LaTeX Class for the *Association for Computing Machinery**

Boris Veytsman†

2022/10/24, v1.88

Abstract

This package provides a class for typesetting publications of the Association for Computing Machinery.

Contents

1 Introduction **3**

2 User's guide **3**

2.1 Installation . . . 3
2.2 Invocation and options . . . 6
2.3 Top matter . . . 7
2.4 Top matter of ACM Engage materials . . . 19
2.5 ACM cover page . . . 19
2.6 Internationalization . . . 20
2.7 Algorithms . . . 21
2.8 Figures and tables . . . 21
2.9 Descriptions of images . . . 23
2.10 Theorems . . . 23
2.11 Online-only and offline-only material . . . 23
2.12 Note about anonymous mode . . . 24
2.13 Acknowledgments . . . 24
2.14 Bibliography . . . 25
2.14.1 Processing using BibTeX . . . 25
2.14.2 Processing using BibLaTeX . . . 28
2.15 Colors . . . 29
2.16 Other notable packages and typographic remarks . . . 29
2.17 Counting words . . . 30
2.18 Creative Commons licenses for ACM publications . . . 30
2.19 Disabled or forbidden commands . . . 31
2.20 Notes for wizards . . . 31
2.21 Currently supported publications . . . 32
2.22 A note about `sigchi-a` format . . . 33

*©2016–2022, Association for Computing Machinery

†borisv@lk.net, boris@varphi.com

3 Implementation **35**
3.1 Identification . . . 35
3.2 Preload hook . . . 35
3.3 Options . . . 35
3.4 Setting switches . . . 39
3.5 Loading the base class and package . . . 40
3.6 Citations . . . 41
3.7 Internationalization . . . 43
3.8 Sectioning . . . 45
3.9 Hyperxmp and hyperref . . . 48
3.10 Other packages . . . 50
3.11 Paper size and paragraphing . . . 50
3.12 Fonts . . . 53
3.13 Image descriptions . . . 55
3.14 Floats . . . 56
3.15 Lists . . . 58
3.16 Top-matter data . . . 59
3.17 Concepts system . . . 75
3.18 Copyright system . . . 76
3.19 Maketitle hook . . . 82
3.20 ACM Engage top matter . . . 82
3.21 Typesetting top matter . . . 82
3.22 Headers and Footers . . . 99
3.23 Sectioning . . . 106
3.24 TOC lists . . . 108
3.25 Theorems . . . 108
3.26 Balancing columns . . . 111
3.27 Acknowledgments . . . 113
3.28 Conditional typesetting . . . 113
3.29 Additional bibliography commands . . . 113
3.30 Index . . . 114
3.31 End of Class . . . 114

1 Introduction

The Association for Computing Machinery[1] is the world's largest educational and scientific computing society, which delivers resources that advance computing as a science and a profession. It was one of the early adopters of TEX for its typesetting.

It provided several different classes for a number of journals and conference proceedings. Unfortunately during the years since these classes were written, the code was patched many times, and supporting different versions of the classes became difficult.

This package provides the uniform interface for all ACM publications. It is intended to replace all the different classes and packages and provide an up-to-date LATEX package.

This package uses only free TEX packages and fonts included in TEXLive, MikTEX and other popular TEX distributions. It is intended to be published in these distributions itself, which minimizes users' efforts in the installation and support of this package.

I am grateful to Michael D. Adams, Leif Andersen, Lawrence Christopher Angrave, Dirk Beyer, Andrew Black, Joachim Breitner, Yegor Bugayenko, Benjamin Byholm, John Collins, Roberto Di Cosmo, Nils Anders Danielsson, Michael Ekstrand, Matthew Fluet, Paolo G. Giarrusso, Ben Greenman, Enrico Gregorio, Jamie Davis, Ulrike Fischer, Jason Hemann, Peter Kemp, Luis Leiva, Ben Liblit, Rholais Lii, LianTze Lim, Kuldeep S. Meel, Kai Mindermann, Frank Mittelbach, Serguei Mokhov, Ross Moore, John Owens, Joel Nider, Scott Pakin, Tobias Pape, Henning Pohl, Philip Quinn, Mathias Rav, Andreas Reichinger, Matteo Riondato, Craig Rodkin, Bernard Rous, Feras Saad, Kerry A. Seitz, Jr., David Shamma, Gabriel Scherer, Kartik Singhal, Christoph Sommer, Stephen Spencer, Shin Hwei Tan, Daniel Thomas, Shari Trewin, Zack Weinberg, John Wickerson and many others for their invaluable help.

The development version of the package is available at https://github.com/borisveytsman/acmart.

2 User's guide

This class uses many commands and customizaton options, so it might appear intimidating for a casual user. Do not panic! Many of these commands and options can be safely left with their default values or the values recommended by your conference or journal editors. If you have problems or questions, do not hesitate to ask me directly or the community at https://github.com/borisveytsman/acmart, https://tex.stackexchange.com or the closest TEX Users Group. The world-wide TEX Users Group is at https://tug.org/; please consider joining us if you use TEX regularly.

2.1 Installation

Most probably, you already have this package installed in your favorite TEX distribution; if not, you may want to upgrade. You may need to upgrade it anyway since this package uses a number of relatively recent packages, especially the ones related to fonts.

The latest released version of this package can be found on CTAN: https://www.ctan.org/pkg/acmart. The development version can be found on GitHub: https://github.com/borisveytsman/acmart. At this address you can file a bug report—or even contribute your own enhancement by making a pull request.

[1] http://www.acm.org/

Please note that the version on Github is a development (or experimental) version: please download it for testing new features. The production version is the one on CTAN and ACM sites.

Most users should not attempt to install this package themselves but should rather rely on their TEX distributions to provide it. If you decide to install the package yourself, follow the standard rules:

1. Run `latex acmart.ins`. This will produce the file `acmart.cls`
2. Put the files `acmart.cls` and `ACM-Reference-Format.bst` in places where LATEX can find them (see [1] or the documentation for your TEX system).
3. Update the database of file names. Again, see [1] or the documentation for your TEX system for the system-specific details.
4. The file `acmart.pdf` provides the documentation for the package. (This is probably the file you are reading now.)

As an alternative to items 2 and 3 you can just put the files in the working directory where your `.tex` file is.

This class uses a number of other packages. They are included in all major TEX distributions (TEXLive, MacTEX, MikTEX) of 2015 and later, so you probably have them installed. Just in case here is the list of these packages:

- *amscls*, http://www.ctan.org/pkg/amscls
- *amsfonts*, http://www.ctan.org/pkg/amsfonts
- *amsmath*, http://www.ctan.org/pkg/amsmath
- *binhex*, http://www.ctan.org/pkg/binhex
- *balance*, http://www.ctan.org/pkg/balance
- *booktabs*, http://www.ctan.org/pkg/booktabs
- *caption*, http://www.ctan.org/pkg/caption
- *comment*, http://www.ctan.org/pkg/comment
- *cm-super*, http://www.ctan.org/pkg/cm-super
- *cmap*, http://www.ctan.org/pkg/cmap
- *doclicense*, http://www.ctan.org/pkg/doclicense
- *draftwatermark*, http://www.ctan.org/pkg/draftwatermark
- *environ*, http://www.ctan.org/pkg/environ
- *etoolbox*, http://www.ctan.org/pkg/etoolbox
- *fancyhdr*, http://www.ctan.org/pkg/fancyhdr
- *float*, http://www.ctan.org/pkg/float
- *fontaxes*, http://www.ctan.org/pkg/fontaxes

- *geometry*, http://www.ctan.org/pkg/geometry
- *graphics*, http://www.ctan.org/pkg/graphics
- *hyperref*, http://www.ctan.org/pkg/hyperref
- *hyperxmp*, http://www.ctan.org/pkg/hyperxmp
- *iftex*, http://www.ctan.org/pkg/iftex
- *inconsolata*, http://www.ctan.org/pkg/inconsolata
- *libertine*, http://www.ctan.org/pkg/libertine
- *manyfoot*, http://www.ctan.org/pkg/manyfoot
- *microtype*, http://www.ctan.org/pkg/microtype
- *mmap*, http://www.ctan.org/pkg/mmap
- *ms*, http://www.ctan.org/pkg/ms
- *mweights*, http://www.ctan.org/pkg/mweights
- *natbib*, http://www.ctan.org/pkg/natbib
- *nccfoots*, http://www.ctan.org/pkg/nccfoots
- *newtx*, http://www.ctan.org/pkg/newtx
- *oberdiek*, http://www.ctan.org/pkg/oberdiek
- *pdftex-def*, http://www.ctan.org/pkg/pdftex-def
- *refcount*, http://www.ctan.org/pkg/refcount
- *setspace*, http://www.ctan.org/pkg/setspace
- *textcase*, http://www.ctan.org/pkg/textcase
- *totpages*, http://www.ctan.org/pkg/totpages
- *trimspaces*, http://www.ctan.org/pkg/trimspaces
- *upquote*, http://www.ctan.org/pkg/upquote
- *url*, http://www.ctan.org/pkg/url
- *xcolor*, http://www.ctan.org/pkg/xcolor
- *xkeyval*, http://www.ctan.org/pkg/xkeyval
- *xstring*, http://www.ctan.org/pkg/xstring

2.2 Invocation and options

To use this class, put in the preamble of your document

```
\documentclass[⟨options⟩]{acmart}
```

There are several options corresponding to the type of the document and its general appearance. They are described below. Generally speaking, the options have `key=value` forms, for example,

```
\documentclass[format=acmsmall, screen=true, review=false]{acmart}
```

The option `format` describes the format of the output. There are several possible values for this option, for example,

```
\documentclass[format=acmtog]{acmart}
```

Actually the words `format=` can be omitted, e.g.,

```
\documentclass[acmtog, review=false]{acmart}
```

The possible formats are listed in Table 1. Note that formats starting with `acm` are intended for journals, transactions, and course materials, while formats starting with `sig` are intended for proceedings published as books.

Note that sometimes conference proceedings are published as a special issue (or issues) of an ACM journal. In this case, you should use the journal format for a conference paper. Please contact your conference committee if in doubt.

Starting in 2020, ACM retired formats `sigchi` and `sigchi-a`. SIGCHI conferences now use `sigconf` format for their publications. If a file uses `sigchi` format, a warning is issued, and the format is automatically switched to `sigconf`. Format `sigchi-a` can be used for non-ACM documents only (see Section 2.22). The format `acmcp` is used for ACM cover pages discussed in Section 2.5.

There are several Boolean options that can take `true` or `false` values. They are listed in Table 2. The words `=true` can be omitted when setting a Boolean option, so instead of `screen=true` one can write just `screen`, for example,

```
\documentclass[acmsmall, screen, review]{acmart}
```

The option `review` is useful when combined with the `manuscript` format option. It provides a version suitable for reviewers and copy editors.

Two samples in the `samples` directory, `manuscript` and `acmsmall-submission`, show manuscripts formatted for submission to ACM.

The default for the option `screen` depends on the publication. At present it is `false` for all publications *but* PACM, since PACM is now electronic-only. Thus PACM titles (see Table 5) set this option to `true`. In the future this option may involve additional features suitable for on-screen versions of articles.

The option `natbib` is used when the corresponding BibTeX style is based on `natbib`. In most cases you do not need to set it. See Section 2.14.

The option `anonymous` is used for anonymous review processes and causes all author information to be obscured.

Table 1: The possible values for the `format` option

Value	Meaning
`manuscript`	A manuscript. This is the default.
`acmsmall`	Small single-column format. Used for ACMJCSS, CIE, CSUR, DLT, FAC, GAMES, JACM, JATS, JDIQ, JDS, JEA, JERIC, JETC, JRC, PACMCGIT, PACMHCI, PACMNET, PACMPL, TAAS, TACCESS, TACO, TALG, TALLIP (formerly TALIP), TCPS, TDS, TEAC, TECS, TELO, THRI, TIIS, TIOT, TISSEC, TIST, TKDD, TMIS, TOCE, TOCHI, TOCL, TOCS, TOCT, TODAES, TODS, TOIS, TOIT, TOMACS, TOMM (formerly TOMCCAP), TOMPECS, TOMS, TOPC, TOPLAS, TOPS, TORS TOS, TOSEM, TOSN, TQC, TRETS, TSAS, TSC, TSLP and TWEB, including special issues.
`acmlarge`	Large single-column format. Used for DTRAP, HEALTH, IMWUT, JOCCH, POMACS and TAP, including special issues.
`acmtog`	Large double-column format. Used for TOG, including annual conference Technical Papers.
`sigconf`	Proceedings format for most ACM conferences (with the exception of SIGPlAN) and all ICPS volumes.
`sigplan`	Proceedings format for SIGPLAN conferences.
`acmengage`	ACM EngageCSEdu Course materials.
`acmcp`	ACM cover page.

The option `timestamp` is used to include a time stamp in the footer of each page. When preparing a document, this can help avoid confusing different revisions. The footer also includes the page range of the document. This helps detect missing pages in hard copies.

The option `authordraft` is intended for author's drafts that are not intended for distribution. It typesets a copyright block to give the author an idea of its size and the overall size of the paper but overprints it with the phrase "Unpublished working draft. Not for distribution.", which is also used as a watermark. This option sets `timestamp` and `review` to `true`, but these can be overriden by setting these options to `false` *after* setting `authordraft` to `true`.

The option `balance` determines whether the last page in the two column mode has balanced columns. By default it is `true`; however, it may lead to problems for some documents. Set it to `false` if you encounter compilation errors. Note that for one page documents `\balance` command might cause problems. An alternative is the (experimental) option `pbalance`, which uses the new package `pbalance` for this end.

The option `urlbreakonhyphens` determines whether URLs can be split between lines after hyphens. By default it is true. Set it to `false` to disallow these breaks.

The option `language` is used to define the languages for the multi-language papers. It is discussed in Section 2.6.

2.3 Top matter

A number of commands set up *top matter* or (in computer science jargon) *metadata* for an article. They establish the publication name, article title, authors, DOI and other data. Some of these commands, like `\title` and `\author`, should be put by the authors.

Table 2: Boolean options

Option	Default	Meaning
review	false	A review version: lines are numbered and hyperlinks are colored
screen	see text	A screen version: hyperlinks are colored
natbib	true	Whether to use the natbib package (see Section 2.14)
anonymous	false	Whether to make author(s) anonymous
authorversion	false	Whether to generate a special version for the authors' personal use or posting (see Section 2.3)
nonacm	false	Use the class typesetting options for a non-ACM document, which will not include the conference/journal header and footers. Currenly such documents allow only a Creative Commons license.
timestamp	false	Whether to put a time stamp in the footer of each page
authordraft	false	Whether author's-draft mode is enabled
acmthm	true	Whether to define theorem-like environments, see Section 2.10
balance	true	Whether to balance the last page in two column mode
pbalance	false	Whether to balance the last page in two column mode using pbalance package
urlbreakonhyphens	true	Whether to break urls on hyphens

Others, like \acmVolume and \acmDOI—by the editors. Below we describe these commands and mention who should issue them. These macros should be used *before* the \maketitle command. Note that in previous versions of ACM classes some of these commands should be used before \maketitle, and some after it. Now they all must be used before \maketitle.

This class internally loads the amsart class, so many top-matter commands are inherited from amsart [2].

\acmJournal The macro \acmJournal{⟨*shortName*⟩} sets the name of the journal or transaction for journals and transactions. The argument is the short name of the publication *in uppercase*, for example,

```
\acmJournal{TOMS}
```

The currently recognized journals are listed in Table 5. Note that conference proceedings published in *book* form do not set this macro.

\acmConference The macro \acmConference[⟨*short name*⟩]{⟨*name*⟩}{⟨*date*⟩}{⟨*venue*⟩} is used for conference proceedings published in the book form. The arguments are the following:

short name: the abbreviated name of the conference (optional).

name: the name of the conference.

date: the date(s) of the conference.

venue: the place of the conference.

Examples:

```
\acmConference[TD'15]{Technical Data Conference}{November
12--16}{Dallas, TX, USA}
\acmConference{SA'15 Art Papers}{November 02--06, 2015}{Kobe, Japan}
```

\acmBooktitle By default we assume that conference proceedings are published in the book named *Proceedings of CONFERENCE*, where CONFERENCE is the name of the conference inferred from the command \acmConference above. However, sometimes the book title is different. The command \acmBooktitle can be used to set this title, for example,

```
\acmBooktitle{Companion to the first International Conference on the
Art, Science and Engineering of Programming (Programming '17)}
```

An ACM paper should have either \acmJournal or \acmConference command. If it has both (or more) commands, the last one takes precedence. Note that if you have the command \acmConference in a journal format like acmsmall, the class will use conference format for bibstrip and reference citation formatting. In the samples directory there is a file sample-acmsmall-conf.tex with the example of this usage.

An ACM Engage material should *not* use \acmJournal or \acmConference command. It may use \acmBooktitle to override the default *ACM EngageCSEdu*. It should use \acmYear to set the date of the material.

\editor In most cases, conference proceedings are edited. You can use the command \editor{⟨*editor*⟩} to set the editor of the volume. This command can be repeated, for example,

```
\editor{Jennifer B. Sartor}
\editor{Theo D'Hondt}
\editor{Wolfgang De Meuter}
```

\title The command \title, as in the amsart class, has two arguments: one optional, and one mandatory:

\title[⟨*ShortTitle*⟩]{⟨*FullTitle*⟩}

The mandatory argument is the full title of the article. The optional argument, if present, defines the shorter version of the title for running heads. If the optional argument is absent, the full title is used instead.

It is expected that this command is inserted by the author of the manuscript.

