate)%
      \else
       \ifxetex\else
        /CreationDate(\@pdfcreationdate)%
      \fi\fi
      \ifx\@pdfmoddate\@empty
       /ModDate(D:\pdfx@convDate)%
      \else
       /ModDate(\@pdfmoddate)%
      \fi
      ^^J/Producer(\pdfx@Producer)%
      /Trapped/False^^J%
      /GTS_PDFEVersion(PDF/E-1\xmp@Conformance:\xmp@ReleaseDate)%
     }%  end of  PDF/E  info
    \endgroup  %% end of scope for  \sep
   }% end of  \PDF@FinishDoc
  }% end of  \AtBeginDocument
%% {\def\sep{;}% should not be needed, but just in case
%%  \pdfinfo{%   order of these dictionary keys should not matter
%%     \ifx\pdfx@Title\@empty\else /Title(\pdfx@Title)\fi
%%     \ifx\pdfx@Author\@empty\else /Author(\pdfx@Author)\fi
%%     \ifx\pdfx@Subject\@empty\else /Subject(\pdfx@Subject)\fi
%%     \ifx\pdfx@Keywords\@empty\else /Keywords(\pdfx@Keywords)\fi
%%   \ifx\pdfx@Author\@empty\else /Author(\pdfx@Author)\fi
%%   /CreationDate(\pdfx@convDate)%
%%   /Creator(\pdfx@CreatorTool)%
%%   /GTS_PDFEVersion(PDF/E-1\xmp@Conformance:\xmp@ReleaseDate)%
%%   \ifx\pdfx@Keywords\@empty\else /Keywords(\pdfx@Keywords)\fi
%%   /ModDate(D:\pdfx@convDate)%
%%   /Producer(\pdfx@Producer)%
%%   \ifx\pdfx@Subject\@empty\else /Subject(\pdfx@Subject)\fi
%%   \ifx\pdfx@Title\@empty\else /Title(\pdfx@Title)\fi
%%   /Trapped/False%
%%  }%  end of  PDF/E  info
%% }% end of scope for  \sep
 \else  %%  PDF/A
  \def\pdfx@confA{a}%
  \def\pdfx@confB{b}%
  \def\pdfx@confU{u}%
  \expandafter\def\expandafter\xmp@conf\expandafter
   {\csname pdfx@conf\xmp@Conformance\endcsname}%
  \AtBeginDocument{%
   \def\PDF@FinishDoc{%  ??? What uses this ???
   \begingroup
    \def\sep{; }% should not be needed, but just in case
    \pdfinfo{%
     \ifx\pdfx@pdfTitle\@empty\else /Title(\pdfx@pdfTitle)^^J\fi
     \ifx\pdfx@pdfAuthor\@empty\else /Author(\pdfx@pdfAuthor)^^J\fi
     \ifx\pdfx@pdfSubject\@empty\else /Subject(\pdfx@pdfSubject)^^J\fi
     \ifx\pdfx@pdfKeywords\@empty\else /Keywords(\pdfx@pdfKeywords)^^J\fi
      /Creator(\pdfx@CreatorTool)^^J%
     \ifx\@pdfcreationdate\@empty
      /CreationDate(D:\pdfx@convDate)%
     \else
      \ifxetex\else
       /CreationDate(\@pdfcreationdate)%
     \fi\fi
     \ifx\@pdfmoddate\@empty
      /ModDate(D:\pdfx@convDate)%
     \else
      /ModDate(\@pdfmoddate)%
     \fi
     ^^J/Producer(\pdfx@Producer)%
     /Trapped/False^^J%
     /GTS_PDFA1Version (PDF/A-\xmp@Part\xmp@conf:\xmp@ReleaseDate)%
    }%  end of  PDF/A  info
   \endgroup  %%  end of scope for  \sep
  }% end of  \PDF@FinishDoc
 }% end of  \AtBeginDocument
\fi\fi

%%-----------------------------------------------------------------------
%%  2018-12-16:   xmpincl  needs the  ifthen  package
%%  it should be loaded outside the grouping, else  biblatex  may barf
%%
\RequirePackage{ifthen}
\begingroup
%% override the \ifpdf  check of  xmpincl  package, inside the grouping
 \pdftrue
 \RequirePackage{xmpincl}
%% combine coding from  xmpincl  and  hyperxml to support XeTeX
\def\pdfx@xmpincl@xetex#1{%
 \IfFileExists{#1.xmp}{%
  \mcs@xmpincl@patchFile{#1}%
  \begingroup
   \special{pdf:fstream @pdfx@Metadata (#1.xmpi)
    <<
      /Type /Metadata
      /Subtype /XML
    >>
   }%
   \special{pdf:put @catalog
    <<
      /Metadata @pdfx@Metadata
    >>
   }%
  \endgroup
 }{%
  \newcommand{\mcs@xmpincl@filename}{#1.xmp}%
    \PackageError{xmpincl}%
    {The file \mcs@xmpincl@filename\space was not found}%
    {The file \mcs@xmpincl@filename\space The metadata file
     wasn't found.\MessageBreak Oops.}%
 }
}
\ifxetex
 \let\includexmp\pdfx@xmpincl@xetex
\fi

%% macro provided by Leonardo E. Segovia on 2017-05-15
%% <leonardo.segovia@cs.uns.edu.ar>
\def\pdfx@xmpincl@luatex#1{%
 \IfFileExists{#1.xmp}{%
   \mcs@xmpincl@patchFile{#1}%
   \begingroup
   \pdfcompresslevel=0
   \immediate\pdfobj uncompressed stream attr {/Type /Metadata /Subtype /XML}
   file{#1.xmpi}%
   \pdfcatalog{%\pdfx@LanguageSpec
    /Metadata \the\pdflastobj\space 0 R}%
   \endgroup
 }{%
  \newcommand{\mcs@xmpincl@filename}{#1.xmp}%
   \PackageError{xmpincl}%
   {The file \mcs@xmpincl@filename\space was not found}%
   {The file \mcs@xmpincl@filename\space The metadata file
     wasn't found.\MessageBreak Oops.}%
 }
}
\ifluatex
 \let\includexmp\pdfx@xmpincl@luatex
\fi

%%----------------------------------------------------------------------
\begingroup
 \ifpdfx@x
  \ifpdfx@vt
   \def\xmp@template{pdfvt}%
  \else
   \def\xmp@template{pdfx}%    formerly  pdfx-1a
  \fi
 \else
  \ifpdfx@e
   \def\xmp@template{pdfe}%
  \else
   \def\xmp@template{pdfa}%
 \fi\fi
 \catcode`\'=12 \catcode`\<=12 \catcode`\>=12 \catcode`\?=12
 \catcode`\"=12 \catcode`\= 12 %% used within the template file
%% patch commands from  xmpincl.sty  ...
 \def\pdfx@xmpinclStart{% supply byte-order marker
  <?xpacket begin='^^ef^^bb^^be' id='W5M0MpCehiHzreSzNTczkc9d' ?> %
 }%
 \def\pdfx@xmpinclStartAlt{% no byte-order marker
  <?xpacket begin='' id='W5M0MpCehiHzreSzNTczkc9d' ?> %
 }%
 \def\pdfx@xmpinclEnd{%  allow XMP packet to be writable
  <?xpacket end='w'?> %
 }%
 \let\mcs@xmpinclStart\pdfx@xmpinclStart
 \let\mcs@xmpinclStartAlt\pdfx@xmpinclStartAlt
 \ifpdfx@noBOM  % don't use the byte-order marker
  \let\mcs@xmpinclStart\pdfx@xmpinclStartAlt
 \fi
 \let\mcs@xmpinclEnd\pdfx@xmpinclEnd
%% ... preventing their redefinition
 \def\newcommand#1#2{}%
%%
%% \def\pdfx@endeval{%
%%  \noexpand \TE@setvaltrue \noexpand \else
%%  \noexpand \TE@setvalfalse \noexpand \fi
%%   \noexpand \TE@negatefalse \noexpand \fi}%
%% \let\TE@endeval\pdfx@endeval
 \ifluatex\else\ifxetex\else
  \inputencoding{8bit}%
 \fi\fi
 \makeatletter
 \def\cf@encoding{L8U}\fontencoding{L8U}%
 \providecommand{\ifnot@empty}[2]{\ifx#1\@empty\relax\else#2\fi}%
 \pdfx@xmpmarkup
\expandafter\global\expandafter
  \let\csname L8U-cmd\expandafter\endcsname\csname U-cmd\endcsname
 \def\cf@encoding{L8U}\fontencoding{L8U}%
 \providecommand{\ifnot@empty}[2]{\ifx#1\@empty\relax\else#2\fi}%
 \obeyspaces%
%% beware 128 space characters -- for padding end of XMP packet
 \gdef\paddingline{
 \typeout{Using XMP template file: \xmp@template.xmp}%
 \includexmp{\xmp@template}%
\endgroup