\subtitle Besides title, ACM classes allow a subtitle, set with the \subtitle{⟨*subtitle*⟩} macro.

The commands for specifying authors are highly structured. The reason is they serve double duty: the authors' information is typeset in the manuscript *and* is used by the metadata extraction tools for indexing and cataloguing. Therefore it is very important to follow the guidelines exactly.

\author \orcid \affiliation \email The basic commands are \author, \orcid (for the researchers registered with ORCID, http://www.orcid.org/), \affiliation and \email. In the simplest case, you enter them in this order:

```
\author{...}
\orcid{...}
\affiliation{...}
\email{...}
```

Do *not* use the LaTeX \and macro or commas, or \\ between the authors! Each author deserves his or her own \author command. An attempt to list several authors or their e-mails in one command leads to a warning or an error. This is not a bug, but the expected behavior.

Note that some formats do not typeset e-mails or ORCID identifiers. Do not worry: the metadata tools will get them.

ACM strongly encourages that you include ORCIDs for all authors before compiling or submitting for review and/or production processing.

If you do not have an ORCID, you may get one for free by registering at http://www.orcid.org/.

Sometimes an author has several affiliations. In this case, the \affiliation command should be repeated:

```
\author{...}
\orcid{...}
\affiliation{...}
\affiliation{...}
\email{...}
```

Similarly you can repeat the \email command.

You may have several authors with the same affiliation, different affiliations, or overlapping affiliations (author A_1 is affiliated with institutions I_1 and I_2, while author A_2 is affiliated with I_2 only, author A_3 is affiliated with I_1 and I_3, etc.). The recommended

solution is to put the \affiliation commands after each author, possibly repeating them:

```
\author{...}
\orcid{...}
\affiliation{...}
\affiliation{...}
\email{...}
\author{...}
\orcid{...}
\affiliation{...}
\email{...}
\author{...}
\orcid{...}
\affiliation{...}
\affiliation{...}
\email{...}
```

In some cases, when several authors share the same affiliation, you can try to save space using the format

```
\author{...}
\email{...}
\author{...}
\email{...}
\affiliation{...}
```

However, this format is not generally recommended.

\additionalaffiliation

In some cases, too many affiliations can take too much space. The command \additionalaffiliation{⟨*affiliation*⟩} creates a footnote after an author's name with the words "Also with {⟨*affiliation*⟩}". You should use this command only as a last resort. An example of usage is:

```
\author{G. Tobin}
\author{Ben Trovato}
\additionalaffiliation{%
  \institution{The Th{\o}rv{\"a}ld Group}
  \streetaddress{1 Th{\o}rv{\"a}ld Circle}
  \city{Hekla}
  \country{Iceland}}
\affiliation{%
  \institution{Institute for Clarity in Documentation}
  \streetaddress{P.O. Box 1212}
  \city{Dublin}
  \state{Ohio}
  \postcode{43017-6221}}
```

Here Trovato and Tobin share their affiliation with the Institute for Clarity in Documentation, but only Ben Trovato is affiliated with The Thørväld Group.

\position
\institution
\department
\streetaddress
\city
\state
\postcode
\country

The \affiliation and \additionalaffiliation commands are further structured to interact with the metadata extraction tools. Inside these commands you should use the \position, \institution, \department, \city, \streetaddress, \state, \postcode

and \country macros to indicate the corresponding parts of the affiliation. Note that in some cases (for example, journals) these parts are not printed in the resulting copy, but they *are* necessary since they are used by the XML metadata extraction programs. Do *not* put commas or \\ between the elements of \affiliation. They will be provided automatically.

The fields \institution, \city and \country are mandatory. If they are not provided, an error or a warning is issued. Currently the absence of \country produces an error; ACM may change this in the future.

An example of the author block:

```
\author{A. U. Thor}
\orcid{1234-4564-1234-4565}
\affiliation{%
  \institution{University of New South Wales}
  \department{School of Biomedical Engineering}
  \streetaddress{Samuels Building (F25), Kensington Campus}
  \city{Sidney}
  \state{NSW}
  \postcode{2052}
  \country{Australia}}
\email{author@nsw.au.edu}
\author{A. N. Other}
\affiliation{%
  \institution{University of New South Wales}
  \city{Sidney}
  \state{NSW}
  \country{Australia}}
\author{C. O. Respondent}
\orcid{1234-4565-4564-1234}
\affiliation{%
  \institution{University of Pennsylvania}
  \city{Philadelphia}
  \state{PA}
  \country{USA}}
\affiliation{%
  \institution{University of New South Wales}
  \city{Sidney}
  \state{NSW}
  \country{Australia}}
```

Note that the old ACM conference formats did not allow more than six authors and required some effort from authors to achieve alignment. The new format is much better in this.

Sometimes an author works in several departments within the same insitution. There could be two situations: the departments are independent, or one department is within another. In the first case, just repeat the command \department several times. To handle the second case the command has an optional numerical parameter. The departments with higher numbers are higher in the organizational chart. Compare

```
\affiliation{%
  \department[0]{Department of Lunar Studies} % 0 is the default
  \department[1]{John Doe Institute} % higher than 0
  \institution{University of San Serriffe}
```

```
  \country{San Serriffe}}
```

and

```
\affiliation{%
  \department{Department of Lunar Studies} % Not in the John Doe Institute!
  \department{John Doe Institute}
  \institution{University of San Serriffe}
  \country{San Serriffe}}
```

The command `\affiliation` formats its output according to American conventions. This might be wrong for some cases. Consider, for example, a German address. In Germany, the postcode is put before the city and is not separated by a comma. We can handle this order using

```
\affiliation{%
  \institution{Fluginstitut}
  \streetaddress{Sonnenallee 17}
  \postcode{123456}
  \city{Helm}
  \country{Germany}}
```

However, the comma after the postcode is unfortunate: the address will be typeset (in some formats) as

```
Fluginstitut
Sonenallee 17
123456, Helm, Germany
```

To overcome this problem, the command `\affiliation` has an optional parameter `obeypunctuation`, which can be `false` (the default) or `true`. If this parameter is `true`, `\afffiliation` obeys the author's command. Thus

```
\affiliation[obeypunctuation=true]{%
  \institution{Fluginstitut}\\
  \streetaddress{Sonnenallee 17}\\
  \postcode{123456}
  \city{Helm},
  \country{Germany}}
```

will be typeset as

```
Fluginstitut
Sonenallee 17
123456 Helm, Germany
```

Note that you should *not* use this option for journals.

It is expected that these commands are inserted by the author of the manuscript.

`\thanks` Like `amsart` (and unlike standard LaTeX), we allow `\thanks` only *outside* of the commands `\title` and `\author`. This command is obsolete and should *not* be used in most

cases. Do not list your acknowledgments or grant sponsors here. Put this information in the acks environment (see Section 2.13).

\authorsaddresses In some formats, addresses are printed as a footnote on the first page. By default LaTeX typesets them itself using the information you give it. However, you can override its choice using the commmand \authorsaddresses{⟨*contact addresses*⟩}, for example,

```
\authorsaddresses{%
 Authors' addresses: G.~Zhou, Computer Science Department, College of
 William and Mary, 104 Jameson Rd, Williamsburg, PA 23185, US;
 V.~B\'eranger, Inria Paris-Rocquencourt, Rocquencourt, France;
 A.~Patel, Rajiv Gandhi University, Rono-Hills, Doimukh, Arunachal
 Pradesh, India; H.~Chan, Tsinghua University, 30 Shuangqing Rd,
 Haidian Qu, Beijing Shi, China; T.~Yan, Eaton Innovation Center,
 Prague, Czech Republic; T.~He, C.~Huang, J.~A.~Stankovic University
 of Virginia, School of Engineering Charlottesville, VA 22903, USA;
 T. F. Abdelzaher, (Current address) NASA Ames Research Center,
 Moffett Field, California 94035.}
```

You can *suppress* printing authors' addresses by setting them to an empty string: \authorsaddresses{}. Please note that authors' addresses are mandatory for journal articles.

\titlenote \subtitlenote \authornote While the command \thanks generates a note without a footnote mark, sometimes the authors might need notes more tightly connected to the title, subtitle or author. The commands \titlenote, \subtitlenote and \authornote that follow the corresponding commands (\title, \subtitle and \author) generate such notes. For example,

```
\title{This is a title}
\titlenote{This is a titlenote}
\author{A. U. Thor}
\authornote{This is an authornote}
```

Please never use a \footnote inside an \author or \title command since this confuses the metadata extraction software. (Actually these commands now produce errors.)

\authornotemark Sometimes one may need to have the same footnote connected to several authors. The command \authornotemark[⟨*number*⟩] adds just the footnote mark, for example,

```
\author{A. U. Thor}
\authornote{Both authors contributed equally to the paper}
...
\author{A. N. Other}
\authornotemark[1]
```

The correct numbering of these marks is the responsibility of the user.

\acmVolume \acmNumber \acmArticle \acmYear \acmMonth The macros \acmVolume, \acmNumber, \acmArticle, \acmYear and \acmMonth are inserted by the editor and set the journal volume, issue, article number, year and month corrspondingly. The arguments of all these commands, including \acmMonth, is numerical. For example,

```
\acmVolume{9}
\acmNumber{4}
\acmArticle{39}
\acmYear{2010}
```

```
\acmMonth{3}
```

Note that `\acmArticle` is used not only for journals but also for some conference proceedings.

`\acmArticleSeq` The articles in the same issue of a journal have a *sequence number*. It is used to vertically position the black blob on the first page of some formats. By default it is the same as the article number, but the command `\acmArticleSeq{`⟨*n*⟩`}` can be used to change it:

```
\acmArticle{39}   % The sequence number will be 39 by default
\acmArticleSeq{5} % We redefine it to 5
```

Setting this number to zero suppresses the blob.

`\acmSubmissionID` If your paper got a Submission ID from the Conference Management System, put it here:

```
\acmSubmissionID{123-A56-BU3}
```

`\acmPrice` The macro `\acmPrice{`⟨*price*⟩`}` sets the price for the article, for example,

```
\acmPrice{25.00}
```

Note that you do not need to put the dollar sign here, just the amount. By default the price is $15.00, unless the copyright is set to `usgov`, `rightsretained`, `iw3c2w3`, or `iw3c2w3g`, when it is suppressed. Note that to override the defaults you need to set the price *after* the `\setcopyright` command. Also, the command `\acmPrice{}` suppresses the printing of the price.

`\acmISBN` Book-like volumes have ISBN numbers attached to them. The macro `\acmISBN{`⟨*ISBN*⟩`}` sets it. Normally it is set by the typesetter, for example,

```
\acmISBN{978-1-4503-3916-2}
```

Setting it to the empty string, as `\acmISBN{}`, suppresses printing the ISBN.

`\acmDOI` The macro `\acmDOI{`⟨*DOI*⟩`}` sets the DOI of the article, for example,

```
\acmDOI{10.1145/9999997.9999999}
```

It is normally set by the typesetter. Setting it to the empty string, as `\acmDOI{}`, suppresses the DOI.

`\acmBadgeR` `\acmBadgeL` Some conference articles get special distinctions, for example, the artifact evaluation for PPoPP 2016 (see http://ctuning.org/ae/ppopp2016.html). These articles display special badges supplied by the conference organizers. This class provides commands to add these badges: `\acmBadgeR[`⟨*url*⟩`]{`⟨*graphics*⟩`}` and `\acmBadgeL[`⟨*url*⟩`]{`⟨*graphics*⟩`}`. The first command puts the badge to the right of the title, and the second one—to the left. The arguments have the following meaning: `[`⟨*url*⟩`]`, if provided, sets the link to the badge authority in the screen version, while `{`⟨*graphics*⟩`}` sets the graphics file with the badge image. The file must be a cropped square, which is scaled to a standard size in the output. For example, if the badge image is `ae-logo.pdf`, the command is

```
\acmBadgeR[http://ctuning.org/ae/ppopp2016.html]{ae-logo}
```

\startPage The macro \startPage{⟨*page*⟩} sets the first page of the article in a journal or book. It is used by the typesetter.

\terms \keywords The command \keywords{⟨*keyword, keyword,…*⟩} sets keywords for the article. They must be separated by commas, for example,

```
\keywords{wireless sensor networks, media access control,
multi-channel, radio interference, time synchronization}
```

CCSXML (*env.*) \ccsdesc ACM publications are classified according to the ACM Computing Classification Scheme (CCS). CCS codes are used both in the typeset version of the publications *and* in the metadata in various databases. Therefore you need to provide both TEX commands and XML metadata with the paper.

The tool at http://dl.acm.org/ccs.cfm can be used to generate CCS codes. After you select the topics, click on "Generate CCS codes" to get results like the following:

```
\begin{CCSXML}
<ccs2012>
 <concept>
  <concept_id>10010520.10010553.10010562</concept_id>
  <concept_desc>Computer systems organization~Embedded systems</concept_desc>
  <concept_significance>500</concept_significance>
 </concept>
 <concept>
  <concept_id>10010520.10010575.10010755</concept_id>
  <concept_desc>Computer systems organization~Redundancy</concept_desc>
  <concept_significance>300</concept_significance>
 </concept>
 <concept>
  <concept_id>10010520.10010553.10010554</concept_id>
  <concept_desc>Computer systems organization~Robotics</concept_desc>
  <concept_significance>100</concept_significance>
 </concept>
 <concept>
  <concept_id>10003033.10003083.10003095</concept_id>
  <concept_desc>Networks~Network reliability</concept_desc>
  <concept_significance>100</concept_significance>
 </concept>
</ccs2012>
\end{CCSXML}

\ccsdesc[500]{Computer systems organization~Embedded systems}
\ccsdesc[300]{Computer systems organization~Redundancy}
\ccsdesc{Computer systems organization~Robotics}
\ccsdesc[100]{Networks~Network reliability}
```

You just need to copy this code and paste it in your paper anywhere before \maketitle.

CCS Concepts and user-defined keywords are required for all articles over two pages in length, and are optional for one- and two-page articles (or abstracts).

\setcopyright There are several possibilities for the copyright of the papers published by the ACM: the authors may transfer the rights to the ACM, license them to the ACM, some or all authors might be employees of the US or Canadian governments, etc. Accordingly the

Table 3: Parameters for the \setcopyright command

Parameter	Meaning
none	The copyright and permission information is not typeset. (This is the option for some ACM conferences.)
acmcopyright	The authors transfer the copyright to the ACM (the "traditional" choice).
acmlicensed	The authors retain the copyright but license the publication rights to ACM.
rightsretained	The authors retain the copyright and publication rights to themselves or somebody else.
usgov	All the authors are employees of the US government.
usgovmixed	Some authors are employees of the US government.
cagov	All the authors are employees of the Canadian government.
cagovmixed	Some authors are employees of the Canadian government.
licensedusgovmixed	Some authors are employees of the US government, and the publication rights are licensed to ACM.
licensedcagov	All the authors are employees of the Canadian government, and the publication rights are licensed to ACM.
licensedcagovmixed	Some authors are employees of the Canadian government, and the publication rights are licensed to ACM.
othergov	Authors are employees of a government other than the US or Canada.
licensedothergov	Authors are employees of a government other than the US or Canada, and the publication rights are licensed to ACM.
iw3c2w3	Special statement for conferences organized by IW3C2.
iw3c2w3g	Special statement for conferences organized by IW3C2, when some authors are approved Google employees.
cc	Creative Commons license. If this key is set, *doclicense* images are used to typeset the license. See also \setcctype command. Note that at present this license can be used only for acmengage format or for nonacm publications.

command \setcopyright{...} is introduced. Its argument is the copyright status of the paper, for example, \setcopyright{acmcopyright}. The possible values for this command are listed in Table 3. This command must be placed in the preamble, before \begin{document}. Additional information about ACM copyright rules is discussed in Section **??**.

\setcctype If Creative Commons license is used, the package by default chooses CC-BY 4.0 Attribution 4.0 International license. You can override this choice by the command \setcctype[⟨*version*⟩]{⟨*type*⟩}, where [⟨*version*⟩] can be either 3.0 or 4.0 (4.0 by default), and {⟨*type*⟩} can be one of zero, by, by-sa, by-nd, by-nc, by-nc-sa, by-nc-nd (see https://creativecommons.org/licenses/ for the explanation). This command should be used in the preamble only.

Material published under Creative Commons license should include the corresponding icon. A modern TEX distribution includes these icons in the package *doclicense*. In case your distribution does not have them, ACM provides a file ccicons.zip with these icons. Just unzip it in the same directory where your document is.

The ACM submission software should generate the right command for you to paste into your file.

`\copyrightyear` Each copyright statement must have the year of copyright. By default it is the same as `\acmYear`, but you can override this using the macro `\copyrightyear`, e.g.,

```
\acmYear{2016}
\copyrightyear{2015}
```

There is a special case for a personal copy that the authors may be allowed to generate for their use or a posting on a personal site (check the instructions for the specific journal or conference for the details). The document option `authorversion=true` produces a special form of the copyright statement for this case. Note that you still need the `\setcopyright` command and (optionally) `\copyrightyear` command to tell TEX about the copyright owner and year. Also, you should be aware that due to the different sizes of the permssion blocks for the printed version and authors' version, the page breaks might be different between them.

`abstract` (*env.*) The environment `abstract` must *precede* the `\maketitle` command. Again, this is different from the standard LATEX. Putting `abstract` after `\maketitle` will trigger an error.

`teaserfigure` (*env.*) A special kind of figure is used for many two-column conference proceedings. This figure is placed just after the authors but before the main text. The environment `teaserfigure` is used for these figures. This environment must be used *before* `\maketitle`, for example,

```
\begin{teaserfigure}
  \includegraphics[width=\textwidth]{sampleteaser}
  \caption{This is a teaser}
  \label{fig:teaser}
\end{teaserfigure}
```

`\settopmatter` Some information in the top matter is printed for certain journals or proceedings and suppressed for others. You can override these defaults using the command `\settopmatter{`⟨*settings*⟩`}`. The settings and their meanings are listed in Table 4. For example,

```
\settopmatter{printacmref=false, printccs=true, printfolios=true}
```

The parameter `authorsperrow` requires some explanation. In conference proceedings authors' information is typeset in boxes, several boxes per row (see `sample-sigconf.pdf`, `sample-sigplan.pdf`, etc.). The number of boxes per row is determined automatically. If you want to override this, you can do it using this parameter, for example,

```
\settopmatter{authorsperrow=4}
```

However, in most cases you should *not* do this and should use the default settings. Setting `authorsperrow` to 0 will revert it to the default settings.

The parameter `printacmref` specifies whether to print the ACM bibliographic entry (default), or not. Note that this entry is required for all articles over one page in length, and is optional for one-page articles (abstracts).

`\received` The command `\received[`⟨*stage*⟩`]{`⟨*date*⟩`}` sets the history of the publication.

Table 4: Settings for the `\settopmatter` command

Parameter	Values	Meaning
`printccs`	true/false	Whether to print CCS categories
`printacmref`	true/false	Whether to print the ACM bibliographic entry
`printfolios`	true/false	Whether to print page numbers (folios)
`authorsperrow`	numeric	Number of authors per row for the title page in conference proceedings formats

The `[`⟨*stage*⟩`]` argument is optional; the default is `Received` for the first date and `revised` for the subsequent ones. For example,

```
\received{20 February 2007}
\received[revised]{12 March 2009}
\received[accepted]{5 June 2009}
```

`\maketitle` The macro `\maketitle` must be the last command in the top-matter group. That is it must follow the commands defined in this section.

`\shortauthors` *After* the command `\maketitle`, the macro `\shortauthors` stores the names of the authors for the running head. You can redefine it if the list of author's name is too long, e.g.,

```
\maketitle
\renewcommand{\shortauthors}{Zhou et al.}
```

2.4 Top matter of ACM Engage materials

ACM Engage materials resemble conference proceedings, but have some special features. First, as a rule, they are released under a Creative Commons license. By default CC-BY is used. However, if you want to use another variant of CC license, use `\setcctype` command, for example, `\setcctype{by-nc}`. Second, abstract is called *synopsis*. Third, there are special top matter items used for the materials, such as *Course, Resource Type, Programming Language, CS Topics*.

`\setengagemetadata` These items are set with the command `\setengagemetadata{`⟨*name*⟩`}{`⟨*value*⟩`}`, for example,

```
\setengagemetadata{Course}{CS1}
\setengagemetadata{Programming Language}{Python}
\setengagemetadata{Knowledge Unit}{Programming Concepts}
\setengagemetadata{CS Topics}{Functions, Data Types, Expressions,
Mathematical Reasoning}
```

Note that the type of Creative Commons license, if such license is used, is automatically added to the metadata.

2.5 ACM cover page

ACM cover pages are forms of extended abstracts that are added to journals at the late stage. Authors prepare them as separate `.tex` files using `acmcp` format. At present only JDS uses them, but in the future this may change.

There are several top matter commands specific for this format.

\acmArticleType There are five article types accepted by JDS: *Research* (the default), *Review*, *Discussion*, *Invited*, and *Position*. The command \acmArticleType{⟨*type*⟩} sets the article type, for example

```
\acmArticleType{Review}
```

\acmCodeLink \acmDataLink The commands \acmCodeDataLink{⟨*link*⟩} and \acmDataLink{⟨*link*⟩} set the links to the data and code accompanying the paper, for example,

```
\acmCodeLink{https://github.com/repository/code}
\acmDataLink{https://datadryad.org/stash/dataset/doi:DOI}
```

You may repeat these commands if you have several repositories.

ACM cover page should have the following obligatory sections:

- Problem statement,
- Methods,
- Results,
- Significance.

Sometimes the addresses extracted from the authors' data are too long to fit on the page. In this case the command \authorsaddresses can be use to override them, for example,

```
\authorsaddresses{Corresponding author: Ben Trovato,
\href{mailto:trovato@corporation.com}{trovato@corporation.com};
Institute for Clarity in Documentation, P.O. Box 1212, Dublin,
Ohio, USA, 43017-6221}
```

2.6 Internationalization

ACM accepts publications in languages other than English, as well as papers in English with translations of titles, subtitles, keywords and abstracts into other languages. Papers in languages other than English usually have titles, subtitles (if applicable), keywords and abstracts in English. Note that CCS concepts are always typeset in English.

To submit these papers you need to set the option language in the \documentclass command. This option can be repeated, for example,

```
\documentclass[sigconf, language=french, language=english]{acmart}
```

The last language in the list is the main language of the paper, i.e. the one for the main title, abstract, body, etc. The other languages are *secondary,* and used for translated titles, keywords, abstracts. Thus the paper above is written in English, and has a secondary abstract and a secondary title in French. On the other hand, a paper in French wih secondary titles and abstracts in English and German should use, for example

```
\documentclass[sigconf,
               language=german,
               language=english,
               language=french]{acmart}
```

This key can use any language defined in *babel* package [3] (currently the package is tested with English, French, German and Spanish languages; other languages may require a translation of `\keywordsname` macro). Actually *acmart* loads *babel* internally, so you can use the facilities provided by this package.

If this key is set, you have access to several additional top matter commands.

`\translatedtitle` `\translatedsubtitle` `\translatedkeywords`

The commands `\translatedtitle{`⟨*language*⟩`}`title, `\translatedsubtitle{`⟨*language*⟩`}`subtitle and `\translatedkeywords`language`keywords` are used to set title, subtitle and keywords in the secondary language. For example, a paper in English with French title and abstract may set

```
\title{A note on computational complexity}
\translatedtitle{french}{Remarque sur la complexit\'e de calcul}
```

while a paper in French should set

```
\title{Remarque sur la complexit\'e de calcul}
\translatedtitle{english}{A note on computational complexity}
```

`translatedabstract` (*env.*)

Similarly, `translatedabstract` environment has a mandatory language argument, for example,

```
\begin{translatedastract}{english}
  This is the English version of the abstract
\end{translatedastract}
```

You can repeat these commands if a paper has more than one secondary language.

Use the standard commands (`\title`, `\subtitle`, `\keywords`, `abstract`) for the main language of the paper.

2.7 Algorithms

There are now several good packages for typesetting algorithms [4, 5, 6], and the authors are free to choose their favorite one.

2.8 Figures and tables

The new ACM styles use the standard LaTeX interface for figures and tables. There are some important items to be aware of, however.

1. The captions for figures must be entered *after* the figure bodies and for tables *before* the table bodies.

2. The ACM uses the standard types for figures and tables and adds several new ones. In total there are the following types:

   figure, table: a standard figure or table taking a full text width in one-column formats and one column width in two-column formats.

   figure*, table* in two-column formats, a special figure or table taking a full text width.

   teaserfigure: a special figure before `\maketitle`.

3. Accordingly, when scaling images, one should use the following sizes:

   (a) For `teaserfigure`, `figure` in one-column mode or `figure*` in two-column mode, use `\textwidth`. In one-column mode, you can also use `\columnwidth`, which coincides with `\textwidth` in this case.

   (b) For `figure` in two-column mode, use `\columnwidth`.

It is strongly recommended to use the package `booktabs` [7] and follow its main principles of typography with respect to tables:

1. Never, ever use vertical rules.

2. Never use double rules.

It is also a good idea not to overuse horizontal rules.

For table *footnotes* you have several options described in the TeX FAQ [1]. The simplest one is to use a `\minipage` environment:

```
\begin{table}
\caption{Simulation Configuration}
\label{tab:conf}
\begin{minipage}{\columnwidth}
\begin{center}
\begin{tabular}{ll}
  \toprule
  TERRAIN\footnote{This is a table footnote. This is a
    table footnote. This is a table footnote.} &
    (200\,m$\times$200\,m) Square\\
  Node Number     & 289\\
  Node Placement  & Uniform\\
  Application     & Many-to-Many/Gossip CBR Streams\\
  Payload Size    & 32 bytes\\
  Routing Layer   & GF\\
  MAC Layer       & CSMA/MMSN\\
  Radio Layer     & RADIO-ACCNOISE\\
  Radio Bandwidth & 250Kbps\\
  Radio Range     & 20m--45m\\
  \bottomrule
\end{tabular}
\end{center}
\bigskip
\footnotesize\emph{Source:} This is a table
 sourcenote. This is a table sourcenote. This is a table
 sourcenote.

 \emph{Note:} This is a table footnote.
\end{minipage}
\end{table}
```

Tables and figures are by default centered. However, in some cases (for example, when you use several subimages per figure) you may need to override this. A good way to do so is to put the contents into a `\minipage` of the width `\columnwidth`.

2.9 Descriptions of images

`\Description` Some readers of ACM publications might be visually challenged. These readers might use a voice-over software to read aloud the papers. It is important to provide them a description of each image used in the paper.

The command `\Description[`⟨*short description*⟩`]{`⟨*long description*⟩`}` should be placed inside every `figure`, `teaserfigure` or `marginfigure` environment to provide a description of the image(s) used in the figure. Unlike `\caption`, which is used alongside the image, `\Description` is intended to be used instead of the image, for example,

```
\begin{figure}
  \centering
  \includegraphics{voltage}
  \Description{A bell-like histogram centered at $0.5$~V with most
  measurements between $0.2$~V and $0.8$~V}
  \caption{Histogram of the measurements of voltage}
  \label{fig:voltage}
\end{figure}
```

At present the lack of descriptions generates a warning at compilation.

2.10 Theorems

The ACM classes define two theorem styles and several pre-defined theorem environments:

acmplain: this is the style used for `theorem`, `conjecture`, `proposition`, `lemma` and `corollary`, and

acmdefinition: this is the style used for `example` and `definition`.

These environments are defined by default. In the unusual circumstance that a user does not wish to have these environments defined, the option `acmthm=false` in the preamble will suppress them.

Sometimes authors want to define new theorem-like constructs that use `theorem` counters. These constructs must be defined either after `\begin{document}`, or delayed using `\AtEndPreamble` macro, for example,

```
\AtEndPreamble{%
  \theoremstyle{acmdefinition}
  \newtheorem{remark}[theorem]{Remark}}
```

2.11 Online-only and offline-only material

`printonly` (*env.*) `screenonly` (*env.*) Some supplementary material in ACM publications is put online but not in the printed version. The text inside the environment `screenonly` will be typeset only when the option `screen` (see Section 2.2) is set to `true`. Conversely, the text inside the environment `printonly` is typeset only when this option is set to `false`. For example,

```
\section{Supplementary materials}

\begin{printonly}
```

```
  Supplementary materials are available in the online version of this paper.
\end{printonly}

\begin{screenonly}
  (The actual supplementary materials.)
\end{screenonly}
```

We use the `comment` package for typesetting this code, so `\begin` and `\end` should start on a line of their own with no leading or trailing spaces.

2.12 Note about anonymous mode

anonsuppress (*env.*) When the option `anonymous` is selected, TEX suppresses author information (including the number of authors) for a blind review. However, sometimes the information identifying the authors may be present in the body of the paper. For example,

```
\begin{anonsuppress}
  This is the continuation of the previous work by the author
  \cite{prev1, prev2}.
\end{anonsuppress}
```

As for the `printonly` and `screenonly` environments, `\begin{anonsuppress}` and `\end{anonsuppress}` should start on a line of their own with no leading or trailing spaces.

`\anon` To suppress short snippets of information, use the command `\anon[`⟨*substitute*⟩`]{`⟨*suppressed-text*⟩`}`. By default `[`⟨*substitute*⟩`]` is the word ANONYMOUS. Examples:

```
This work was performed at \anon{NSA}.
This work was performed at \anon[No Such Agency]{NSA}.
```

2.13 Acknowledgments

The traditional "Acknowledgments" section is conventionally used to thank persons and granting agencies for their help and support. However, there are several important considerations about this section.

First, in anonymous mode this section must be omitted: it gives too much information to reviewers. Second, data about grants is extracted and stored separately by the postprocessing software. ACM classes provide facilities for both these tasks.

acks (*env.*) The environment `acks` starts an unnumbered section "Acknowledgments" unless the anonymous mode is chosen. Put all thanks inside this environment.

As for the `printonly` and `screenonly` environments, `\begin{acks}` and `\end{acks}` should start on a line of their own with no leading or trailing spaces.

`\grantsponsor` `\grantnum` All financial support *must* be listed using the commands `\grantsponsor` and `\grantnum`. These commands tell the postprocessing software about the granting organization and grant. The format of these commands is the following:

`\grantsponsor{`⟨*sponsorID*⟩`}{`⟨*name*⟩`}{`⟨*url*⟩`}`
`\grantnum[`⟨*url*⟩`]{`⟨*sponsorID*⟩`}{`⟨*number*⟩`}`.

Here {⟨*sponsorID*⟩} is the unique ID used to match grants to sponsors, {⟨*name*⟩} is the name of the sponsor, {⟨*url*⟩} is its URL, and {⟨*number*⟩} is the grant number. The {⟨*sponsorID*⟩} of the `\grantnum` command must correspond to the {⟨*sponsorID*⟩} of a `\grantsponsor` command. Some awards have their own web pages, which you can include using the optional argument of the `\grantnum` command.

At present {⟨*sponsorID*⟩} is chosen by the authors and can be an arbitrary key in the same way the label of a `\cite` is arbitrarily chosen. There might be a change to this policy if the ACM decides to create a global database of sponsoring organizations.

Example:

```
\begin{acks}
  The authors would like to thank Dr. Yuhua Li for providing the
  matlab code of the \textit{BEPS} method.

  The authors would also like to thank the anonymous referees for
  their valuable comments and helpful suggestions. This work is
  supported by the \grantsponsor{GS501100001809}{National Natural
  Science Foundation of
  China}{https://doi.org/10.13039/501100001809} under Grant
  No.:~\grantnum{GS501100001809}{61273304}
  and~\grantnum[http://www.nnsf.cn/youngscientists]{GS501100001809}{Young
  Scientists' Support Program}.
\end{acks}
```

2.14 Bibliography

The ACM lets you use either BibTEX or BibLATEX to process your references: they require slightly different setup of your LATEX file, as detailed in the following subsections.

2.14.1 Processing using BibTEX

This uses the `natbib` package for formatting references and the BibTEX style file `ACM-Reference-Format.bst` for BibTEX processing. You can disable loading of `natbib` using the option `natbib=false` in `\documentclass`. However, it is not recommended, as well as the use of BibTEX styles other than `ACM-Reference-Format.bst`, and may delay the processing of the manuscript.

`\citestyle` If you use `natbib`, you can select one of two predefined citation styles using the command `\citestyle`: the author-year format `acmauthoryear` or the numeric format `acmnumeric`. For example,

```
\citestyle{acmauthoryear}
```

Note that numeric citations are the default mode for most formats.

`\setcitestyle` You can further customize `natbib` using the `\setcitestyle` command, for example,

```
\setcitestyle{numbers,sort&compress}
```

One of the more common versions is

```
\setcitestyle{nosort}
```

It is useful if you do not like the way natbib sorts citation lists.

If you use natbib, then commands like \citep and \citeauthor are automatically supported. The command \shortcite is the same as \cite in numerical mode and cites the year in author-date mode.

Note that before version 1.48 the command \citeyear put the year in parentheses. In version 1.48 and later it produces just the year; the command \citeyearpar can be used to emulate its old behavior.

There are several customized BibTeX entry types and fields in the ACM style file ACM-Reference-Format.bst that you may want to be aware of.

The style supports the fields doi and url, for example,

```
  doi =          "10.1145/1188913.1188915",
  url =          "http://ccrma.stanford.edu/~jos/bayes/bayes.pdf",
```

Normally the printing of URL is suppressed if DOI is present. However, there is a special field distinctURL. If it is present and is not zero, URL is printed even if DOI is present.

The style supports the arXiv-recommended fields eprint and (optionally) primaryclass, for example,

```
  eprint =       "960935712",
  primaryclass = "cs",
```

See the examples at https://arxiv.org/help/hypertex/bibstyles.

There are several special entry types. Types online and game are used for Web pages and games, for example,

```
 @online{Thornburg01,
  author =       "Harry Thornburg",
  year =         "2001",
  title =        "Introduction to Bayesian Statistics",
  url =          "http://ccrma.stanford.edu/~jos/bayes/bayes.html",
  month =        mar,
  lastaccessed = "March 2, 2005",
 }
```

Entry types artifactsoftware, artifactdataset (with synonyms software and dataset) can be used to cite software artifacts and datasets, for example,

```
 @ArtifactSoftware{R,
    title = {R: A Language and Environment for Statistical Computing},
    author = {{R Core Team}},
    organization = {R Foundation for Statistical Computing},
    address = {Vienna, Austria},
    year = {2019},
    url = {https://www.R-project.org/},
}
 @ArtifactDataset{UMassCitations,
  author    =  {Sam Anzaroot and Andrew McCallum},
  title     =  {{UMass} Citation Field Extraction Dataset},
  year      = 2013,
  url       =
     {http://www.iesl.cs.umass.edu/data/data-umasscitationfield},
```

```
 lastaccessed = {May 27, 2019}
}
```

For these entry types you can use the `lastaccessed` field to add the access date for the URL.