%%
%% revert active characters to previous encoding
%%
\ifpdf@activechars
 \global\let ^^c0\pdfx@save@co
 \global\let ^^c1\pdfx@save@ci
 \global\let ^^c2\pdfx@save@cii
 \global\let ^^c3\pdfx@save@ciii
 \global\let ^^c4\pdfx@save@civ
 \global\let ^^c5\pdfx@save@cv
 \global\let ^^c6\pdfx@save@cvi
 \global\let ^^c7\pdfx@save@cvii
 \global\let ^^c8\pdfx@save@cviii
 \global\let ^^c9\pdfx@save@cix
 \global\let ^^ca\pdfx@save@ca
 \global\let ^^cb\pdfx@save@cb
 \global\let ^^cc\pdfx@save@cc
 \global\let ^^cd\pdfx@save@cd
 \global\let ^^ce\pdfx@save@ce
 \global\let ^^cf\pdfx@save@cf
 \global\let ^^d0\pdfx@save@do
 \global\let ^^d1\pdfx@save@di
 \global\let ^^d2\pdfx@save@dii
 \global\let ^^d3\pdfx@save@diii
 \global\let ^^d4\pdfx@save@div
 \global\let ^^d5\pdfx@save@dv
 \global\let ^^d6\pdfx@save@dvi
 \global\let ^^d7\pdfx@save@dvii
 \global\let ^^d8\pdfx@save@dviii
 \global\let ^^d9\pdfx@save@dix
 \global\let ^^da\pdfx@save@da
 \global\let ^^db\pdfx@save@db
 \global\let ^^dc\pdfx@save@dc
 \global\let ^^dd\pdfx@save@dd
 \global\let ^^de\pdfx@save@de
 \global\let ^^df\pdfx@save@df
 \global\let ^^e0\pdfx@save@eo
 \global\let ^^e1\pdfx@save@ei
 \global\let ^^e2\pdfx@save@eii
 \global\let ^^e3\pdfx@save@eiii
 \global\let ^^e4\pdfx@save@eiv
 \global\let ^^e5\pdfx@save@ev
 \global\let ^^e6\pdfx@save@evi
 \global\let ^^e7\pdfx@save@evii
 \global\let ^^e8\pdfx@save@eviii
 \global\let ^^e9\pdfx@save@eix
 \global\let ^^ea\pdfx@save@ea
 \global\let ^^eb\pdfx@save@eb
 \global\let ^^ec\pdfx@save@ec
 \global\let ^^ed\pdfx@save@ed
 \global\let ^^ee\pdfx@save@ee
 \global\let ^^ef\pdfx@save@ef
 \global\let ^^f0\pdfx@save@fo
 \global\let ^^f1\pdfx@save@fi
 \global\let ^^f2\pdfx@save@fii
 \global\let ^^f3\pdfx@save@fiii
\fi

\endgroup

%%
%% controls the color model and conversions with  xcolor  package
%%
\ifpdfx@cmyk
 %
 % this will have been done already for PDF/X
 %
 \PassOptionsToPackage{cmyk,hyperref}{xcolor}
 \def\pdfx@handlexcolor{\def\@@mod{cmyk}\selectcolormodel{cmyk}%
   \convertcolorsUtrue\convertcolorsDtrue}
 \ifpdfx@x
 \else
%%  \AtBeginDocument{%
%%   \def\@linkcolor{0 1 1 0}%
%%   \def\@anchorcolor{0 0 0 1}%
%%   \def\@citecolor{1 0 1 0}%
%%   \def\@filecolor{.5 0 0 .5}%
%%   \def\@urlcolor{0 1 0 0}%
%%   \def\@menucolor{0 1 1 0}%
%%   \def\@runcolor{.5 0 0 .5}%
%%   \def\@linkbordercolor{0 1 1 0}%
%%   \def\@citebordercolor{1 0 1 0}%
%%   \def\@filebordercolor{.5 0 0 .5}%
%%   \def\@urlbordercolor{1 0 0 0}%
%%   \def\@menubordercolor{0 1 1 0}%
%%   \def\@runbordercolor{.7 0 0 .3}%
%%   \def\Fld@bcolor{0 0 0 0}%
%%   \def\Fld@bordercolor{0 1 1 0}%
%%  }
 \fi
\else
 \PassOptionsToPackage{rgb,hyperref}{xcolor}
 \def\pdfx@handlexcolor{\def\@@mod{rgb}\selectcolormodel{rgb}%
   \convertcolorsUtrue\convertcolorsDtrue}
\fi
\@ifpackageloaded{xcolor}{\pdfx@handlexcolor
 \ifpdfx@cmyk\else\color{black}\fi}{%
 \AtBeginDocument{\@ifpackageloaded{xcolor}{\pdfx@handlexcolor}{}}
}

%%----------------------------------------------------------------------
%%  Disable some actions in Beamer navigation
\@ifclassloaded{beamer}{%
 \let\real@insertslidenavigationsymbol
   \insertslidenavigationsymbol
 \let\real@insertbackfindforwardnavigationsymbol
   \insertbackfindforwardnavigationsymbol
 \def\pdfx@insertslidenavigationsymbol{{%
  \let\Acrobatmenu\pdfx@Acrobatmenu@noaction
  \real@insertslidenavigationsymbol
 }}%
 \def\pdfx@insertbackfindforwardnavigationsymbol{{%
  \let\Acrobatmenu\pdfx@Acrobatmenu@noaction
  \real@insertbackfindforwardnavigationsymbol
 }}%
 \AtBeginDocument{%
  \ifHy@pdfa
   \let\insertslidenavigationsymbol
     \pdfx@insertslidenavigationsymbol
   \let\insertbackfindforwardnavigationsymbol
     \pdfx@insertbackfindforwardnavigationsymbol
  \fi}%
}{}