There are two ways to enter video or audio sources in the bibliograpy corresponding to two different possibilies. For standalone sources available online, you can use an `online` entry and set its `howpublished` field. For example,

```
@online{Obama08,
 author =       "Barack Obama",
 year   =       "2008",
 title  =       "A more perfect union",
 howpublished = "Video",
 day    =       "5",
 url    =       "http://video.google.com/videoplay?docid=6528042696351994555",
 month  =       mar,
 lastaccessed = "March 21, 2008",
}
```

For sources available as attachments to conference proceedings and similar documents, you can use the usual `inproceedings` entry type and set its `howpublished` field:

```
@Inproceedings{Novak03,
 author =       "Dave Novak",
 title =        "Solder man",
 booktitle =    "ACM SIGGRAPH 2003 Video Review on Animation theater Program",
 year =         "2003",
 publisher =    "ACM Press",
 address =      "New York, NY",
 pages =        "4",
 month =        "March 21, 2008",
 doi =          "10.9999/woot07-S422",
 howpublished = "Video",
}
```

Sometimes you need to cite a complete issue of a journal. The `periodical` entry type is intended for this:

```
@periodical{JCohen96,
 key =          "Cohen",
 editor =       "Jacques Cohen",
 title =        "Special issue: Digital Libraries",
 journal =      "Communications of the {ACM}",
 volume =       "39",
 number =       "11",
 month =        nov,
 year =         "1996",
}
```

If you do not know the year of publication, the style will add “[n. d.]” (for “no date”) to the entry.

If you do not know the author (this is often the case for online entries), use the `key` field to add a key for sorting and citations, for example,

```
@online{TUGInstmem,
 key =          {TUG},
 year  =        2017,
 title =        "Institutional members of the {\TeX} Users Group",
 url =          "http://wwtug.org/instmem.html",
 lastaccessed = "May 27, 2017",
}
```

A note about sorting. The current ACM bibliography styles always sort the entries according to authors names and publication year. There is a controversy about sorting names with "von" or "van" part: should Ludwig van Beethoven be sorted under "V" or under "B"? The American practice is to use "van" in sorting, i.e. to file van Beethoven under "V". However, some authorities recommend to sort Dutch persons according to their last names (see e.g. https://www.ifla.org/files/assets/cataloguing/pubs/names-of-persons_1996.pdf). While I do not want to take a part in this dispute, I would like to point to the old "noopsort" trick by Oren Patashnik. Add to the `.bib` file the line

```
@PREAMBLE{"\providecommand{\noopsort}[1]{}"}
```

and then encode the author as

```
  author = {Ludwig {\noopsort{Beethoven}}van Beethoven},
```

This will make the author to be sorted as "Beethoven" rather than "van Beethoven".

The current bst style defines a number of macros for common journal names. In particular, all journals listed in Table 5 are includes, so you can use strings like `journal = taccess` for *ACM Transactions on Accessible Computing*.

2.14.2 Processing using BibLaTeX

You will find in this package two sets of style files for BibLaTeX, `acmnumeric` and `acmauthoryear`, that mimic the behaviour of the ACM-Reference-Format.bst BibTeX sytle. They provide you access to all the power of BibLaTeX and already include support for advanced citation of software artefact from the `biblatex-software` package, also separately available on CTAN. Look at the `biblatex-software` documentation to learn more about what it offers.

There are a few key differences in how the LaTeX sources are set up when using BibLaTeX instead of BibTeX, that we summarize briefly here (please refer to the official BibLaTeX documentation for more details).

In the preamble of your document you need to load the BibLaTeX package and select the approriate bibliography style, as follows

```
\RequirePackage[
 datamodel=acmdatamodel,
 style=acmnumeric, % use style=acmauthoryear for publications that require it
 ]{biblatex}
```

Also in the preamble, you need to declare the bibliography sources files using the `\addbibresouce` directe (one `\addbibresource` command per source file), e.g.:

```
\addbibresource{software.bib}
\addbibresource{sample-base.bib}
```

At the end of the document, where you want the bibliography to appear, you need to place the command `\printbibliography`.

Look at the `sample-*-biblatex.tex` files that can be found in the samples directory after running `make` for templates showcasing these BibLaTeX styles.

2.15 Colors

While printed ACM publications are usually black and white, `screen` mode allows the use of colors. The ACM classes pre-define several colors according to [8]: `ACMBlue`, `ACMYellow`, `ACMOrange`, `ACMRed`, `ACMLightBlue`, `ACMGreen`, `ACMPurple` and `ACMDarkBlue`. You can use them in color assignments.

The ACM provides the following recommendation on color use.

The most accessible approach would be to ensure that your article is still readable when printed in greyscale. The most notable reasons for this are:

1. The most common type of inherited Color Vision Deficiency (CVD) is red-green (in which similar-brightness colors that differ only in their amounts of red or green are often confused), and it affects up to 8% of males and 0.5% of females of Northern European descent.

2. The most common type of acquired Color Vision Deficiency (CVD) is blue-yellow (including mild cases for many older adults).

3. Most printing is in black and white.

4. Situational impairments (e.g., bright sunlight shining on a mobile screen) tend to reduce the entire color gamut, reducing color discriminability.

Note: It is *not* safe to encode information using only variations in color (i.e., only differences in hue and/or saturation) as there is bound to be someone affected!

To ensure that you are using the most accessible colors, the ACM recommends that you choose sets of colors to help ensure suitable variations in when printed in greyscale by using either of the following tools:

1. ColourBrewer: http://colorbrewer2.org/

2. ACE: The Accessible Colour Evaluator: http://daprlab.com/ace/ for designing WCAG 2.0 compliant palettes.

2.16 Other notable packages and typographic remarks

Several other packages are recommended for specialized tasks.

The package `subcaption` [9] is recommended for complex figures with several subplots or subfigures that require separate subcaptioning. The packages `nomencl` [10] and `glossaries` [11] can be used for the automatic creation of the lists of symbols and concepts used.

By default acmart prevents all widows and orphans (i.e., lonely lines at the beginning or end of the page) and hyphenation at the end of the page. This is done by the rather strict settings

```
\widowpenalty=10000
\clubpenalty=10000
\brokenpenalty=10000
```

However, this may lead to frustrating results when the authors must obey a page limit. Setting these penalties to smaller values may help if you absolutely need to.

Another problem might be the too strict line breaking rules. Again, a strategically placed \sloppy command or putting the problematic paragraph inside sloppypar environment might help—but beware, the results might be, well, sloppy.

Note that the uppercasing in section titles is done using the textcase package [12], so the command \NoCaseChange inside the title may help to prevent extraneous uppercasing.

2.17 Counting words

Some ACM conferences use word count limits for papers. The calculation of word number for a paper with math, tables and figures is not a trivial task. Currently the authoritative word count is done by translating the PDF to text and using wc -w on the output. Authors can use the package texcount (used by Overleaf) to get an estimate of the word count. To faciliate this one adds to the beginning of the package metacomments

```
%TC:macro \cite [option:text,text]
%TC:macro \citep [option:text,text]
%TC:macro \citet [option:text,text]
%TC:envir table 0 1
%TC:envir table* 0 1
%TC:envir tabular [ignore] word
%TC:envir displaymath 0 word
%TC:envir math 0 word
%TC:envir comment 0 0
```

and uses \begin{math}...\end{math} instead of dollar signs for math. Note that the count is in any case approximate, and the final decision of editors is based on PDF count.

The script texcount provides a report of word count in the document.

2.18 Creative Commons licenses for ACM publications

At present ACM does not allow the authors to typeset Creative Commons license for most ACM publications. These licenses can be used under an agreement with the ACM publishing office. In this case they are inserted by ACM itself.

The exceptions are ACM Engage format, which allows Creative Commons license, and conferences organized and copyrighted by IW3C2. In these cases the authors should use correspondingly \setcopyright{cc}, \setcopyright{iw3c2w3}, or \setcopyright{iw3c2w3g} (the latter should be used by Google employees).

Yet another case is the typesetting of non-ACM materials, when the option nonacm is used. This case is somewhat opposite, because for this case *only* Creative Common licenses are supported.

The command \setcopyright{cc} produces an error unless the format is acmengage or nonacm option is selected. On the other hand, if the option nonacm is selected, any argument of \setcopyright other than cc is treated as none.

2.19 Disabled or forbidden commands

The goal of acmart package is to provide a uniform look and feel for ACM publications. Accordingly, a number of commands is forbidden or disabled in acmart.

You may *not* put several authors or several e-mails into a \author or \email command. This may lead to errors or warning.

You cannot change \baselinestretch in your document: this produces an error.

You should not abuse the command \vspace: this command may disturb the typesetting of ACM papers.

You should not load amssymb package since the package acmart defines the corresponding symbols itself.

2.20 Notes for wizards

Sometimes you need to change the behavior of acmart. The usual way to do this is to redefine commands in the preamble. However, these definitions are executed *after* acmart is loaded and certain decisions are made. This presents a number of problems.

For example, one may want to use the titletoc package with acmart. This package should be loaded before hyperref. However, since acmart loads hyperref itself, the line \usepackage{titletoc} in the preamble will lead to grief (see http://tex.stackexchange.com/questions/357265/using-titletoc-with-acm-acmart-style).

Another example is passing options to a package. Suppose you want to use the dvipsnames option of the xcolor package. Normally you cannot do this because acmart loads this package itself without options.

The file acmart-preload-hook.tex can be used to solve these problems. If this file exists, it will be processed before any other package. You can use this file to load packages or pass options to them. For example, if you put in this file

```
\let\LoadClassOrig\LoadClass
\renewcommand\LoadClass[2][]{\LoadClassOrig[#1]{#2}%
\usepackage{titletoc}}
```

then titletoc will be loaded before hyperref. If you put in this file

```
\PassOptionsToPackage{dvipsnames}{xcolor}
```

you will pass dvipsnames to xcolor.

Important note. This hook makes it too easy to create a manuscript that is not acceptable by the ACM. It is even easier to create a file that cannot be compiled. So please do not use it *unless you know what you are doing*. And if you use it, *do not ask for support.* If you decide to use this hook, you are on your own.

\AtBeginMaketitle Another hook is \AtBeginMaketitle. The commands in this hook are executed before \maketitle, for example,

```
\AtBeginMaketitle{\acmPrice{125.00}}
```

2.21 Currently supported publications

Table 5: ACM publications and arguments of the `\acmJournal` command

Abbreviation	Publication
ACMJCSS	ACM Journal on Computing and Sustainable Societies
CIE	ACM Computers in Entertainment
CSUR	ACM Computing Surveys
DLT	Distributed Ledger Technologies: Research and Practice
DGOV	Digital Government: Research and Practice
DTRAP	Digital Threats: Research and Practice
FAC	Formal Aspects of Computing
GAMES	ACM Games: Research and Practice
HEALTH	ACM Transactions on Computing for Healthcare
IMWUT	PACM on Interactive, Mobile, Wearable and Ubiquitous Technologies
JACM	Journal of the ACM
JATS	ACM Journal on Autonomous Transportation Systems
JDIQ	ACM Journal of Data and Information Quality
JDS	ACM/IMS Journal of Data Science
JEA	ACM Journal of Experimental Algorithmics
JERIC	ACM Journal of Educational Resources in Computing
JETC	ACM Journal on Emerging Technologies in Computing Systems
JOCCH	ACM Journal on Computing and Cultural Heritage
JRC	ACM Journal on Responsible Computing
PACMCGIT	Proceedings of the ACM on Computer Graphics and Interactive Techniques
PACMHCI	PACM on Human-Computer Interaction
PACMNET	PACM on Networking
PACMPL	PACM on Programming Languages
POMACS	PACM on Measurement and Analysis of Computing Systems
TAAS	ACM Transactions on Autonomous and Adaptive Systems
TACCESS	ACM Transactions on Accessible Computing
TACO	ACM Transactions on Architecture and Code Optimization
TALG	ACM Transactions on Algorithms
TALLIP	ACM Transactions on Asian and Low-Resource Language Information Processing
TAP	ACM Transactions on Applied Perception
TCPS	ACM Transactions on Cyber-Physical Systems
TDS	ACM/IMS Transactions on Data Science
TEAC	ACM Transactions on Economics and Computation
TECS	ACM Transactions on Embedded Computing Systems
TELO	ACM Transactions on Evolutionary Learning
THRI	ACM Transactions on Human-Robot Interaction
TIIS	ACM Transactions on Interactive Intelligent Systems
TIOT	ACM Transactions on Internet of Things
TISSEC	ACM Transactions on Information and System Security
TIST	ACM Transactions on Intelligent Systems and Technology
TKDD	ACM Transactions on Knowledge Discovery from Data

Table 5: ACM publications and arguments of the `\acmJournal` command (continued)

Abbreviation	Publication
TMIS	ACM Transactions on Management Information Systems
TOCE	ACM Transactions on Computing Education
TOCHI	ACM Transactions on Computer-Human Interaction
TOCL	ACM Transactions on Computational Logic
TOCS	ACM Transactions on Computer Systems
TOCT	ACM Transactions on Computation Theory
TODAES	ACM Transactions on Design Automation of Electronic Systems
TODS	ACM Transactions on Database Systems
TOG	ACM Transactions on Graphics
TOIS	ACM Transactions on Information Systems
TOIT	ACM Transactions on Internet Technology
TOMACS	ACM Transactions on Modeling and Computer Simulation
TOMM	ACM Transactions on Multimedia Computing, Communications and Applications
TOMPECS	ACM Transactions on Modeling and Performance Evaluation of Computing Systems
TOMS	ACM Transactions on Mathematical Software
TOPC	ACM Transactions on Parallel Computing
TOPLAS	ACM Transactions on Programming Languages and Systems
TOPS	ACM Transactions on Privacy and Security
TORS	ACM Transactions on Recommender Systems
TOS	ACM Transactions on Storage
TOSEM	ACM Transactions on Software Engineering and Methodology
TOSN	ACM Transactions on Sensor Networks
TQC	ACM Transactions on Quantum Computing
TRETS	ACM Transactions on Reconfigurable Technology and Systems
TSAS	ACM Transactions on Spatial Algorithms and Systems
TSC	ACM Transactions on Social Computing
TSLP	ACM Transactions on Speech and Language Processing
TWEB	ACM Transactions on the Web

Besides the publications listed in Table 5, there is a special "publication" type FACMP, a forthcoming ACM publication, reserved for new journals which are not assigned an ISSN yet.

2.22 A note about `sigchi-a` format

Starting in Spring 2020 ACM retired SIGCHI Extended Abstract format (`sigchi-a`). ACM will not, under any circumstances, accept documents in this format for publication and will not offer technical support to the authors who use this template.

You may use this format in the `nonacm` mode only, as in

```
\documentclass[sigchi-a, nonacm]{acmart}
```

`sidebar` (*env.*)
`marginfigure` (*env.*)
`margintable` (*env.*)

This format has large margin uses for special figures and tables. This package provides three environments for this with optional captions:

sidebar: textual information in the margin,

marginfigure: a figure in the margin,

margintable: a table in the margin.

The environments `figure` and `table` produce figures and tables with the width of the text column. The environments `figure*` and `table*` produce "wide" figures and tables, which take a large part of the margin.

The horizontal sizes of figures are:

1. `figure`: `\columnwidth`,
2. `marginfigure`: `\marginparwidth`,
3. `figure*`: `\fulltextwidth`.

3 Implementation

3.1 Identification

We start with a declaration of who we are. Most `.dtx` files put driver code in a separate `.drv` driver file. We roll this code into the main file and use the pseudo-guard `<gobble>` for it.

```
⟨class⟩\NeedsTeXFormat{LaTeX2e}
⟨*gobble⟩
\ProvidesFile{acmart.dtx}
⟨/gobble⟩
⟨class⟩\ProvidesClass{acmart}
[2022/10/24 v1.88 Typesetting articles for the Association for Computing Machinery]
```

And the driver code:

```
⟨*gobble⟩
\documentclass{ltxdoc}
\usepackage{array,booktabs,amsmath,graphicx,fancyvrb,tabularx, longtable}
\usepackage[tt=false, type1=true]{libertine}
\usepackage[varqu]{zi4}
\usepackage[libertine]{newtxmath}
\usepackage[tableposition=top]{caption}
\usepackage{hypdoc}
\PageIndex
\CodelineIndex
\RecordChanges
\EnableCrossrefs
\begin{document}
  \DocInput{acmart.dtx}
\end{document}
⟨/gobble⟩
⟨*class⟩
\def\@classname{acmart}
```

3.2 Preload hook

We preload `acmart-preload-hook`:

```
\InputIfFileExists{acmart-preload-hook.tex}{%
  \ClassWarning{\@classname}{%
    I am loading acmart-preload-hook.tex. You are fully responsible
    for any problems from now on.}}{}
```

3.3 Options

We need `xkeyval` since some of our options may have values:

```
\RequirePackage{xkeyval}
```

We use `xstring` to check whether user input is valid

```
\RequirePackage{xstring}
```

We need `iftex` to check the engine

```
\RequirePackage{iftex}
```

`format` The possible formats

```
\define@choicekey*+{acmart.cls}{format}[\ACM@format\ACM@format@nr]{%
  manuscript, acmsmall, acmlarge, acmtog, sigconf, siggraph,
  sigplan, sigchi, sigchi-a, acmengage, acmcp}[manuscript]{}{%
  \ClassError{\@classname}{The option format must be manuscript,
    acmsmall, acmlarge, acmtog, sigconf, siggraph,
    sigplan, sigchi or sigchi-a}}
\def\@DeclareACMFormat#1{\DeclareOptionX{#1}{\setkeys{acmart.cls}{format=#1}}}
\@DeclareACMFormat{manuscript}
\@DeclareACMFormat{acmsmall}
\@DeclareACMFormat{acmlarge}
\@DeclareACMFormat{acmtog}
\@DeclareACMFormat{sigconf}
\@DeclareACMFormat{siggraph}
\@DeclareACMFormat{sigplan}
\@DeclareACMFormat{sigchi}
\@DeclareACMFormat{sigchi-a}
\@DeclareACMFormat{acmengage}
\@DeclareACMFormat{acmcp}
\ExecuteOptionsX{format}
```

`\if@ACM@screen` Whether we use screen mode

```
\define@boolkey+{acmart.cls}[@ACM@]{screen}[true]{%
  \if@ACM@screen
    \PackageInfo{\@classname}{Using screen mode}%
  \else
    \PackageInfo{\@classname}{Not using screen mode}%
  \fi}{\PackageError{\@classname}{The option screen can be either true or
    false}}
\ExecuteOptionsX{screen=false}
```

`\if@ACM@urlbreakonhyphens`

```
\define@boolkey+{acmart.cls}[@ACM@]{urlbreakonhyphens}[true]{%
  \if@ACM@urlbreakonhyphens
    \PackageInfo{\@classname}{Using breaking urls on hyphens}%
  \else
    \PackageInfo{\@classname}{Not breaking urls on hyphens}%
 \fi}{\PackageError{\@classname}{The option urlbreakonhyphens can be either true or
    false}}
\ExecuteOptionsX{urlbreakonhyphens=true}
```

`\if@ACM@acmthm` Whether we define theorem-like environments.

```
\define@boolkey+{acmart.cls}[@ACM@]{acmthm}[true]{%
  \if@ACM@acmthm
    \PackageInfo{\@classname}{Requiring acmthm}%
  \else
    \PackageInfo{\@classname}{Suppressing acmthm}%
  \fi}{\PackageError{\@classname}{The option acmthm can be either true or
    false}}
\ExecuteOptionsX{acmthm=true}
```

`\if@ACM@review` Whether we use review mode

```
\define@boolkey+{acmart.cls}[@ACM@]{review}[true]{%
```

```
  \if@ACM@review
    \PackageInfo{\@classname}{Using review mode}%
    \AtBeginDocument{\@ACM@printfoliostrue}%
  \else
    \PackageInfo{\@classname}{Not using review mode}%
  \fi}{\PackageError{\@classname}{The option review can be either true or
    false}}
\ExecuteOptionsX{review=false}
```

`\if@ACM@authorversion` Whether we use author's-version mode

```
\define@boolkey+{acmart.cls}[@ACM@]{authorversion}[true]{%
  \if@ACM@authorversion
    \PackageInfo{\@classname}{Using authorversion mode}%
  \else
    \PackageInfo{\@classname}{Not using authorversion mode}%
 \fi}{\PackageError{\@classname}{The option authorversion can be either true or
    false}}
\ExecuteOptionsX{authorversion=false}
```

`\if@ACM@nonacm` Special option for non-ACM publications using the ACM typesetting options.

```
\define@boolkey+{acmart.cls}[@ACM@]{nonacm}[true]{%
  \if@ACM@nonacm
    \PackageInfo{\@classname}{Using nonacm mode}%
    \AtBeginDocument{\@ACM@printacmreffalse}%
    % in 'nonacm' mode we disable the "ACM Reference Format"
    % printing by default, but this can be re-enabled by the
    % user using \settopmatter{printacmref=true}
  \else
    \PackageInfo{\@classname}{Not using nonacm mode}%
  \fi}{\PackageError{\@classname}{The option nonacm can be either true or
    false}}
\ExecuteOptionsX{nonacm=false}
```

`\if@ACM@balance` Whether to balance the last page

```
\define@boolkey+{acmart.cls}[@ACM@]{balance}[true]{}{%
  \PackageError{\@classname}{The option balance can be either true or
    false}}
\ExecuteOptionsX{balance}
```

`\if@ACM@pbalance` Whether to balance the last page

```
\define@boolkey+{acmart.cls}[@ACM@]{pbalance}[true]{}{%
  \PackageError{\@classname}{The option pbalance can be either true or
    false}}
\ExecuteOptionsX{pbalance=false}
```

`\if@ACM@natbib@override` This macro is no longer used.

`\if@ACM@natbib` Whether we use `natbib` mode

```
\define@boolkey+{acmart.cls}[@ACM@]{natbib}[true]{%
  \if@ACM@natbib
    \PackageInfo{\@classname}{Explicitly selecting natbib mode}%
  \else
    \PackageInfo{\@classname}{Explicitly deselecting natbib mode}%
  \fi}{\PackageError{\@classname}{The option natbib can be either true or
```

```
    false}}
\ExecuteOptionsX{natbib=true}
```

\if@ACM@anonymous Whether we use anonymous mode

```
\define@boolkey+{acmart.cls}[@ACM@]{anonymous}[true]{%
  \if@ACM@anonymous
    \PackageInfo{\@classname}{Using anonymous mode}%
  \else
    \PackageInfo{\@classname}{Not using anonymous mode}%
  \fi}{\PackageError{\@classname}{The option anonymous can be either true or
    false}}
\ExecuteOptionsX{anonymous=false}
```

\if@ACM@timestamp Whether we use timestamp mode

```
\define@boolkey+{acmart.cls}[@ACM@]{timestamp}[true]{%
  \if@ACM@timestamp
    \PackageInfo{\@classname}{Using timestamp mode}%
  \else
    \PackageInfo{\@classname}{Not using timestamp mode}%
  \fi}{\PackageError{\@classname}{The option timestamp can be either true or
    false}}
\ExecuteOptionsX{timestamp=false}
```

\if@ACM@authordraft Whether we use author-draft mode

```
\define@boolkey+{acmart.cls}[@ACM@]{authordraft}[true]{%
  \if@ACM@authordraft
    \PackageInfo{\@classname}{Using authordraft mode}%
    \@ACM@timestamptrue
    \@ACM@reviewtrue
  \else
    \PackageInfo{\@classname}{Not using authordraft mode}%
 \fi}{\PackageError{\@classname}{The option authordraft can be either true or
    false}}
\ExecuteOptionsX{authordraft=false}
```

\ACM@fontsize The font size to pass to the base class

```
% \changes{v1.87}{2022/08/27}{Added fontsize 8pt}
\def\ACM@fontsize{}
\DeclareOptionX{8pt}{\edef\ACM@fontsize{\CurrentOption}}
\DeclareOptionX{9pt}{\edef\ACM@fontsize{\CurrentOption}}
\DeclareOptionX{10pt}{\edef\ACM@fontsize{\CurrentOption}}
\DeclareOptionX{11pt}{\edef\ACM@fontsize{\CurrentOption}}
\DeclareOptionX{12pt}{\edef\ACM@fontsize{\CurrentOption}}
```

\ACM@languages The languages of the document

```
\def\ACM@languages{}
\DeclareOptionX{language}{%
  \ifx\ACM@languages\@empty
  \gdef\ACM@languages{english}\fi
  \g@addto@macro\ACM@languages{, #1}}

\DeclareOptionX{draft}{\PassOptionsToClass{\CurrentOption}{amsart}}
\DeclareOptionX{*}{\PassOptionsToClass{\CurrentOption}{amsart}}
\ProcessOptionsX
\ClassInfo{\@classname}{Using format \ACM@format, number \ACM@format@nr}
```

3.4 Setting switches

`\if@ACM@manuscript` Whether we use manuscript mode

```
\newif\if@ACM@manuscript
```

`\if@ACM@journal` There are two kinds of publications: journals and books

```
\newif\if@ACM@journal
```

`\if@ACM@journal@bibstrip` Sometimes ACM wants a journal-like publication to have conference information in the bibstrip and vice versa, so we have an additional switch.

```
\newif\if@ACM@journal@bibstrip
```

`\if@ACM@sigchiamode` The formatting of SIGCHI extended abstracts is quite unusual. We have a special switch for them.

```
\newif\if@ACM@sigchiamode
```

`\if@ACM@engage` ACM Engage course materials have special formatting

```
\newif\if@ACM@engage
\@ACM@engagefalse
```

`\if@ACM@acmcp` ACM cover page formatting

```
\newif\if@ACM@acmcp
\@ACM@acmcpfalse
```

Setting up switches

```
\ifnum\ACM@format@nr=5\relax % siggraph
\ClassWarning{\@classname}{%
  The format siggraph is now obsolete.\MessageBreak
  I am switching to sigconf.}
  \setkeys{acmart.cls}{format=sigconf}
\fi
\ifnum\ACM@format@nr=7\relax % sigchi
\ClassWarning{\@classname}{%
  The format sigchi is now obsolete.\MessageBreak
  I am switching to sigconf.}
  \setkeys{acmart.cls}{format=sigconf}
\fi
\ifnum\ACM@format@nr=8\relax % sigchi
\ClassWarning{\@classname}{%
  ACM SIGCHI has retired the SIGCHI-A template\MessageBreak
  effective immediately. ACM is keeping this template\MessageBreak
  option available to authors who are working on legacy\MessageBreak
  documents only. ACM will not, under any circumstances,\MessageBreak
  accept documents in this format for publication and\MessageBreak
  will not offer technical support to the authors who use\MessageBreak
  this template.\MessageBreak
  ACM SIGCHI is directing Conference leaders and\MessageBreak
  authors to publish their articles using the SIGCONF\MessageBreak
  template call.}
\fi
\ifnum\ACM@format@nr=0\relax
  \@ACM@manuscripttrue
\else
```

```
  \@ACM@manuscriptfalse
\fi
\@ACM@sigchiamodefalse
\ifcase\ACM@format@nr
\relax % manuscript
  \@ACM@journaltrue
\or % acmsmall
  \@ACM@journaltrue
\or % acmlarge
  \@ACM@journaltrue
\or % acmtog
  \@ACM@journaltrue
\or % sigconf
  \@ACM@journalfalse
\or % siggraph
  \@ACM@journalfalse
 \or % sigplan
  \@ACM@journalfalse
 \or % sigchi
  \@ACM@journalfalse
\or % sigchi-a
  \@ACM@journalfalse
  \@ACM@sigchiamodetrue
\or % acmengage
  \@ACM@journalfalse
  \@ACM@engagetrue
\or % acmcp
  \@ACM@journaltrue
  \@ACM@acmcptrue
  \AtBeginDocument{\@ACM@printacmreffalse}%
\fi
\if@ACM@journal
 \@ACM@journal@bibstriptrue
\else
 \@ACM@journal@bibstripfalse
\fi
```

3.5 Loading the base class and package

At this point we either have `\ACM@fontsize` or use defaults

```
\ifx\ACM@fontsize\@empty
  \ifcase\ACM@format@nr
  \relax % manuscript
    \def\ACM@fontsize{9pt}%
  \or % acmsmall
    \def\ACM@fontsize{10pt}%
  \or % acmlarge
    \def\ACM@fontsize{10pt}%
  \or % acmtog
    \def\ACM@fontsize{9pt}%
  \or % sigconf
    \def\ACM@fontsize{9pt}%
  \or % siggraph
    \def\ACM@fontsize{9pt}%
```

```
   \or % sigplan
    \def\ACM@fontsize{10pt}%
   \or % sigchi
    \def\ACM@fontsize{9pt}%
  \or % sigchi-a
    \def\ACM@fontsize{10pt}%
  \or % acmengage
    \def\ACM@fontsize{10pt}%
  \or % acmcp
    \def\ACM@fontsize{9pt}%
  \fi
\fi
\ClassInfo{\@classname}{Using fontsize \ACM@fontsize}
\LoadClass[\ACM@fontsize, reqno]{amsart}
\RequirePackage{microtype}
```

We need `etoolbox` for delayed code

```
\RequirePackage{etoolbox}
```

Booktabs is now the default

```
\RequirePackage{booktabs}
```

We need `totpages` to calculate the number of pages and `refcount` to use that number

```
\RequirePackage{refcount}
\RequirePackage{totpages}
```

The `\collect@body` macro in `amsmath` is defined using `\def`. We load `environ` to access the `\long` version of this command

```
\RequirePackage{environ}
```

We use `setspace` for double spacing

```
\if@ACM@manuscript
\RequirePackage{setspace}
\onehalfspacing
\fi
```

We need `textcase` for better upcasing

```
\RequirePackage{textcase}
```

```
\if@ACM@acmcp
\RequirePackage{framed}
\fi
```

3.6 Citations

We patch `\setcitestyle` to allow, for example, `\setcitestyle{sort}` and `\setcitestyle{nosort}`. We patch `\citestyle` to warn about undefined citation styles.

```
\if@ACM@natbib
  \RequirePackage{natbib}
  \renewcommand{\bibsection}{%
     \section*{\refname}%
     \phantomsection\addcontentsline{toc}{section}{\refname}%
  }
  \renewcommand{\bibfont}{\bibliofont}
  \renewcommand\setcitestyle[1]{
```

```
\@for\@tempa:=#1\do
{\def\@tempb{round}\ifx\@tempa\@tempb
   \renewcommand\NAT@open{(}\renewcommand\NAT@close{)}\fi
 \def\@tempb{square}\ifx\@tempa\@tempb
   \renewcommand\NAT@open{[}\renewcommand\NAT@close{]}\fi
 \def\@tempb{angle}\ifx\@tempa\@tempb
   \renewcommand\NAT@open{$<$}\renewcommand\NAT@close{$>$}\fi
 \def\@tempb{curly}\ifx\@tempa\@tempb
   \renewcommand\NAT@open{\{}\renewcommand\NAT@close{\}}\fi
 \def\@tempb{semicolon}\ifx\@tempa\@tempb
   \renewcommand\NAT@sep{;}\fi
 \def\@tempb{colon}\ifx\@tempa\@tempb
   \renewcommand\NAT@sep{;}\fi
 \def\@tempb{comma}\ifx\@tempa\@tempb
   \renewcommand\NAT@sep{,}\fi
 \def\@tempb{authoryear}\ifx\@tempa\@tempb
   \NAT@numbersfalse\fi
 \def\@tempb{numbers}\ifx\@tempa\@tempb
   \NAT@numberstrue\NAT@superfalse\fi
 \def\@tempb{super}\ifx\@tempa\@tempb
   \NAT@numberstrue\NAT@supertrue\fi
 \def\@tempb{nobibstyle}\ifx\@tempa\@tempb
   \let\bibstyle=\@gobble\fi
 \def\@tempb{bibstyle}\ifx\@tempa\@tempb
   \let\bibstyle=\@citestyle\fi
 \def\@tempb{sort}\ifx\@tempa\@tempb
   \def\NAT@sort{\@ne}\fi
 \def\@tempb{nosort}\ifx\@tempa\@tempb
   \def\NAT@sort{\z@}\fi
 \def\@tempb{compress}\ifx\@tempa\@tempb
   \def\NAT@cmprs{\@ne}\fi
 \def\@tempb{nocompress}\ifx\@tempa\@tempb
   \def\NAT@cmprs{\z@}\fi
 \def\@tempb{sort&compress}\ifx\@tempa\@tempb
   \def\NAT@sort{\@ne}\def\NAT@cmprs{\@ne}\fi
 \def\@tempb{mcite}\ifx\@tempa\@tempb
   \let\NAT@merge\@ne\fi
 \def\@tempb{merge}\ifx\@tempa\@tempb
   \@ifnum{\NAT@merge<\tw@}{\let\NAT@merge\tw@}{}\fi
 \def\@tempb{elide}\ifx\@tempa\@tempb
   \@ifnum{\NAT@merge<\thr@@}{\let\NAT@merge\thr@@}{}\fi
 \def\@tempb{longnamesfirst}\ifx\@tempa\@tempb
   \NAT@longnamestrue\fi
 \def\@tempb{nonamebreak}\ifx\@tempa\@tempb
   \def\NAT@nmfmt#1{\mbox{\NAT@up#1}}\fi
 \expandafter\NAT@find@eq\@tempa=\relax\@nil
 \if\@tempc\relax\else
   \expandafter\NAT@rem@eq\@tempc
   \def\@tempb{open}\ifx\@tempa\@tempb
    \xdef\NAT@open{\@tempc}\fi
   \def\@tempb{close}\ifx\@tempa\@tempb
    \xdef\NAT@close{\@tempc}\fi
   \def\@tempb{aysep}\ifx\@tempa\@tempb
    \xdef\NAT@aysep{\@tempc}\fi
```

```
    \def\@tempb{yysep}\ifx\@tempa\@tempb
     \xdef\NAT@yrsep{\@tempc}\fi
    \def\@tempb{notesep}\ifx\@tempa\@tempb
     \xdef\NAT@cmt{\@tempc}\fi
    \def\@tempb{citesep}\ifx\@tempa\@tempb
     \xdef\NAT@sep{\@tempc}\fi
  \fi
 }%
 \NAT@@setcites
 }
 \renewcommand\citestyle[1]{%
   \ifcsname bibstyle@#1\endcsname%
   \csname bibstyle@#1\endcsname\let\bibstyle\@gobble%
   \else%
   \@latex@error{Undefined ‘#1’ citestyle}%
   \fi
 }%
\fi
```

`\bibstyle@acmauthoryear` The default author-year format:

```
\newcommand{\bibstyle@acmauthoryear}{%
 \setcitestyle{%
   authoryear,%
   open={[},close={]},citesep={;},%
   aysep={},yysep={,},%
   notesep={, }}}
```