%%----------------------------------------------------------------------
\ifpdfx@transliterated
%% support for bookmarks with transliterated input
 \ifxetex\let\pdf@escapehex\empty\fi  % don’t need it
 \expandafter\ifx\csname pdf@escapehex\endcsname\relax
  \PackageWarning{pdfx}{%
   Missing an implementation of \string\pdf@escapehex ^^J
   Translated Bookmarks cannot be generated.^^J}%
  \newcommand{\pdfxBookmark}[4][]{#2[#1]{#4}}%
 \else
```

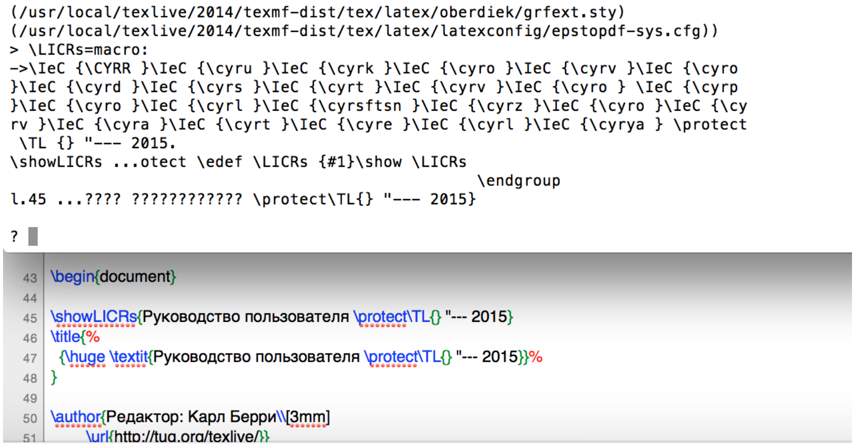
```
\def\pdfx@GeneratePdfString#1#2{%
 % converts a UTF-8 string to UTF-16be
 \StringEncodingConvert{#1}{#2}{utf8}{utf16be}%
 \edef#1{\string\376\string\377\pdfescapestring{#1}}%
}
\newtoks\pdfx@DisabledCommands
\def\pdfxDisableCommands#1{%
\expandafter\pdfx@DisabledCommands
 \expandafter{\the\pdfx@DisabledCommands#1}}
\pdfxDisableCommands{%
 \def\80{}%    else   \000\( --> \000\80\050   \000\000\050
 \aftergroup\let\aftergroup\HyPsd@ConvertToUnicode\aftergroup\@gobble}
\let\Hy@@writetorep\@@writetorep
\def\pdfx@@writetorep#1#2#3#4#5{%
 \begingroup
  \pdfx@xmpunimarkup
  \pdfx@prebookmark
  \edef\pdfstringdefPreHook{%\pdfstringdefPreHook
   \the\pdfx@DisabledCommands}%
  \Hy@@writetorep{#1}{#2}{#3}{#4}{#5}%
 \endgroup
}
\newcommand{\pdfxBookmark}[4][]{%
 \ifx\relax#3\relax
  \PackageError{pdfx}{Unknown macro \string#3.
    A proper bookmark cannot be created}%
   {Proceed to process the \string#1 as usual.}%
  #2{#4}%
 \else
  \ifluatex  % use the utf8 directly
   \let\pdfx@temp#3\relax
   \def\pdfx@prebookmark{%
    \pdfx@DisabledCommands{}%
    \let#3\pdfx@temp
   }%
  \else\ifxetex  % use the utf8 directly
   \let\pdfx@temp#3\relax
   \def\pdfx@prebookmark{%
    \pdfx@DisabledCommands{}%
    \let#3\pdfx@temp
   }%
  \else
   % convert the utf8 to utf16be
   \pdfxBookmarkString\pdfx@temp{#3}%
  \fi\fi
  \let\@@writetorep\pdfx@@writetorep
  \ifx\empty#1\empty
   \def#3{#4}%
   #2{#3}%
  \else
   \def#3{#1}%
   #2[#3]{#4}%
```

```
% $Id: texlive-ru.tex 34060 2014-05-16 19:52:41Z boris $
%
%\def\Status{1}
\providecommand{\pdfxopts}{a-2u,KOIxmp}
\providecommand{\thisyear}{2015}
%\immediate\write18{rm \jobname.xmpdata}%  uncomment for Unix-based systems
\begin{filecontents*}{\jobname.xmpdata}
\Title{\textKOI{òŐËÏŚÏÄÓÔŚÏ ĐÏÌŰÚÏŚÁÔĆÌŃ} TeX Live \textemdash \thisyear}
\Author{\textKOI{òĆÄÁËÔÏÒ: ëÁÒÌ âĆÒÒÉ}}
\Subject{\textKOI{ś ÜÔÏÍ ÄÏËŐÍĆÎÔĆ ÏĐÉÓÁÎÙ ÏÓÎÏŚÎÙĆ ŚÏÚÍÖÏÎÏÓÔÉ ĐÒÏÇÒÁÍÍÎÏÇÏ ĐÒÏÄŐËÔÁ }
 TeX Live \textKOI{--- ÄÉÓÔÒÉÂŐÔÉŚÁ }TeX\textKOI{Á É ÄÒŐÇÉÈ ĐÒÏÇÒÁÍÍ ÄÌŃ} GNU/Linux
 \textKOI{É ÄÒŐÇÉÈ }UNIX\textKOI{ÏŚ}, MacOSX\textKOI{ É  Windows.}}
\Keywords{TeX Live \thisyear\sep \textKOI{óÔÒŐËÔŐÒÁ}\sep \textKOI{ŐÓÔÁÎÏŚËÉ}\sep \TeX}
\CoverDisplayDate{\textKOI{íÁÊ} \thisyear}
\CoverDate{2015-05-06}
\Copyrighted{False}
\Copyright{Public Domain}
\CopyrightURL{http://tug.org/texlive/}
\Creator{pdfTeX + pdfx.sty with options \pdfxopts }
\end{filecontents*}
\documentclass{article}
\usepackage[\pdfxopts]{pdfx}[2016/03/09]
\PassOptionsToPackage{obeyspaces}{url}
\let\tldocrussian=1  % for live4ht.cfg
\usepackage{cmap}
\usepackage{tex-live}
\usepackage[koi8-r]{inputenc}
\usepackage[russian]{babel}
 ...
\begin{document}
\title{%
  {\huge \textit{òŐËÏŚÏÄÓÔŚÏ ĐÏÌŰÚÏŚÁÔĆÌŃ \protect\TL{} "--- \thisyear}}%
}
\author{òĆÄÁËÔÏÒ: ëÁÒÌ âĆÒÒÉ\\[3mm]
        \url{http://tug.org/texlive/}}
\date{íÁÊ \thisyear}
```

Figure 2: Example of cyrillics in metadata, shown as if T1-encoded. See Figure ?? for the actual result.

macro	encodings	bytes 128–255 with languages
\textLAT	Latin-1	Western European
\textLII	Latin-2	Middle European
\textLIII	Latin-3	South European
\textLIV	Latin-4	North European
\textLTV	Latin-5	Turkish
\textLVI	Latin-6	Nordic
\textLVII	Latin-7	Baltic Rim
\textLIIX	Latin-8	Celtic
\textLIX	Latin-9	Western European, incl.
\textKOI	KOI8-R, KOI8-RU	cyrillic alphabets
\textLGR	LGR, ISO-8859-7	Greek & Polytonic Greek
\textARM	ArmTEX, ArmSCII8	Armenian
\textHEB	HE8, ISO-8859-8, CP1255	Hebrew
\textHEBO	CP862	Hebrew
\(...\)	parses simple mathematical expressions	

Figure 3: Parser macros, defined for specific types of input.



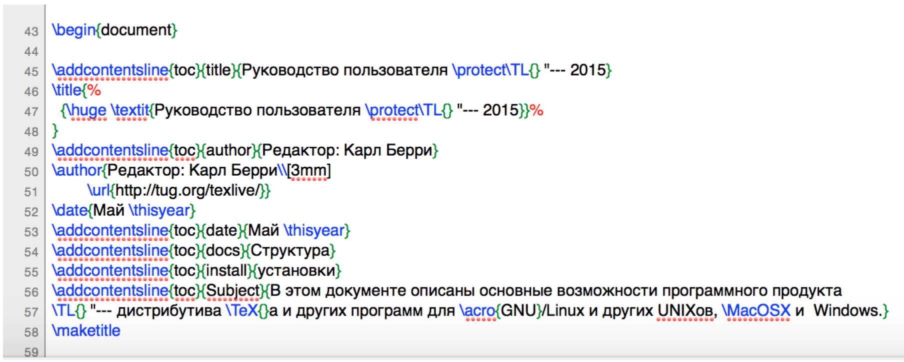
```
(/usr/local/texlive/2014/texmf-dist/tex/latex/oberdiek/grfext.sty)
(/usr/local/texlive/2014/texmf-dist/tex/latex/latexconfig/epstopdf-sys.cfg))
> \LICRs=macro:
->\IeC {\CYRR }\IeC {\cyru }\IeC {\cyrk }\IeC {\cyro }\IeC {\cyrv }\IeC {\cyro
}\IeC {\cyrd }\IeC {\cyrs }\IeC {\cyrt }\IeC {\cyrv }\IeC {\cyro } \IeC {\cyrp
}\IeC {\cyro }\IeC {\cyrl }\IeC {\cyrsftsn }\IeC {\cyrz }\IeC {\cyro }\IeC {\cy
rv }\IeC {\cyra }\IeC {\cyrt }\IeC {\cyre }\IeC {\cyrl }\IeC {\cyrya } \protect
 \TL {} "--- 2015.
\showLICRs ...otect \edef \LICRs {#1}\show \LICRs
                                                  \endgroup
l.45 ...???? ???????????? \protect\TL{} "--- 2015}

? 
```

```
\begin{document}

\showLICRs{Руководство пользователя \protect\TL{} "--- 2015}
\title{%
  {\huge \textit{Руководство пользователя \protect\TL{} "--- 2015}}%
}