`\bibstyle@acmnumeric` The default numeric format:

```
\newcommand{\bibstyle@acmnumeric}{%
 \setcitestyle{%
   numbers,sort&compress,%
   open={[},close={]},citesep={,},%
   notesep={, }}}
```

The default is numeric:

```
\if@ACM@natbib
\citestyle{acmnumeric}
\fi
```

3.7 Internationalization

```
\if@ACM@journal
 \renewcommand\keywordsname{Additional Key Words and Phrases}%
\else
 \renewcommand\keywordsname{Keywords}%
\fi
\if@ACM@engage
  \renewcommand\abstractname{Synopsis}%
\fi
\ifx\ACM@languages\@empty
\else
 \RequirePackage[\ACM@languages]{babel}%
 \addto\captionsenglish{%
     \if@ACM@journal
```

```
      \renewcommand\keywordsname{Additional Key Words and Phrases}%
    \else
      \renewcommand\keywordsname{Keywords}%
    \fi
    \renewcommand\acksname{Acknowledgements}%
    \if@ACM@engage
       \renewcommand\abstractname{Synopsis}%
    \fi
}%
\addto\captionsfrench{%
    \if@ACM@journal
      \renewcommand\keywordsname{Mots Clés et Phrases Supplémentaires}%
    \else
      \renewcommand\keywordsname{Mots clés}%
    \fi
    \renewcommand\acksname{Remerciements}%
}%
\addto\captionsgerman{%
    \if@ACM@journal
      \renewcommand\keywordsname{Zusätzliche Schlagwörter und Phrasen}%
    \else
      \renewcommand\keywordsname{Schlagwörter}%
    \fi
    \renewcommand\acksname{Danksagungen}%
}%
\addto\captionsspanish{%
    \if@ACM@journal
      \renewcommand\keywordsname{Palabras y Frases Claves Adicionales}%
    \else
      \renewcommand\keywordsname{Palabras claves}%
    \fi
    \renewcommand\acksname{Expresiones de gratitud}%
}%
\fi
```

`\ACM@lang@check` Some commands should not be used if the document is monlingual

```
\newcommand\ACM@lang@check[1]{%
  \ifx\ACM@languages\@empty\relax
  \ClassError{\@classname}{%
    Command \string#1 \MessageBreak is used in monlingual document}{%
    You used a command (\string#1) \MessageBreak
    that does not have a meaning \MessageBreak
    unless are languages are defined. \MessageBreak
    Please choose the languages in \string\documentclass
    \MessageBreak
    (e.g. \string\documentclass[languages={french, english}]{acmart}),
    \MessageBreak
    or delete the command.}%
  \fi}
```

`\@translatedtitle`

```
\def\@translatedtitle{}
```

`\translatedtitle` The title of the paper in a different language

```
\newcommand\translatedtitle[2]{\ACM@lang@check{\translatedtitle}%
\g@addto@macro\@translatedtitle{\par\foreignlanguage{#1}{#2}}}
```

`\@translatedsubtitle`

```
\def\@translatedsubtitle{}
```

`\translatedsubtitle` The subtitle of the paper in a different language

```
\newcommand\translatedsubtitle[2]{\ACM@lang@check{\translatedsubtitle}%
\g@addto@macro\@translatedsubtitle{\par\foreignlanguage{#1}{#2}}}
```

`\@translatedkeywords`

```
\def\@translatedkeywords{}
```

`\translatedkeywords` Add keywords to the paper in the language specified

```
\newcommand\translatedkeywords[2]{\ACM@lang@check{\translatedkeywords}%
\g@addto@macro\@translatedkeywords{\@mktranslatedkeywords{#1}{#2}}}
```

`\@translatedabstracts` The container for translated abstracts.

```
\def\@translatedabstracts{}
```

`translatedabstract` We save translated abstracts into `\@translatedabstracts`

```
\newenvironment{translatedabstract}[1]{\Collect@Body
  \@savetranslatedabstract\@mktranslatedabstract{#1}}{}
```

`\@savetranslatedabstract` And saving the abstract

```
\long\def\@savetranslatedabstract#1{\if@ACM@maketitle@typeset
  \ClassError{\@classname}{Abstract must be defined before maketitle
    command. Please move it!}\fi
  \ACM@lang@check{translatedabstract}%
  \g@addto@macro\@translatedabstracts{\bgroup#1\egroup}}
```

3.8 Sectioning

`\@startsection` Before we call `hyperref`, we redefine `\startsection` commands to their LaTeX defaults since the `amsart` ones are too AMS-specific. We need to do this early since we want `hyperref` to have a chance to redefine them again:

```
\def\@startsection#1#2#3#4#5#6{%
  \if@noskipsec \leavevmode \fi
  \par
  \@tempskipa #4\relax
  \@afterindenttrue
  \ifdim \@tempskipa <\z@
    \@tempskipa -\@tempskipa \@afterindentfalse
  \fi
  \if@nobreak
    \everypar{}%
  \else
    \addpenalty\@secpenalty\addvspace\@tempskipa
  \fi
  \@ifstar
    {\@ssect{#3}{#4}{#5}{#6}}%
    {\@dblarg{\@sect{#1}{#2}{#3}{#4}{#5}{#6}}}}
```

```
\def\@sect#1#2#3#4#5#6[#7]#8{%
  \edef\@toclevel{\ifnum#2=\@m 0\else\number#2\fi}%
  \ifnum #2>\c@secnumdepth
    \let\@svsec\@empty
  \else
    \refstepcounter{#1}%
    \protected@edef\@svsec{\@seccntformat{#1}\relax}%
  \fi
  \@tempskipa #5\relax
  \ifdim \@tempskipa>\z@
    \begingroup
      #6{%
        \@hangfrom{\hskip #3\relax\@svsec}%
          \interlinepenalty \@M #8\@@par}%
    \endgroup
    \csname #1mark\endcsname{#7}%
    \ifnum #2>\c@secnumdepth \else
        \@tochangmeasure{\csname the#1\endcsname}%
    \fi
    \addcontentsline{toc}{#1}{%
      \ifnum #2>\c@secnumdepth \else
        \protect\numberline{\csname the#1\endcsname}%
      \fi
      #7}%
  \else
    \def\@svsechd{%
      #6{\hskip #3\relax
      \@svsec #8}%
      \csname #1mark\endcsname{#7}%
      \ifnum #2>\c@secnumdepth \else
        \@tochangmeasure{\csname the#1\endcsname\space}%
      \fi
      \addcontentsline{toc}{#1}{%
        \ifnum #2>\c@secnumdepth \else
          \protect\numberline{\csname the#1\endcsname}%
        \fi
        #7}}%
  \fi
  \@xsect{#5}}
\def\@xsect#1{%
  \@tempskipa #1\relax
  \ifdim \@tempskipa>\z@
    \par \nobreak
    \vskip \@tempskipa
    \@afterheading
  \else
    \@nobreakfalse
    \global\@noskipsectrue
    \everypar{%
      \if@noskipsec
        \global\@noskipsecfalse
       {\setbox\z@\lastbox}%
        \clubpenalty\@M
        \begingroup \@svsechd \endgroup
```

```
        \unskip
        \@tempskipa #1\relax
        \hskip -\@tempskipa
      \else
        \clubpenalty \@clubpenalty
        \everypar{}%
      \fi}%
  \fi
  \ignorespaces}
\def\@seccntformat#1{\csname the#1\endcsname\quad}
\def\@ssect#1#2#3#4#5{%
  \@tempskipa #3\relax
  \ifdim \@tempskipa>\z@
    \begingroup
      #4{%
        \@hangfrom{\hskip #1}%
          \interlinepenalty \@M #5\@@par}%
    \endgroup
  \else
    \def\@svsechd{#4{\hskip #1\relax #5}}%
  \fi
  \@xsect{#3}}
```

`\@startsection` The amsart package redefines `\startsection`. Here we redefine it again to make the table of contents work.

```
\def\@starttoc#1#2{\begingroup\makeatletter
  \setTrue{#1}%
  \par\removelastskip\vskip\z@skip
  \@startsection{section}\@M\z@{\linespacing\@plus\linespacing}%
    {.5\linespacing}{\centering\contentsnamefont}{#2}%
  \@input{\jobname.#1}%
  \if@filesw
    \@xp\newwrite\csname tf@#1\endcsname
    \immediate\@xp\openout\csname tf@#1\endcsname \jobname.#1\relax
  \fi
  \global\@nobreakfalse \endgroup
  \addvspace{32\p@\@plus14\p@}%
}
```

`\l@subsection` Section spacing is more generous than for amsart

```
\def\l@section{\@tocline{1}{0pt}{1pc}{2pc}{}}
```

`\l@subsection` The spacing in amsart is too large

```
\def\l@subsection{\@tocline{2}{0pt}{1pc}{3pc}{}}
```

`\l@subsubsection` The spacing in amsart is too large

```
\def\l@subsubsection{\@tocline{3}{0pt}{1pc}{5pc}{}}
```

We need to define foonote-related stuff before the call to hyperref (Ross Moore)

`\@makefntext` We do not use indentation for footnotes

```
\def\@makefntext{\noindent\@makefnmark}
```

\@footnotetext In sigchi-a mode our footnotes are in the margin!

```
\if@ACM@sigchiamode
\long\def\@footnotetext#1{\marginpar{%
    \reset@font\small
    \interlinepenalty\interfootnotelinepenalty
    \protected@edef\@currentlabel{%
       \csname p@footnote\endcsname\@thefnmark
    }%
    \color@begingroup
      \@makefntext{%
        \rule\z@\footnotesep\ignorespaces#1\@finalstrut\strutbox}%
    \color@endgroup}}%
\fi
```

\@mpfootnotetext We want the footnotes in minipages centered:

```
\long\def\@mpfootnotetext#1{%
  \global\setbox\@mpfootins\vbox{%
    \unvbox\@mpfootins
    \reset@font\footnotesize
    \hsize\columnwidth
    \@parboxrestore
    \protected@edef\@currentlabel
         {\csname p@mpfootnote\endcsname\@thefnmark}%
    \color@begingroup\centering
      \@makefntext{%
        \rule\z@\footnotesep\ignorespaces#1\@finalstrut\strutbox}%
    \color@endgroup}}
```

\@makefnmark AMS classes use a buggy definition of \makefnmark. We revert to the standard one.

```
\def\@makefnmark{\hbox{\@textsuperscript{\normalfont\@thefnmark}}}
```

3.9 Hyperxmp and hyperref

Adding hyperxmp

```
\RequirePackage{hyperxmp}
```

And now, hyperref

```
\let\@footnotemark@nolink\@footnotemark
\let\@footnotetext@nolink\@footnotetext
\RequirePackage[bookmarksnumbered,unicode]{hyperref}
\pdfstringdefDisableCommands{%
  \def\addtocounter#1#2{}%
  \def\unskip{}%
  \def\textbullet{- }%
  \def\textrightarrow{ -> }%
  \def\footnotemark{}%
}
\urlstyle{rm}
\ifcase\ACM@format@nr
\relax % manuscript
\or % acmsmall
\or % acmlarge
\or % acmtog
\or % sigconf
```

```
\or % siggraph
\or % sigplan
  \urlstyle{sf}
\or % sigchi
\or % sigchi-a
  \urlstyle{sf}
\or % acmengage
\or % acmcp
\fi
\AtEndPreamble{%
  \if@ACM@urlbreakonhyphens
    \def\do@url@hyp{\do\-}%
  \fi
  \if@ACM@screen
    \hypersetup{colorlinks,
      linkcolor=ACMPurple,
      citecolor=ACMPurple,
      urlcolor=ACMDarkBlue,
      filecolor=ACMDarkBlue}
    \else
    \hypersetup{hidelinks}
  \fi
  \hypersetup{pdflang={en},
    pdfdisplaydoctitle}}
```

Bibliography mangling.

```
\if@ACM@natbib
  \let\citeN\cite
  \let\cite\citep
  \let\citeANP\citeauthor
  \let\citeNN\citeyearpar
  \let\citeyearNP\citeyear
  \let\citeNP\citealt
  \DeclareRobustCommand\citeA
     {\begingroup\NAT@swafalse
       \let\NAT@ctype\@ne\NAT@partrue\NAT@fullfalse\NAT@open\NAT@citetp}%
  \providecommand\newblock{}%
\else
  \AtBeginDocument{%
    \let\shortcite\cite%
    \providecommand\citename[1]{#1}}
\fi
\newcommand\shortcite[2][]{%
  \ifNAT@numbers\cite[#1]{#2}\else\citeyearpar[#1]{#2}\fi}
```

`\bibliographystyle` The `amsart` package redefines `\bibliographystyle` since it prefers the AMS bibliography style. We turn it back to the LaTeX definition:

```
\def\bibliographystyle#1{%
  \ifx\@begindocumenthook\@undefined\else
    \expandafter\AtBeginDocument
  \fi
    {\if@filesw
       \immediate\write\@auxout{\string\bibstyle{#1}}%
     \fi}}
```

3.10 Other packages

Graphics and color.

```
\RequirePackage{graphicx}
\RequirePackage[prologue]{xcolor}
```

We define ACM colors according to [8]:

```
\definecolor[named]{ACMBlue}{cmyk}{1,0.1,0,0.1}
\definecolor[named]{ACMYellow}{cmyk}{0,0.16,1,0}
\definecolor[named]{ACMOrange}{cmyk}{0,0.42,1,0.01}
\definecolor[named]{ACMRed}{cmyk}{0,0.90,0.86,0}
\definecolor[named]{ACMLightBlue}{cmyk}{0.49,0.01,0,0}
\definecolor[named]{ACMGreen}{cmyk}{0.20,0,1,0.19}
\definecolor[named]{ACMPurple}{cmyk}{0.55,1,0,0.15}
\definecolor[named]{ACMDarkBlue}{cmyk}{1,0.58,0,0.21}
```

Author-draft mode or sigchi-a mode

```
\if@ACM@authordraft
  \RequirePackage{draftwatermark}
  \SetWatermarkFontSize{0.5in}
  \SetWatermarkColor[gray]{.9}
  \SetWatermarkText{\parbox{12em}{\centering
      Unpublished working draft.\\
      Not for distribution.}}
\else
  \if@ACM@sigchiamode
    \if@ACM@nonacm\else
      \RequirePackage{draftwatermark}
      \SetWatermarkFontSize{0.5in}
      \SetWatermarkColor[gray]{.9}
      \SetWatermarkText{\parbox{12em}{\centering
          Legacy document. \\
          Not for publication in an ACM venue}}
    \fi
  \fi
\fi
```

3.11 Paper size and paragraphing

We use `geometry` for dimensions. Note that the present margins do not depend on the font size option—we might need to change this. See https://github.com/borisveytsman/acmart/issues/5#issuecomment-272881329.

```
\RequirePackage{geometry}
\ifcase\ACM@format@nr
\relax % manuscript
   \geometry{letterpaper,head=13pt,
   marginparwidth=6pc,heightrounded}%
\or % acmsmall
   \geometry{twoside=true,
     includeheadfoot, head=13pt, foot=2pc,
     paperwidth=6.75in, paperheight=10in,
     top=58pt, bottom=44pt, inner=46pt, outer=46pt,
     marginparwidth=2pc,heightrounded
   }%
```

```
\or % acmlarge
   \geometry{twoside=true, head=13pt, foot=2pc,
     paperwidth=8.5in, paperheight=11in,
     includeheadfoot,
     top=78pt, bottom=114pt, inner=81pt, outer=81pt,
     marginparwidth=4pc,heightrounded
     }%
\or % acmtog
   \geometry{twoside=true, head=13pt, foot=2pc,
     paperwidth=8.5in, paperheight=11in,
     includeheadfoot, columnsep=24pt,
     top=52pt, bottom=75pt, inner=52pt, outer=52pt,
     marginparwidth=2pc,heightrounded
     }%
\or % sigconf
   \geometry{twoside=true, head=13pt,
     paperwidth=8.5in, paperheight=11in,
     includeheadfoot, columnsep=2pc,
     top=57pt, bottom=73pt, inner=54pt, outer=54pt,
     marginparwidth=2pc,heightrounded
     }%
\or % siggraph
   \geometry{twoside=true, head=13pt,
     paperwidth=8.5in, paperheight=11in,
     includeheadfoot, columnsep=2pc,
     top=57pt, bottom=73pt, inner=54pt, outer=54pt,
     marginparwidth=2pc,heightrounded
     }%
\or % sigplan
   \geometry{twoside=true, head=13pt,
     paperwidth=8.5in, paperheight=11in,
     includeheadfoot=false, columnsep=2pc,
     top=1in, bottom=1in, inner=0.75in, outer=0.75in,
     marginparwidth=2pc,heightrounded
     }%
\or % sigchi
   \geometry{twoside=true, head=13pt,
     paperwidth=8.5in, paperheight=11in,
     includeheadfoot, columnsep=2pc,
     top=66pt, bottom=73pt, inner=54pt, outer=54pt,
     marginparwidth=2pc,heightrounded
     }%
\or % sigchi-a
   \geometry{twoside=false, head=13pt,
     paperwidth=11in, paperheight=8.5in,
     includeheadfoot, marginparsep=72pt,
     marginparwidth=170pt, columnsep=20pt,
     top=72pt, bottom=72pt, left=314pt, right=72pt
     }%
     \@mparswitchfalse
     \reversemarginpar
\or % acmengage
   \geometry{twoside=true, head=13pt,
     paperwidth=8.5in, paperheight=11in,
```

```
    includeheadfoot, columnsep=2pc,
    top=57pt, bottom=73pt, inner=54pt, outer=54pt,
    marginparwidth=2pc,heightrounded
    }%
\or % acmcp
  \geometry{twoside=true,
    includeheadfoot, head=13pt, foot=2pc,
    paperwidth=6.75in, paperheight=10in,
    top=58pt, bottom=44pt, inner=46pt, outer=46pt,
    marginparwidth=2pc,heightrounded
  }%
\fi
```

\parindent \parskip Paragraphing

```
\setlength\parindent{10\p@}
\setlength\parskip{\z@}
\ifcase\ACM@format@nr
\relax % manuscript
\or % acmsmall
\or % acmlarge
\or % acmtog
  \setlength\parindent{9\p@}%
\or % sigconf
\or % siggraph
\or % sigplan
\or % sigchi
\or % sigchi-a
\or % acmengage
\or % acmcp
\fi
```

\normalparindent The amsart package defines the \normalparindent length and initializes it to 12pt (the value of \parindent in amsart). It is later used to set the \listparindent length in the quotation environment and the \parindent length in the \@footnotetext command. We set \normalparindent to the value of \parindent as selected by acmart for consistent paragraph indents.

```
\setlength\normalparindent{\parindent}
```

Footnotes require some consideration. We have several layers of footnotes: frontmatter footnotes, "regular" footnotes and the special insert for the bibstrip. In the old ACM classes, the bibstrip was a \@float. The problem with floats is that they tend to, well, float—and we want the guarantee they stay.

We use manyfoot for layered footnotes instead.

\copyrightpermissionfootnoterule This is the footnote rule that separates the bibstrip from the rest of the paper. It is a full width rule.

```
\def\copyrightpermissionfootnoterule{\kern-3\p@
  \hrule \@width \columnwidth \kern 2.6\p@}

\RequirePackage{manyfoot}
\SelectFootnoteRule[2]{copyrightpermission}
\DeclareNewFootnote{authorsaddresses}
\SelectFootnoteRule[2]{copyrightpermission}
\DeclareNewFootnote{copyrightpermission}
```

\footnoterule Tschichold's rules:

```
\def\footnoterule{\kern-3\p@
  \hrule \@width 4pc \kern 2.6\p@}
```

\endminipage We do not use footnote rules in minipages

```
\def\endminipage{%
    \par
    \unskip
    \ifvoid\@mpfootins\else
      \vskip\skip\@mpfootins
      \normalcolor
      \unvbox\@mpfootins
    \fi
    \@minipagefalse
  \color@endgroup
  \egroup
  \expandafter\@iiiparbox\@mpargs{\unvbox\@tempboxa}}
```

\@textbottom Add some stretch according to David Carlisle's advice at http://tex.stackexchange.com/a/62318/5522

```
\def\@textbottom{\vskip \z@ \@plus 1pt}
\let\@texttop\relax
```

In two-column layouts, force both columns to be the same height by inserting extra internal vertical space to fill out the page.

```
\ifcase\ACM@format@nr
\relax % manuscript
\or % acmsmall
\or % acmlarge
\or % acmtog
  \flushbottom
\or % sigconf
  \flushbottom
\or % siggraph
  \flushbottom
\or % sigplan
  \flushbottom
\or % sigchi
  \flushbottom
\or % sigchi-a
\or % acmengage
  \flushbottom
\or % acmcp
  \flushbottom
\fi
```

3.12 Fonts

Somehow PDFTeX and XeTeX require different incantations to make a PDF compliant with the current Acrobat bugs. Xpdf is much better.

The code below is by Ross Moore.

```
\ifPDFTeX
\input{glyphtounicode}
```

```
\pdfglyphtounicode{f_f}{FB00}
\pdfglyphtounicode{f_f_i}{FB03}
\pdfglyphtounicode{f_f_l}{FB04}
\pdfglyphtounicode{f_i}{FB01}
\pdfglyphtounicode{t_t}{0074 0074}
\pdfglyphtounicode{f_t}{0066 0074}
\pdfglyphtounicode{T_h}{0054 0068}
\pdfgentounicode=1
\RequirePackage{cmap}
\fi
```

`\if@ACM@newfonts` Whether we load the new fonts

```
\newif\if@ACM@newfonts
\@ACM@newfontstrue
\IfFileExists{libertine.sty}{}{\ClassWarning{\@classname}{You do not
    have the libertine package installed.  Please upgrade your
    TeX}\@ACM@newfontsfalse}
\IfFileExists{zi4.sty}{}{\ClassWarning{\@classname}{You do not
    have the inconsolata (zi4.sty) package installed.  Please upgrade your
    TeX}\@ACM@newfontsfalse}
\IfFileExists{newtxmath.sty}{}{\ClassWarning{\@classname}{You do not
    have the newtxmath package installed.  Please upgrade your
    TeX}\@ACM@newfontsfalse}
```

We use Libertine throughout.

```
\if@ACM@newfonts
  \RequirePackage[T1]{fontenc}
  % Note that the order in which packages are loaded matters,
  % and the correct order depends on the LaTeX engine used.
  % See https://github.com/borisveytsman/acmart/issues/402
  % and https://github.com/borisveytsman/acmart/issues/410
  \ifxetex
    \RequirePackage[libertine]{newtxmath}
    \RequirePackage[tt=false]{libertine}
    \setmonofont[StylisticSet=3]{inconsolata}
  \else
    \ifluatex
      \RequirePackage[libertine]{newtxmath}
      \RequirePackage[tt=false]{libertine}
      \setmonofont[StylisticSet=3]{inconsolata}
    \else
       \RequirePackage[tt=false, type1=true]{libertine}
       \RequirePackage[varqu]{zi4}
       \RequirePackage[libertine]{newtxmath}
    \fi
  \fi
\fi
```

`\liningnums` Libertine defines `\liningnums`, which makes `fontspec` unhappy. While we do not use `fontspec`, some users do.

```
\let\liningnums\@undefined
\AtEndPreamble{%
  \DeclareTextFontCommand{\liningnums}{\libertineLF}}
```

The SIGCHI extended abstracts are sans serif:

```
\if@ACM@sigchiamode
  \renewcommand{\familydefault}{\sfdefault}
\fi
```

3.13 Image descriptions

`\if@Description@present` A local switch: whether there is a description in the given figure

```
\newif\if@Description@present
\@Description@presenttrue
```

`\if@undescribed@images` A global switch whether some images were *not* described

```
\newif\if@undescribed@images
\@undescribed@imagesfalse
```

`\Description` The Description macro right now just sets switches

```
\newcommand\Description[2][]{\global\@Description@presenttrue\ignorespaces}
```

The global warning

```
\AtEndDocument{\if@undescribed@images
  \ClassWarningNoLine{\@classname}{Some images may lack descriptions}\fi}
```

Hooks for figures and tables. We also patch `algorithm` and `algorithm*` in case somebody uses them.

```
\AtBeginEnvironment{figure}{\@Description@presentfalse
  \let\@vspace\@vspace@orig
  \let\@vspacer\@vspacer@orig}
\AtBeginEnvironment{figure*}{\@Description@presentfalse
  \let\@vspace\@vspace@orig
  \let\@vspacer\@vspacer@orig}
\AtEndEnvironment{figure}{\if@Description@present\else
  \global\@undescribed@imagestrue
  \ClassWarning{\@classname}{A possible image without description}\fi}
\AtEndEnvironment{figure*}{\if@Description@present\else
  \global\@undescribed@imagestrue
  \ClassWarning{\@classname}{A possible image without description}\fi}
\AtBeginEnvironment{table}{\let\@vspace\@vspace@orig
  \let\@vspacer\@vspacer@orig}
\AtBeginEnvironment{table*}{\let\@vspace\@vspace@orig
  \let\@vspacer\@vspacer@orig}
\AtBeginEnvironment{algorithm}{\let\@vspace\@vspace@orig
  \let\@vspacer\@vspacer@orig}
\AtBeginEnvironment{algorithm*}{\let\@vspace\@vspace@orig
  \let\@vspacer\@vspacer@orig}
\AtBeginEnvironment{lstlisting}{\let\@vspace\@vspace@orig
  \let\@vspacer\@vspacer@orig}
\AtBeginEnvironment{lstlisting*}{\let\@vspace\@vspace@orig
  \let\@vspacer\@vspacer@orig}
\AtBeginEnvironment{minted}{\let\@vspace\@vspace@orig
  \let\@vspacer\@vspacer@orig}
\AtBeginEnvironment{minted*}{\let\@vspace\@vspace@orig
  \let\@vspacer\@vspacer@orig}
\AtBeginEnvironment{listing}{\let\@vspace\@vspace@orig
```

```
  \let\@vspacer\@vspacer@orig}
\AtBeginEnvironment{listing*}{\let\@vspace\@vspace@orig
  \let\@vspacer\@vspacer@orig}

```

3.14 Floats

We use the caption package

```
\RequirePackage{caption, float}
\captionsetup[table]{position=top}
\if@ACM@journal
  \captionsetup{labelfont={sf, small},
    textfont={sf, small}, margin=\z@}
  \captionsetup[figure]{name={Fig.}}
\else
  \captionsetup{labelfont={bf},
    textfont={bf}, labelsep=colon, margin=\z@}
  \ifcase\ACM@format@nr
  \relax % manuscript
  \or % acmsmall
  \or % acmlarge
  \or % acmtog
  \or % sigconf
  \or % siggraph
    \captionsetup{textfont={it}}
  \or % sigplan
    \captionsetup{labelfont={bf},
      textfont={normalfont}, labelsep=period, margin=\z@}
  \or % sigchi
    \captionsetup[figure]{labelfont={bf, small},
      textfont={bf, small}}
    \captionsetup[table]{labelfont={bf, small},
      textfont={bf, small}}
  \or % sigchi-a
    \captionsetup[figure]{labelfont={bf, small},
      textfont={bf, small}}
    \captionsetup[table]{labelfont={bf, small},
      textfont={bf, small}}
  \or % acmengage
  \or % acmcp
  \fi
\fi
```

`sidebar` The `sidebar` environment:

```
\newfloat{sidebar}{}{sbar}
\floatname{sidebar}{Sidebar}
\renewenvironment{sidebar}{\Collect@Body\@sidebar}{}
```

`\@sidebar` The processing of the saved text

```
\long\def\@sidebar#1{\bgroup\let\@vspace\@vspace@orig
  \let\@vspacer\@vspacer@orig\captionsetup{type=sidebar}%
  \marginpar{\small#1}\egroup}
```

marginfigure The marginfigure environment:

```
\newenvironment{marginfigure}{\Collect@Body\@marginfigure}{}
```

\@marginfigure The processing of the saved text

```
\long\def\@marginfigure#1{\bgroup
  \let\@vspace\@vspace@orig
  \let\@vspacer\@vspacer@orig
  \captionsetup{type=figure}%
  \marginpar{\@Description@presentfalse\centering
    \small#1\if@Description@present\else
      \global\@undescribed@imagestrue
      \ClassWarning{\@classname}{A possible image without description}
      \fi}%
  \egroup}
```

margintable The margintable environment:

```
\newenvironment{margintable}{\Collect@Body\@margintable}{}
```

\@margintable The processing of the saved text

```
\long\def\@margintable#1{\bgroup\let\@vspace\@vspace@orig
  \let\@vspacer\@vspacer@orig\captionsetup{type=table}%
  \marginpar{\centering\small#1}\egroup}
```

SIGCHI extended abstracts provide an interesting possibility to push into the margin. Here we use figure* and table* for this.

\fulltextwidth We define the width of the boxes as

```
\newdimen\fulltextwidth
\fulltextwidth=\dimexpr(\textwidth+\marginparwidth+\marginparsep)
```

\@dblfloat We redefine the double-float command. First, we make the size bigger. Second, our default position is going to be tp (to give marginalia a chance)

```
\if@ACM@sigchiamode
\def\@dblfloat{\bgroup\let\@vspace\@vspace@orig
  \let\@vspacer\@vspacer@orig\columnwidth=\fulltextwidth
  \let\@endfloatbox\@endwidefloatbox
  \def\@fpsadddefault{\def\@fps{tp}}%
  \@float}
\fi
```

\end@dblfloat And the end. Just adding a \bgroup.

```
\if@ACM@sigchiamode
\def\end@dblfloat{%
    \end@float\egroup}
\fi
```

\@endwidefloatbox This is the end of a wide box—we basically move everything to the left

```
\def\@endwidefloatbox{%
  \par\vskip\z@skip
  \@minipagefalse
  \outer@nobreak
  \egroup
  \color@endbox
```

```
  \global\setbox\@currbox=\vbox{\moveleft
    \dimexpr(\fulltextwidth-\textwidth)\box\@currbox}%
  \wd\@currbox=\textwidth
}
```

3.15 Lists

```
\ifcase\ACM@format@nr
\relax % manuscript
\or % acmsmall
\or % acmlarge
\or % acmtog
\or % sigconf
\or % siggraph
\or % sigplan
\def\labelenumi{\theenumi.}
\def\labelenumii{\theenumii.}
\def\labelenumiii{\theenumiii.}
\def\labelenumiv{\theenumiv.}
\or % sigchi
\or % sigchi-a
\or % acmengage
\or % acmcp
\fi
```

The AMS uses generous margins for lists. Note that amsart defines \leftmargin values for list levels at the beginning of the document, so we must redefine them in the same manner. Also, note that amsart redefines the enumerate and itemize environments with a \makelabel command that uses \llap, so the \labelwidth value is (effectively) irrelevant; nonetheless, we follow amsart and set \labelwidth to \leftmargin minus \labelsep.

```
\newdimen\@ACM@labelwidth
\AtBeginDocument{%
  \setlength\labelsep{4pt}
  \setlength{\@ACM@labelwidth}{6.5pt}

  %% First-level list: when beginning after the first line of an
  %% indented paragraph or ending before an indented paragraph, labels
  %% should not hang to the left of the preceding/following text.
  \setlength\leftmargini{\z@}
  \addtolength\leftmargini{\parindent}
  \addtolength\leftmargini{2\labelsep}
  \addtolength\leftmargini{\@ACM@labelwidth}

  %% Second-level and higher lists.
  \setlength\leftmarginii{\z@}
  \addtolength\leftmarginii{0.5\labelsep}
  \addtolength\leftmarginii{\@ACM@labelwidth}
  \setlength\leftmarginiii{\leftmarginii}
  \setlength\leftmariniv{\leftmarginiii}
  \setlength\leftmarginv{\leftmariniv}
  \setlength\leftmarginvi{\leftmarginv}
  \@listi}
\newskip\listisep
```

```
\listisep\smallskipamount
\def\@listI{\leftmargin\leftmargini
  \labelwidth\leftmargini \advance\labelwidth-\labelsep
  \listparindent\z@
  \topsep\listisep}
\let\@listi\@listI
\def\@listii{\leftmargin\leftmarginii
  \labelwidth\leftmarginii \advance\labelwidth-\labelsep
  \topsep\z@skip}
\def\@listiii{\leftmargin\leftmarginiii
  \labelwidth\leftmarginiii \advance\labelwidth-\labelsep}
\def\@listiv{\leftmargin\leftmarginiv
  \labelwidth\leftmarginiv \advance\labelwidth-\labelsep}
\def\@listv{\leftmargin\leftmarginv
  \labelwidth\leftmarginv \advance\labelwidth-\labelsep}
\def\@listvi{\leftmargin\leftmarginvi
  \labelwidth\leftmarginvi \advance\labelwidth-\labelsep}
```

\descriptionlabel We do not use a colon by default like amsart does:

```
\renewcommand{\descriptionlabel}[1]{\upshape\bfseries #1}
```

\description Make the description environment indentation consistent with that of the itemize and enumerate environments.

```
\renewenvironment{description}{\list{}{%
    \labelwidth\@ACM@labelwidth
    \let\makelabel\descriptionlabel}%
}{
  \endlist
}
\let\enddescription=\endlist % for efficiency
```

3.16 Top-matter data

\if@ACM@maketitle@typeset The switch to check whether \maketitle is already typeset. It is initally false, and setting top matter when it is true is wrong.

```
\newif\if@ACM@maketitle@typeset
\@ACM@maketitle@typesetfalse
```