\author{Редактор: Карл Берри\\[3mm]
       \url{http://tug.org/texlive/}}
```

Figure 4: How to see LICRs in the .log window.

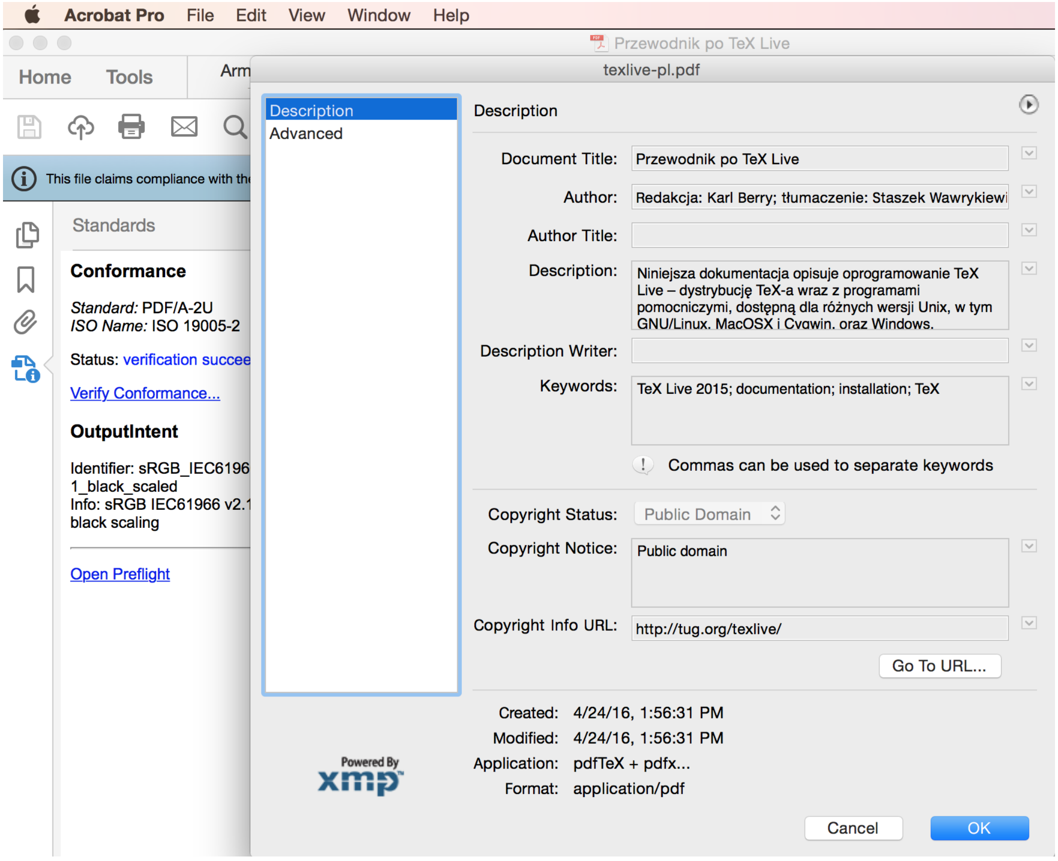
```
% $Id: texlive-ru.tex 34060 2014-05-16 19:52:41Z boris $
%
%\def\Status{1}
\providecommand{\pdfxopts}{a-2u,KOIxmp}
\providecommand{\thisyear}{2015}
%\immediate\write18{rm \jobname.xmpdata}%  uncomment for Unix-based systems
\begin{filecontents*}{\jobname.xmpdata}
\Title{\IeC {\CYRR }\IeC {\cyru }\IeC {\cyrk }\IeC {\cyro }\IeC {\cyrv }\IeC {\cyro }
 \IeC {\cyrd }\IeC {\cyrs }\IeC {\cyrt }\IeC {\cyrv }\IeC {\cyro } \IeC {\cyrp }\IeC {\cyro }
 \IeC {\cyrl }\IeC {\cyrsftsn }\IeC {\cyrz }\IeC {\cyro }\IeC {\cyrv }\IeC {\cyra }\IeC {\cyrt }
 \IeC {\cyre }\IeC {\cyrl }\IeC {\cyrya } TeX Live \textemdash \thisyear}
\Author{\IeC {\CYRR }\IeC {\cyre }\IeC {\cyrd }\IeC {\cyra }\IeC {\cyrk }\IeC {\cyrt }
 \IeC {\cyro }\IeC {\cyrr }: \IeC {\CYRK }\IeC {\cyra }\IeC {\cyrr }\IeC {\cyrl }
 \IeC {\CYRB }\IeC {\cyre }\IeC {\cyrr }\IeC {\cyrr }\IeC {\cyri }
\Keywords{TeX Live \thisyear\sep \IeC {\CYRS }\IeC {\cyrt }\IeC {\cyrr }\IeC {\cyru }
 \IeC {\cyrk }\IeC {\cyrt }\IeC {\cyru }\IeC {\cyrr }\IeC {\cyra }\sep \IeC {\cyru }
 \IeC {\cyrs }\IeC {\cyrt }\IeC {\cyra }\IeC {\cyrn }\IeC {\cyro }\IeC {\cyrv }\IeC {\cyrk }
 \IeC {\cyri }\sep \TeX}
\Subject{\IeC {\CYRV } \IeC {\cyrerev }\IeC {\cyrt }\IeC {\cyro }\IeC {\cyrm } \IeC {\cyrd }
 \IeC {\cyro }\IeC {\cyrk }\IeC {\cyru } ...
 ...
\CoverDisplayDate{\IeC {\CYRM }\IeC {\cyra }\IeC {\cyrishrt } 2015}
\CoverDate{2015-05-06}
\Copyrighted{False}
```

Figure 5: Example of cyrillics in metadata, using LICRs.



```
\begin{document}

\addcontentsline{toc}{title}{Руководство пользователя \protect\TL{} "--- 2015}
\title{%
  {\huge \textit{Руководство пользователя \protect\TL{} "--- 2015}}%
}
\addcontentsline{toc}{author}{Редактор: Карл Берри}
\author{Редактор: Карл Берри\\[3mm]
        \url{http://tug.org/texlive/}}
\date{Май \thisyear}
\addcontentsline{toc}{date}{Май \thisyear}
\addcontentsline{toc}{docs}{Структура}
\addcontentsline{toc}{install}{установки}
\addcontentsline{toc}{Subject}{В этом документе описаны основные возможности программного продукта
\TL{} "--- дистрибутива \TeX{}а и других программ для \acro{GNU}/Linux и других UNIXов, \MacOSX и  Windows.}
\maketitle

```

Figure 6: How to get desired LICRs into the .toc file.



This file claims compliance with th

Conformance

Standard: PDF/A-2U
ISO Name: ISO 19005-2

Status: verification succee

Verify Conformance...

OutputIntent

Identifier: sRGB_IEC61966-1_black_scaled
Info: sRGB IEC61966 v2.1 black scaling

Open Preflight

Description

Document Title: Przewodnik po TeX Live

Author: Redakcja: Karl Berry; tłumaczenie: Staszek Wawrykiewi

Author Title:

Description: Niniejsza dokumentacja opisuje oprogramowanie TeX Live – dystrybucję TeX-a wraz z programami pomocniczymi, dostępną dla różnych wersji Unix, w tym GNU/Linux, MacOSX i Cygwin, oraz Windows.

Description Writer:

Keywords: TeX Live 2015; documentation; installation; TeX

! Commas can be used to separate keywords

Copyright Status: Public Domain

Copyright Notice: Public domain

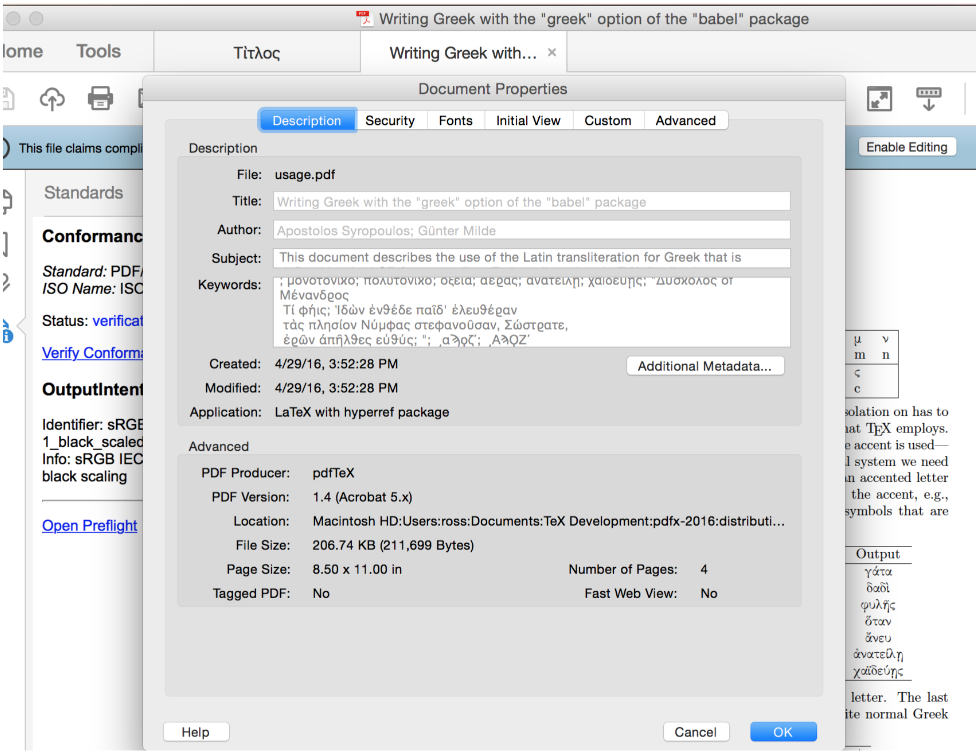
Copyright Info URL: http://tug.org/texlive/

Created: 4/24/16, 1:56:31 PM
Modified: 4/24/16, 1:56:31 PM
Application: pdfTeX + pdfx...
Format: application/pdf

Figure 7: Metadata generated from the coding shown in Figure ?? for the Polish version of TEX Live 2015 documentation, showing Latin-2 encoded characters. The document is valid for PDF/A-2, after having been processed with pdf-LATEX.

```
% iso8859-2
% $Id: texlive-pl.tex, v. 53 2015/05/17
% TeX Live documentation.
% Originally written by Sebastian Rahtz and Michel Goossens,
% now maintained by Karl Berry and others.
% Polish translation and additions by Staszek Wawrykiewicz
% (with a little help from my friends, while my guitar gently weeps ;-)
% Public domain.
%  ----
% UWAGA dla recenzentów/tłumaczy:  %%! to moje komentarze (StaW)
%
\providecommand{\pdfxopts}{a-2u,LATxmp}
\providecommand{\thisyear}{2015}
\begin{filecontents*}{\jobname.xmpdata}
\Title{Przewodnik po TeX Live \thisyear}
\Author{Redakcja: Karl Berry\sep \textLII{tłumaczenie: Staszek Wawrykiewicz}}
\Subject{\textLII{Niniejsza dokumentacja opisuje oprogramowanie \TeX\ Live
 -- dystrybucjê \TeX-a wraz z~programami pomocniczymi, dostêpn± dla różnych wersji Unix,
  w~tym GNU/Linux, MacOSX i~Cygwin, oraz Windows.}\textLF\textLF Documentation originally
 written by Sebastian Rahtz and Michel Goossens, now maintained by Karl Berry and others.}
\Keywords{TeX Live \thisyear\sep documentation\sep installation\sep \TeX}
\Copyright{Public domain}\Copyrighted{False}
\CopyrightURL{http://tug.org/texlive/}
\CoverDisplayDate{Maj \thisyear}
\CoverDate{\thisyear-05-17}
\Creator{pdfTeX + pdfx.sty with options \pdfxopts, from TeX Live 2016}
\end{filecontents*}
%
\documentclass{article}
\let\tldocenglish=0 % for live4ht.cfg
\let\textsl\textit
\usepackage[\pdfxopts]{pdfx}[2016/04/13]
\PassOptionsToPackage{obeyspaces}{url}
\PassOptionsToPackage{breaklinks,colorlinks,linkcolor=hypercolor,citecolor=hypercolor,%
  urlcolor=hypercolor,filecolor=hypercolor,bookmarksopen,hyperindex}{hyperref}
\hypersetup{breaklinks,colorlinks,allcolors=hypercolor}
\usepackage{tex-live}
\usepackage{polski}            %% for PL
\usepackage[latin2]{inputenc}  %% for PL
\usepackage[T1]{fontenc}
...
\begin{document}
\title{\huge \textit{Przewodnik po \protect\TL{} 2015}}
\author{Redakcja: Karl Berry; tłumaczenie: Staszek Wawrykiewicz \\[3mm]
        \url{http://tug.org/texlive/}}
\date{Maj 2015}
```

Figure 8: Start of the LATEX source for the Polish version of TEX Live documentation. Although Latin-2 encoded, the bytes are shown here using LATEX's `T1` encoding [?, p. 449].



Writing Greek with the "greek" option of the "babel" package

Τὶτλος | Writing Greek with…

Document Properties

Description | Security | Fonts | Initial View | Custom | Advanced

Description

File: usage.pdf

Title: Writing Greek with the "greek" option of the "babel" package

Author: Apostolos Syropoulos; Günter Milde

Subject: This document describes the use of the Latin transliteration for Greek that is

Keywords: ; μονοτονικο; πολυτονικο; οξεια; αερας; ανατειλη; χαιδευης; "Δυσκολος of
Μένανδρος
Τί φήις; Ἰδὼν ἐνθέδε παῖδ' ἐλευθέραν
τὰς πλησίον Νύμφας στεφανοῦσαν, Σώστρατε,
ἐρῶν ἀπῆλθες εὐθύς; "; ͵αϡϙϛʹ; ͵ΑϡϘΖʹ

Created: 4/29/16, 3:52:28 PM

Modified: 4/29/16, 3:52:28 PM

Application: LaTeX with hyperref package

Advanced

PDF Producer: pdfTeX

PDF Version: 1.4 (Acrobat 5.x)

Location: Macintosh HD:Users:ross:Documents:TeX Development:pdfx-2016:distributi…

File Size: 206.74 KB (211,699 Bytes)

Page Size: 8.50 x 11.00 in

Number of Pages: 4

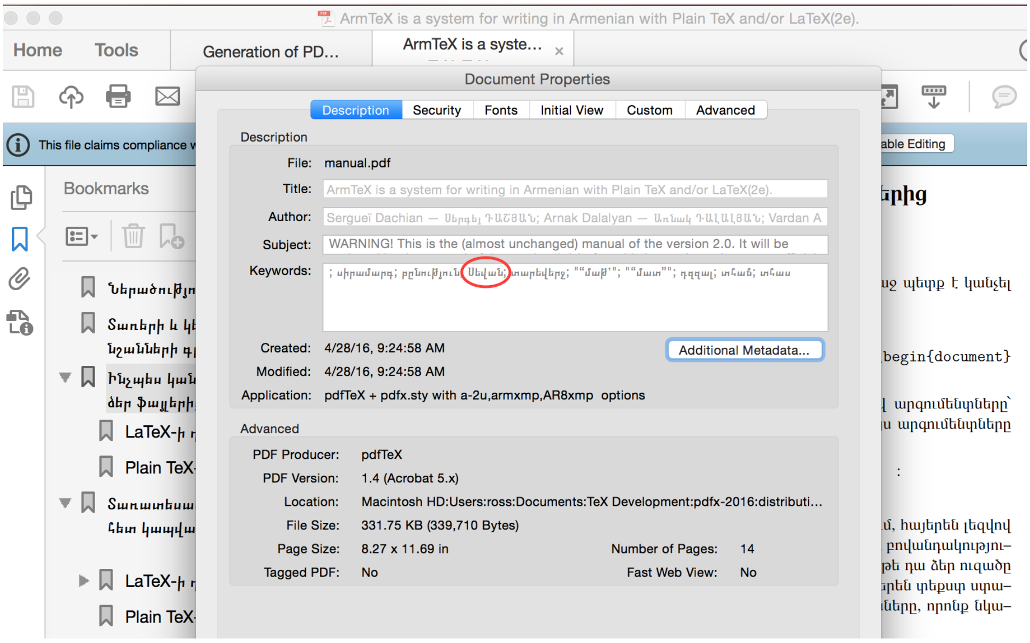
Tagged PDF: No

Fast Web View: No

Figure 9: Metadata generated from the coding shown in Figure ?? using the greek language specified via the LGR encoding.

```
% ...
% This file is part of the Babel system.
% -------------------------------------
%
% It may be distributed and/or modified under the
% conditions of the LaTeX Project Public License, either version 1.3
% ...
% The Current Maintainer of this work is Günter Milde.
% ...

\providecommand{\pdfxopts}{a-2u,LGRxmp,LATxmp}
\begin{filecontents*}{\jobname.xmpdata}
\Title{Writing Greek with the "greek" option of the "babel" package}
\Author{Apostolos Syropoulos\sep Günter Milde}
\Subject{This document describes the use of the Latin transliteration for Greek that is
 defined by the LGR font encoding. Today, all modern LaTeX distributions support literal
 input of Greek, which is the preferred method for new documents. [G. Milde 2013/12/02]}
\Keywords{\textLGR{monotonik'o}\sep \textLGR{polutonik'o}\sep \textgreek{oxe'ia} \sep
   \textgreek{>a'erac}\sep \textgreek{>anate'ilh|}\sep \textgreek{qa"ide'uh|c}} \sep
  \textgreek{D'uskoloc} of \textgreek{M'enandroc}\textLF \textLGR{T'i f'hic? <Id‘wn
  >enj'ede pa~id'' >eleuj'eran\textLF t‘ac plhs'ion N'umfac stefano~usan, S'wstrate,
  \textLF >er~wn 'ap~hljec e>uj'uc? \sep
  \textaristerikeraia\textalpha\textsampi\textqoppa\textzeta\textdexiakeraia\sep
  \textaristerikeraia\textAlpha\textSampi\textQoppa\textZeta\textdexiakeraia}}
\CoverDate{1997-10-15}
\CoverDisplayDate{October 15, 1997}
\Copyright{This file is part of the Babel system.\textLF This file may be distributed and/or
 modified under the conditions of the LaTeX Project Public License, either version 1.3
 of this license or (at your option) any later version.}
\CopyrightURL{http://www.latex-project.org/lppl.txt}
\end{filecontents*}
%
\documentclass[11pt]{article}
\usepackage[\pdfxopts]{pdfx}[2016/04/13]
\hypersetup{colorlinks,allcolors=blue}
\usepackage[american,greek]{babel}
\languageattribute{greek}{polutoniko}
\usepackage{athnum,grmath}
\newcommand{\sg}{\selectlanguage{greek}}
\newcommand{\sa}{\selectlanguage{american}}
\begin{document}
\selectlanguage{american}
\title{Writing Greek with the \ttfamily greek\rmfamily\  option of the
 \ttfamily babel\rmfamily\ package}
\author{Apostolos Syropoulos\\
        ...\\...}
\date{October 15, 1997}
\maketitle
\abstract{\noindent
This document describes the use of the Latin transliteration for Greek that
is defined by the LGR font encoding. Today, all modern LaTeX distributions
support literal input of Greek, which is the preferred method for new
documents. [G. Milde 2013/12/02]}
```

Figure 10: Start of enriched LATEX source for a document describing how to typeset in Greek, with added metadata demonstrating the LGR transliteration encoding.


ArmTeX is a system for writing in Armenian with Plain TeX and/or LaTeX(2e).
Home
Tools
Generation of PD...
ArmTeX is a syste...
This file claims compliance w
able Editing
Bookmarks

Document Properties

Description | Security | Fonts | Initial View | Custom | Advanced

Description

File: manual.pdf

Title: ArmTeX is a system for writing in Armenian with Plain TeX and/or LaTeX(2e).

Author: Sergueï Dachian — Սերգեյ ԴԱՇՅԱՆ; Arnak Dalalyan — Առնակ ԴԱԼԱԼՅԱՆ; Vardan A

Subject: WARNING! This is the (almost unchanged) manual of the version 2.0. It will be

Keywords: ; սիրամարգ; բընութիւն; Սեվան; տարեկերց; ""մաթ'"; ""մատ""; դզզալ; տհաճ; տհաս

Created: 4/28/16, 9:24:58 AM

Modified: 4/28/16, 9:24:58 AM

Application: pdfTeX + pdfx.sty with a-2u,armxmp,AR8xmp options

Additional Metadata...

Advanced

PDF Producer: pdfTeX

PDF Version: 1.4 (Acrobat 5.x)

Location: Macintosh HD:Users:ross:Documents:TeX Development:pdfx-2016:distributi...

File Size: 331.75 KB (339,710 Bytes)

Page Size: 8.27 x 11.69 in | Number of Pages: 14

Tagged PDF: No | Fast Web View: No

Figure 11: Metadata generated from the coding shown in Figure ?? using the Armenian language specified using ArmTEX transliteration. Bookmarks have been generated in Armenian. Figure ?? explains how the word indicated in red is obtained via parsing.

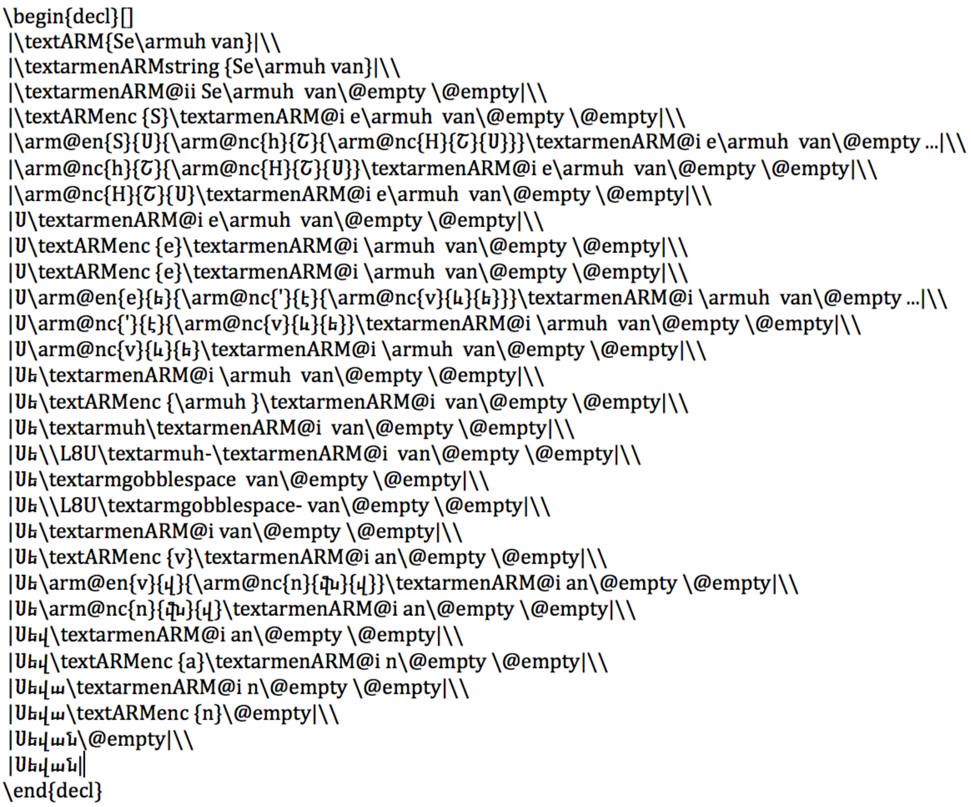
```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%
%% This is the ‘manual.tex’ file (ArmTeX manual in Armenian).
 ...
%%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
\providecommand{\pdfxopts}{a-2u,armxmp,AR8xmp}
\immediate\write18{rm \jobname.xmpdata}
\begin{filecontents*}{\jobname.xmpdata}
\Title{ArmTeX is a system for writing in Armenian with Plain TeX and/or LaTeX(2e).\textLF
 \textARM{\ArmTeX‘ {\aroff\TeX}-um ev {\aroff\LaTeX}-um Hayeren Lezvov Grelu Hamakarg}}
\Author{Sergue\"i Dachian \textARM{--- Sergey DASHYAN}\sep Arnak Dalalyan
 \textARM{--- Ar’nak DALALYAN}\sep Vardan Akopian \textARM{--- Vardan HAKOBYAN}}
\Copyright{\textcopyright 1997\textendash 2013  ArmTeX may be distributed and/or modified
 under the conditions of the LaTeX Project Public License, either version 1.3 of this
 license or (at your option) any later version.}
\CopyrightURL{http://www.latex-project.org/lppl.txt}
\Subject{WARNING! This is the (almost unchanged) manual of the version 2.0. It will be
 replaced by the manual of the version 3.0 before this beta release becomes official.
 A (temporary) brief description of the new features of \latArmTeX~3.0 can be found at
 the end of the ‘‘readme.txt’’ file. \textLF
 \textLF\textARM{OWSHADROWT’YO|WN: Sa tarberak 2.0-i (grethe anphophox) dzer’narkn e’: Ayn
 kphoxarinvi tarberak 3.0-i dzer’narkov naxqan ays beta tho\-ghark\-man pashtonakanacowmu’:
 \ArmTeX~3.0-i nor hnaravoruthyunneri (g’a\-ma\-na\-ka\-vor) hamar’ot nkaragrowmu’ (angleren
 lezvov) karogh eq gu’t\armuh nel~‘‘}readme.txt\textARM{’’ fayli verjum:}
 \textLF\textLF\textARM{Hamakargu’ o’gtagorc’elu hamar bavakan e’ karoghanal ayn kanchel dzer
 fayleric, tirapetel tar’qatesakneru’ phoxogh hramannerin ev i\-ma\-nal the inchpes petq e’
 nermuc’el teqstu’ steghnasharic: Ays gor\-c’o\-ghu\-thyun\-ne\-ru’ nkaragrvac’ en hajordogh
 ereq bag’innerum:}}
\Keywords{\textARM{si\-ra\-marg}\sep \textARM{bu’\armuh nuthyun}\sep \textARM{Se\armuh van}
 \sep \textARM{tare\*verj}\sep \textARM{‘‘mat’’}\sep \textARM{‘‘mat"}\sep \textARM{d\*zzal}
 \sep \textARM{t\*haj’}\sep \textARM{t\*has}}
\CoverDisplayDate{1 June 1999 (\textARM{1-u’ hunisi 1999 th.})}
\Creator{pdfTeX + pdfx.sty with \pdfxopts\space options}
\pdfxEnableCommands{\let\sl\empty%
 \xdef\sectAtitle{\textARM{Nerac’uthyun}}%
 \xdef\sectBtitle{\textARM{Tar’eri ev ketadrakan nshanneri greladzevu’}}%
 ...
 \xdef\sectFtitle{\textARM{Arm\TeX-i phophoxman patmuthyunu’}}%
}
\end{filecontents*}

\documentclass[12pt,a4paper]{article}
\usepackage[\pdfxopts]{pdfx}
\hypersetup{colorlinks,allcolors=blue}
 ...
\title{\ArmTeX$\,$‘ $\,${\aroff \TeX}-um ev {\aroff \LaTeX}-um Hayeren Lezvov
  Grelu Hamakarg\\ {\normalsize\aroff (\latArmTeX: a System for Writing in Armenian
  with \TeX\ and \LaTeX)}}
\author{ ... }%
\date{1-u’ hunisi 1999 th.}
 ...
\begin{document}
\maketitle
 ...
%\section{\sectAtitle}%{Nerac’uthyun}}
\pdfxBookmark{\section}{\sectAtitle}{Nerac’uthyun}
```

Figure 12: Enriched LaTeX source for the Armenian version of the ArmTeX manual, with added metadata demonstrating the ArmTeX transliteration scheme for OT6 encoding. Also shown is coding used to produce bookmarks from the transliteration.

```
\textARM{Se\armuh van}
\textarmenARMstring {Se\armuh van}
\textarmenARM@ii Se\armuh  van\@empty \@empty
\textARMenc {S}\textarmenARM@i e\armuh  van\@empty \@empty
\arm@en{S}{Ő?}{\arm@nc{h}{Ő?}{\arm@nc{H}{Ő?}{Ő?}}}\textarmenARM@i e\armuh  van\@empty ...
\arm@nc{h}{Ő?}{\arm@nc{H}{Ő?}{Ő?}}\textarmenARM@i e\armuh  van\@empty \@empty
\arm@nc{H}{Ő?}{Ő?}\textarmenARM@i e\armuh  van\@empty \@empty
Ő?\textarmenARM@i e\armuh  van\@empty \@empty
Ő?\textARMenc {e}\textarmenARM@i \armuh  van\@empty \@empty
Ő?\textARMenc {e}\textarmenARM@i \armuh  van\@empty \@empty
Ő?\arm@en{e}{Ő„}{\arm@nc{’}{Ő§}{\arm@nc{v}{Ö?}{Ő„}}}\textarmenARM@i \armuh  van\@empty ...
Ő?\arm@nc{’}{Ő§}{\arm@nc{v}{Ö?}{Ő„}}\textarmenARM@i \armuh  van\@empty \@empty
Ő?\arm@nc{v}{Ö?}{Ő„}\textarmenARM@i \armuh  van\@empty \@empty
Ő?Ő„\textarmenARM@i \armuh  van\@empty \@empty
Ő?Ő„\textARMenc {\armuh }\textarmenARM@i  van\@empty \@empty
Ő?Ő„\textarmuh\textarmenARM@i  van\@empty \@empty
Ő?Ő„\\L8U\textarmuh-\textarmenARM@i  van\@empty \@empty
Ő?Ő„\textarmgobblespace  van\@empty \@empty
Ő?Ő„\\L8U\textarmgobblespace- van\@empty \@empty
Ő?Ő„\textarmenARM@i van\@empty \@empty
Ő?Ő„\textARMenc {v}\textarmenARM@i an\@empty \@empty
Ő?Ő„\arm@en{v}{ŐŸ}{\arm@nc{n}{ïŹ?}{ŐŸ}}\textarmenARM@i an\@empty \@empty
Ő?Ő„\arm@nc{n}{ïŹ?}{ŐŸ}\textarmenARM@i an\@empty \@empty
Ő?Ő„ŐŸ\textarmenARM@i an\@empty \@empty
Ő?Ő„ŐŸ\textARMenc {a}\textarmenARM@i n\@empty \@empty
Ő?Ő„ŐŸŐĄ\textarmenARM@i n\@empty \@empty
Ő?Ő„ŐŸŐĄ\textARMenc {n}\@empty
Ő?Ő„ŐŸŐĄŐ¶\@empty
Ő?Ő„ŐŸŐĄŐ¶
```

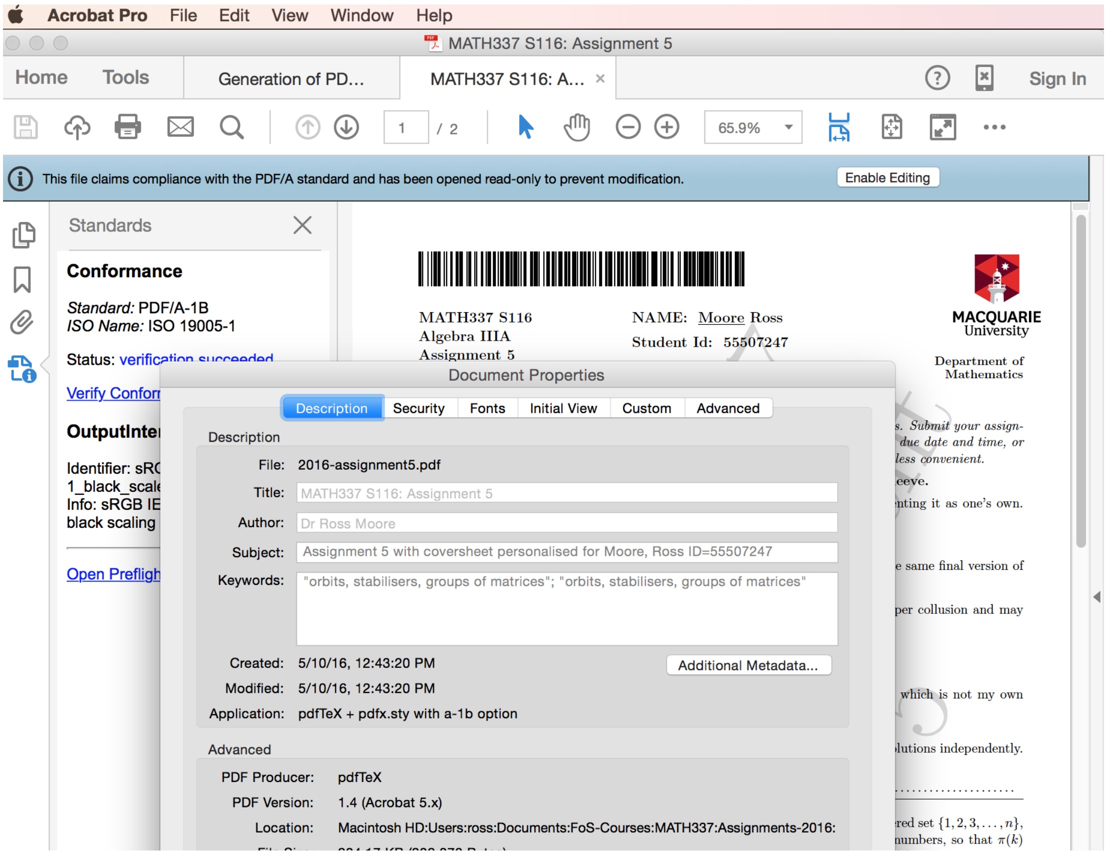
The macro \armen@en (named for **e**mpty or **n**ext), looks ahead to see if the 5th-next argument token is \@empty, signifying that there is nothing left of the original input. (A closed bracing {...} counts as a single argument.) If \@empty the tokens in the 2nd bracing are substituted, otherwise those in the 3rd bracing. Similarly \armen@nc (named for **n**ext **c**haracter) looks to see whether that 5th argument token matches with the character in the 1st bracing. If so, the 2nd bracing's tokens are substituted, else those of the 3rd bracing. This is how to cope with 'Sh' or 'SH', implemented as ligatures in an OT6 encoded font, denoting a different letter from a single 'S'. The macro \armuh is used here to *prevent* a ligature from ev that would otherwise occur. One writes e\armuh v to get the separate letters. As the space becomes an active token, we need \textarmgobblespace to restart parsing appropriately. Of course \textarmenARM@i behaves like \textgreekLGR@i as explained earlier, with a test for \@empty as the 2nd token. At the end, any remaining \@empty expand into nothing.

Figure 13: Partial tracing of the conversion of an Armenian word, indicated by the red oval in Figure **??**, from `OT6` transliterated form into UTF-8 bytes. In each line, TEX expansion occurs at the position of the left-most '\'. The resulting bytes are shown here in `T1` encoding, as in previous examples, with `?` indicating an invisible character in the byte range `0x80`–`0x9f`. See Figure **??** for how this source appears with UTF-8 encoding.



```
\begin{decl}[]
 |\textARM{Se\armuh van}|\\
 |\textarmenARMstring {Se\armuh van}|\\
 |\textarmenARM@ii Se\armuh  van\@empty \@empty|\\
 |\textARMenc {S}\textarmenARM@i e\armuh  van\@empty \@empty|\\
 |\arm@en{S}{Ս}{\arm@nc{h}{Շ}{\arm@nc{H}{Շ}{Ս}}}\textarmenARM@i e\armuh  van\@empty ...|\\
 |\arm@nc{h}{Շ}{\arm@nc{H}{Շ}{Ս}}\textarmenARM@i e\armuh  van\@empty \@empty|\\
 |\arm@nc{H}{Շ}{Ս}\textarmenARM@i e\armuh  van\@empty \@empty|\\
 |Ս\textarmenARM@i e\armuh  van\@empty \@empty|\\
 |Ս\textARMenc {e}\textarmenARM@i \armuh  van\@empty \@empty|\\
 |Ս\textARMenc {e}\textarmenARM@i \armuh  van\@empty \@empty|\\
 |Ս\arm@en{e}{ե}{\arm@nc{'}{է}{\arm@nc{v}{և}{ե}}}\textarmenARM@i \armuh  van\@empty ...|\\
 |Ս\arm@nc{'}{է}{\arm@nc{v}{և}{ե}}\textarmenARM@i \armuh  van\@empty \@empty|\\
 |Ս\arm@nc{v}{և}{ե}\textarmenARM@i \armuh  van\@empty \@empty|\\
 |Սե\textarmenARM@i \armuh  van\@empty \@empty|\\
 |Սե\textARMenc {\armuh }\textarmenARM@i  van\@empty \@empty|\\
 |Սե\textarmuh\textarmenARM@i  van\@empty \@empty|\\
 |Սե\\L8U\textarmuh-\textarmenARM@i  van\@empty \@empty|\\
 |Սե\textarmgobblespace  van\@empty \@empty|\\
 |Սե\\L8U\textarmgobblespace- van\@empty \@empty|\\
 |Սե\textarmenARM@i van\@empty \@empty|\\
 |Սե\textARMenc {v}\textarmenARM@i an\@empty \@empty|\\
 |Սե\arm@en{v}{վ}{\arm@nc{n}{փ}{վ}}\textarmenARM@i an\@empty \@empty|\\
 |Սե\arm@nc{n}{փ}{վ}\textarmenARM@i an\@empty \@empty|\\
 |Սեվ\textarmenARM@i an\@empty \@empty|\\
 |Սեվ\textARMenc {a}\textarmenARM@i n\@empty \@empty|\\
 |Սեվա\textarmenARM@i n\@empty \@empty|\\
 |Սեվա\textARMenc {n}\@empty|\\
 |Սեվան\@empty|\\
 |Սեվան||
\end{decl}
```

Figure 14: Image of part of the source coding for Figure ??, viewed as UTF-8 encoded, within editing software.



This file claims compliance with the PDF/A standard and has been opened read-only to prevent modification.

Standards

Conformance

Standard: PDF/A-1B
ISO Name: ISO 19005-1

Status: verification succeeded

Verify Confor

OutputInte

Identifier: sRG
1_black_scale
Info: sRGB IE
black scaling

Open Prefligh

MATH337 S116 NAME: Moore Ross
Algebra IIIA Student Id: 55507247
Assignment 5

Document Properties

Description | Security | Fonts | Initial View | Custom | Advanced

Description

File: 2016-assignment5.pdf
Title: MATH337 S116: Assignment 5
Author: Dr Ross Moore
Subject: Assignment 5 with coversheet personalised for Moore, Ross ID=55507247
Keywords: "orbits, stabilisers, groups of matrices"; "orbits, stabilisers, groups of matrices"
Created: 5/10/16, 12:43:20 PM
Modified: 5/10/16, 12:43:20 PM
Application: pdfTeX + pdfx.sty with a-1b option

Additional Metadata...

Advanced

PDF Producer: pdfTeX
PDF Version: 1.4 (Acrobat 5.x)
Location: Macintosh HD:Users:ross:Documents:FoS-Courses:MATH337:Assignments-2016:

Figure 15: Metadata from student assignment papers, using information drawn from a database. The start of the LATEX coding for this example is shown in Figure ??.

```
\providecommand{\theassignmentnumber}{5}
\providecommand{\assignLecturer}{Dr Ross Moore}
\providecommand{\theunitcode}{MATH337}
\providecommand{\theunitname}{Algebra IIIA}
\providecommand{\theyear}{2016}
...
\def\assigntopics{orbits, stabilisers, groups of matrices}
\providecommand{\pdfxopts}{a-1b}
%% XMP metadata for PDF/A conformance
\begin{filecontents*}{\jobname.xmpdata}
\Title{\theunitcode\ \theoffering: Assignment \theassignmentnumber}
\Author{\assignLecturer}
\Copyright{Macquarie University, Mathematics Department}
\Subject{Assignment \theassignmentnumber, with coversheet personalised for \thestudentname,
  id = \thestudentid}
\Keywords{\assigntopics}
\Creator{pdfTeX + pdfx.sty with \pdfxopts\space option}
\pdfxEnableCommands{\def\utext#1{#1,}}
\end{filecontents*}

\documentclass[a4paper,11pt]{article}
\RequirePackage{assignments}
\usepackage[\pdfxopts]{pdfx}
```

Figure 16: Start of the LATEX source for an assignment paper, using macro expansion values supplied via definitions prepended to this file.