We use the xkeyval interface to define journal titles and the relevant information

```
\define@choicekey*+{ACM}{acmJournal}[\@journalCode\@journalCode@nr]{%
  ACMJCSS,%
  CIE,%
  CSUR,%
  DGOV,%
  DLT,%
  DTRAP,%
  FAC,%
  GAMES,%
  HEALTH,%
  IMWUT,%
  JACM,%
  JATS,%
  JDIQ,%
  JDS,%
```

```
JEA,%
JERIC,%
JETC,%
JOCCH,%
JRC,%
PACMCGIT,%
PACMHCI,%
PACMNET,%
PACMPL,%
POMACS,%
TAAS,%
TACCESS,%
TACO,%
TALG,%
TALLIP,%
TAP,%
TCPS,%
TDS,%
TEAC,%
TECS,%
TELO,%
THRI,%
TIIS,%
TIOT,%
TISSEC,%
TIST,%
TKDD,%
TMIS,%
TOCE,%
TOCHI,%
TOCL,%
TOCS,%
TOCT,%
TODAES,%
TODS,%
TOG,%
TOIS,%
TOIT,%
TOMACS,%
TOMM,%
TOMPECS,%
TOMS,%
TOPC,%
TOPS,%
TOPLAS,%
TORS,%
TOS,%
TOSEM,%
TOSN,%
TQC,%
TRETS,%
TSAS,%
TSC,%
TSLP,%
```

```
  TWEB,%
  FACMP%
}{%
\ifcase\@journalCode@nr
\relax % ACMJCSS
  \def\@journalName{ACM Journal on Computing and Sustainable Societies}%
  \def\@journalNameShort{ACM J. Comput. Sustain. Soc.}%
  \def\@permissionCodeOne{2834-5533}%
\or % CIE
  \def\@journalName{ACM Computers in Entertainment}%
  \def\@journalNameShort{ACM Comput. Entertain.}%
  \def\@permissionCodeOne{1544-3574}%
\or % CSUR
  \def\@journalName{ACM Computing Surveys}%
  \def\@journalNameShort{ACM Comput. Surv.}%
  \def\@permissionCodeOne{0360-0300}%
\or % DGOV
  \def\@journalName{Digital Government: Research and Practice}%
  \def\@journalNameShort{Digit. Gov. Res. Pract.}%
  \def\@permissionCodeOne{2639-0175}%
\or % DLT
  \def\@journalName{Distributed Ledger Technologies: Research and Practice}%
  \def\@journalNameShort{Distrib. Ledger Technol.}%
  \def\@permissionCodeOne{2769-6472}%
\or % DTRAP
  \def\@journalName{Digital Threats: Research and Practice}%
  \def\@journalNameShort{Digit. Threat. Res. Pract.}%
  \def\@permissionCodeOne{2576-5337}%
\or % FAC
  \def\@journalName{Formal Aspects of Computing}%
  \def\@journalNameShort{Form. Asp. Comput.}%
  \def\@permissionCodeOne{0934-5043}%
  \def\@permissionCodeTwo{1433-299X}%
\or % GAMES
  \def\@journalName{ACM Games: Research and Practice}%
  \def\@journalNameShort{ACM Games}%
  \def\@permissionCodeOne{2832-5516}%
\or % HEALTH
  \def\@journalName{ACM Transactions on Computing for Healthcare}%
  \def\@journalNameShort{ACM Trans. Comput. Healthcare}%
  \def\@permissionCodeOne{2637-8051}%
\or % IMWUT
  \def\@journalName{Proceedings of the ACM on Interactive, Mobile,
    Wearable and Ubiquitous Technologies}%
 \def\@journalNameShort{Proc. ACM Interact. Mob. Wearable Ubiquitous Technol.}%
  \def\@permissionCodeOne{2474-9567}%
  \@ACM@screentrue
  \PackageInfo{\@classname}{Using screen mode due to \@journalCode}%
\or % JACM
  \def\@journalName{Journal of the ACM}%
  \def\@journalNameShort{J. ACM}%
  \def\@permissionCodeOne{0004-5411}%
\or % JATS
  \def\@journalName{Journal on Autonomous Transportation Systems}%
```

```
  \def\@journalNameShort{ACM J. Auton. Transport. Syst.}%
  \def\@permissionCodeOne{2833-0528}%
\or % JDIQ
  \def\@journalName{ACM Journal of Data and Information Quality}%
  \def\@journalNameShort{ACM J. Data Inform. Quality}%
  \def\@permissionCodeOne{1936-1955}%
\or % JDS
  \def\@journalName{ACM/JMS Journal of Data Science}%
  \def\@journalNameShort{ACM/IMS J. Data Sci.}%
  \def\@permissionCodeOne{2831-3194}%
  \def\@permissionCodeTwo{2831-3194}%
\or % JEA
  \def\@journalName{ACM Journal of Experimental Algorithmics}%
  \def\@journalNameShort{ACM J. Exp. Algor.}%
  \def\@permissionCodeOne{1084-6654}%
\or % JERIC
  \def\@journalName{ACM Journal of Educational Resources in Computing}%
  \def\@journalNameShort{ACM J. Edu. Resources in Comput.}%
  \def\@permissionCodeOne{1073-0516}%
\or % JETC
 \def\@journalName{ACM Journal on Emerging Technologies in Computing Systems}%
  \def\@journalNameShort{ACM J. Emerg. Technol. Comput. Syst.}%
  \def\@permissionCodeOne{1550-4832}%
\or % JOCCH
  \def\@journalName{ACM Journal on Computing and Cultural Heritage}%
  \def\@journalNameShort{ACM J. Comput. Cult. Herit.}%
  \def\@permissionCodeOne{1556-4673}%
  \def\@permissionCodeTwo{1556-4711}%
\or % JRC
  \def\@journalName{ACM Journal on Responsible Computing}%
  \def\@journalNameShort{ACM J. Responsib. Comput.}%
  \def\@permissionCodeOne{2832-0565}%
\or % PACMCGIT
 \def\@journalName{Proceedings of the ACM on Computer Graphics and Interactive Techniques}%
  \def\@journalNameShort{Proc. ACM Comput. Graph. Interact. Tech.}%
  \def\@permissionCodeOne{2577-6193}%
  \@ACM@screentrue
  \PackageInfo{\@classname}{Using screen mode due to \@journalCode}%
\or % PACMHCI
  \def\@journalName{Proceedings of the ACM on Human-Computer Interaction}%
  \def\@journalNameShort{Proc. ACM Hum.-Comput. Interact.}%
  \def\@permissionCodeOne{2573-0142}%
  \@ACM@screentrue
  \PackageInfo{\@classname}{Using screen mode due to \@journalCode}%
\or % PACMNET
  \def\@journalName{Proceedings of the ACM on Networkng}%
  \def\@journalNameShort{Proc. ACM Netw.}%
  \def\@permissionCodeOne{2834-5509}%
\or % PACMPL
  \def\@journalName{Proceedings of the ACM on Programming Languages}%
  \def\@journalNameShort{Proc. ACM Program. Lang.}%
  \def\@permissionCodeOne{2475-1421}%
  \@ACM@screentrue
  \PackageInfo{\@classname}{Using screen mode due to \@journalCode}%
```

```
\or % POMACS
 \def\@journalName{Proceedings of the ACM on Measurement and Analysis of Computing Systems}%
  \def\@journalNameShort{Proc. ACM Meas. Anal. Comput. Syst.}%
  \def\@permissionCodeOne{2476-1249}%
  \@ACM@screentrue
  \PackageInfo{\@classname}{Using screen mode due to \@journalCode}%
\or % TAAS
  \def\@journalName{ACM Transactions on Autonomous and Adaptive Systems}%
  \def\@journalNameShort{ACM Trans. Autonom. Adapt. Syst.}%
  \def\@permissionCodeOne{1556-4665}%
\or % TACCESS
  \def\@journalName{ACM Transactions on Accessible Computing}%
  \def\@journalNameShort{ACM Trans. Access. Comput.}%
  \def\@permissionCodeOne{1936-7228}%
\or % TACO
  \def\@journalName{ACM Transactions on Architecture and Code Optimization}%
  \def\@journalNameShort{ACM Trans. Arch. Code Optim.}%
  \def\@permissionCodeOne{1544-3566}%
  \def\@permissionCodeTwo{1544-3973}%
\or % TALG
  \def\@journalName{ACM Transactions on Algorithms}%
  \def\@journalNameShort{ACM Trans. Algor.}%
  \def\@permissionCodeOne{1549-6325}%
\or % TALLIP
 \def\@journalName{ACM Transactions on Asian and Low-Resource Language Information Processing}%
  \def\@journalNameShort{ACM Trans. Asian Low-Resour. Lang. Inf. Process.}%
  \def\@permissionCodeOne{2375-4699}%
\or % TAP
  \def\@journalName{ACM Transactions on Applied Perception}%
  \def\@journalNameShort{ACM Trans. Appl. Percept.}%
  \def\@permissionCodeOne{1544-3558}%
\or % TCPS
  \def\@journalName{ACM Transactions on Cyber-Physical Systems}%
  \def\@journalNameShort{ACM Trans. Cyber-Phys. Syst.}%
  \def\@permissionCodeOne{2378-962X}%
\or % TDS
  \def\@journalName{ACM/IMS Transactions on Data Science}%
  \def\@journalNameShort{ACM/IMS Trans. Data Sci.}%
  \def\@permissionCodeOne{2577-3224}%
\or % TEAC
  \def\@journalName{ACM Transactions on Economics and Computation}%
  \def\@journalNameShort{ACM Trans. Econ. Comput.}%
  \def\@permissionCodeOne{2167-8375}%
\or % TECS
  \def\@journalName{ACM Transactions on Embedded Computing Systems}%
  \def\@journalNameShort{ACM Trans. Embedd. Comput. Syst.}%
  \def\@permissionCodeOne{1539-9087}%
\or % TELO
  \def\@journalName{ACM Transactions on Evolutionary Learning}%
  \def\@journalNameShort{ACM Trans. Evol. Learn.}%
  \def\@permissionCodeOne{2688-3007}%
\or % THRI
  \def\@journalName{ACM Transactions on Human-Robot Interaction}%
  \def\@journalNameShort{ACM Trans. Hum.-Robot Interact.}%
```

```
  \def\@permissionCodeOne{2573-9522}%
\or % TIIS
  \def\@journalName{ACM Transactions on Interactive Intelligent Systems}%
  \def\@journalNameShort{ACM Trans. Interact. Intell. Syst.}%
  \def\@permissionCodeOne{2160-6455}%
\or % TIOT
  \def\@journalName{ACM Transactions on Internet of Things}%
  \def\@journalNameShort{ACM Trans. Internet Things}%
  \def\@permissionCodeOne{2577-6207}%
\or % TISSEC
  \def\@journalName{ACM Transactions on Information and System Security}%
  \def\@journalNameShort{ACM Trans. Info. Syst. Sec.}%
  \def\@permissionCodeOne{1094-9224}%
\or % TIST
  \def\@journalName{ACM Transactions on Intelligent Systems and Technology}%
  \def\@journalNameShort{ACM Trans. Intell. Syst. Technol.}%
  \def\@permissionCodeOne{2157-6904}%
\or % TKDD
  \def\@journalName{ACM Transactions on Knowledge Discovery from Data}%
  \def\@journalNameShort{ACM Trans. Knowl. Discov. Data.}%
  \def\@permissionCodeOne{1556-4681}%
\or % TMIS
  \def\@journalName{ACM Transactions on Management Information Systems}%
  \def\@journalNameShort{ACM Trans. Manag. Inform. Syst.}%
  \def\@permissionCodeOne{2158-656X}%
\or % TOCE
  \def\@journalName{ACM Transactions on Computing Education}%
  \def\@journalNameShort{ACM Trans. Comput. Educ.}%
  \def\@permissionCodeOne{1946-6226}%
\or % TOCHI
  \def\@journalName{ACM Transactions on Computer-Human Interaction}%
  \def\@journalNameShort{ACM Trans. Comput.-Hum. Interact.}%
  \def\@permissionCodeOne{1073-0516}%
\or % TOCL
  \def\@journalName{ACM Transactions on Computational Logic}%
  \def\@journalNameShort{ACM Trans. Comput. Logic}%
  \def\@permissionCodeOne{1529-3785}%
\or % TOCS
  \def\@journalName{ACM Transactions on Computer Systems}%
  \def\@journalNameShort{ACM Trans. Comput. Syst.}%
  \def\@permissionCodeOne{0734-2071}%
\or % TOCT
  \def\@journalName{ACM Transactions on Computation Theory}%
  \def\@journalNameShort{ACM Trans. Comput. Theory}%
  \def\@permissionCodeOne{1942-3454}%
\or % TODAES
 \def\@journalName{ACM Transactions on Design Automation of Electronic Systems}%
  \def\@journalNameShort{ACM Trans. Des. Autom. Electron. Syst.}%
  \def\@permissionCodeOne{1084-4309}%
\or % TODS
  \def\@journalName{ACM Transactions on Database Systems}%
  \def\@journalNameShort{ACM Trans. Datab. Syst.}%
  \def\@permissionCodeOne{0362-5915}%
\or % TOG
```

```
  \def\@journalName{ACM Transactions on Graphics}%
  \def\@journalNameShort{ACM Trans. Graph.}%
  \def\@permissionCodeOne{0730-0301}
\or % TOIS
  \def\@journalName{ACM Transactions on Information Systems}%
  \def\@journalNameShort{ACM Trans. Inf. Syst.}%
  \def\@permissionCodeOne{1046-8188}%
\or % TOIT
  \def\@journalName{ACM Transactions on Internet Technology}%
  \def\@journalNameShort{ACM Trans. Internet Technol.}%
  \def\@permissionCodeOne{1533-5399}%
\or % TOMACS
  \def\@journalName{ACM Transactions on Modeling and Computer Simulation}%
  \def\@journalNameShort{ACM Trans. Model. Comput. Simul.}%
  \def\@permissionCodeOne{1049-3301}%
  \def\@permissionCodeTwo{1558-1195}%
\or % TOMM
 \def\@journalName{ACM Transactions on Multimedia Computing, Communications and Applications}%
  \def\@journalNameShort{ACM Trans. Multimedia Comput. Commun. Appl.}%
  \def\@permissionCodeOne{1551-6857}%
  \def\@permissionCodeTwo{1551-6865}%
\or % TOMPECS
 \def\@journalName{ACM Transactions on Modeling and Performance Evaluation of Computing Systems}%
  \def\@journalNameShort{ACM Trans. Model. Perform. Eval. Comput. Syst.}%
  \def\@permissionCodeOne{2376-3639}%
\or % TOMS
  \def\@journalName{ACM Transactions on Mathematical Software}%
  \def\@journalNameShort{ACM Trans. Math. Softw.}%
  \def\@permissionCodeOne{0098-3500}%
\or % TOPC
  \def\@journalName{ACM Transactions on Parallel Computing}%
  \def\@journalNameShort{ACM Trans. Parallel Comput.}%
  \def\@permissionCodeOne{2329-4949}%
  \def\@permissionCodeTwo{2329-4957}%
\or % TOPS
  \def\@journalName{ACM Transactions on Privacy and Security}%
  \def\@journalNameShort{ACM Trans. Priv. Sec.}%
  \def\@permissionCodeOne{2471-2566}%
\or % TOPLAS
  \def\@journalName{ACM Transactions on Programming Languages and Systems}%
  \def\@journalNameShort{ACM Trans. Program. Lang. Syst.}%
  \def\@permissionCodeOne{0164-0925}%
\or % TORS
  \def\@journalName{ACM Transactions on Recommender Systems}%
  \def\@journalNameShort{ACM Trans. Recomm. Syst.}%
  \def\@permissionCodeOne{2770-6699}%
\or % TOS
  \def\@journalName{ACM Transactions on Storage}%
  \def\@journalNameShort{ACM Trans. Storage}%
  \def\@permissionCodeOne{1553-3077}%
\or % TOSEM
 \def\@journalName{ACM Transactions on Software Engineering and Methodology}%
  \def\@journalNameShort{ACM Trans. Softw. Eng. Methodol.}%
  \def\@permissionCodeOne{1049-331X}%
```

```
\or % TOSN
  \def\@journalName{ACM Transactions on Sensor Networks}%
  \def\@journalNameShort{ACM Trans. Sensor Netw.}%
  \def\@permissionCodeOne{1550-4859}%
\or % TQC
  \def\@journalName{ACM Transactions on Quantum Computing}%
  \def\@journalNameShort{ACM Trans. Quantum Comput.}%
  \def\@permissionCodeOne{2643-6817}%
\or % TRETS
 \def\@journalName{ACM Transactions on Reconfigurable Technology and Systems}%
  \def\@journalNameShort{ACM Trans. Reconfig. Technol. Syst.}%
  \def\@permissionCodeOne{1936-7406}%
\or % TSAS
  \def\@journalName{ACM Transactions on Spatial Algorithms and Systems}%
  \def\@journalNameShort{ACM Trans. Spatial Algorithms Syst.}%
  \def\@permissionCodeOne{2374-0353}%
\or % TSC
  \def\@journalName{ACM Transactions on Social Computing}%
  \def\@journalNameShort{ACM Trans. Soc. Comput.}%
  \def\@permissionCodeOne{2469-7818}%
\or % TSLP
  \def\@journalName{ACM Transactions on Speech and Language Processing}%
  \def\@journalNameShort{ACM Trans. Speech Lang. Process.}%
  \def\@permissionCodeOne{1550-4875}%
\or % TWEB
  \def\@journalName{ACM Transactions on the Web}%
  \def\@journalNameShort{ACM Trans. Web}%
  \def\@permissionCodeOne{1559-1131}%
\else % FACMP, a dummy journal
  \def\@journalName{ACM Just Accepted}%
  \def\@journalNameShort{ACM Accepted}%
  \def\@permissionCodeOne{XXXX-XXXX}%
\fi
\ClassInfo{\@classname}{Using journal code \@journalCode}%
}{%
  \ClassError{\@classname}{Incorrect journal #1}%
}%
```

`\acmJournal` And the syntactic sugar around it

```
\def\acmJournal#1{\setkeys{ACM}{acmJournal=#1}%
  \global\@ACM@journal@bibstriptrue}
```

The defaults:

```
\def\@journalCode@nr{0}
\def\@journalName{}%
\def\@journalNameShort{\@journalName}%
\def\@permissionCodeOne{XXXX-XXXX}%
\def\@permissionCodeTwo{}%
```

`\acmConference` This is the conference command

```
\newcommand\acmConference[4][]{%
  \gdef\acmConference@shortname{#1}%
  \gdef\acmConference@name{#2}%
  \gdef\acmConference@date{#3}%
```

```
  \gdef\acmConference@venue{#4}%
  \ifx\acmConference@shortname\@empty
    \gdef\acmConference@shortname{#2}%
  \fi
  \global\@ACM@journal@bibstripfalse
}
\if@ACM@journal\else
\acmConference[Conference'17]{ACM Conference}{July 2017}{Washington,
  DC, USA}%
\fi
```

`\acmBooktitle` `\@acmBooktitle` The book title of the conference:

```
\def\acmBooktitle#1{\gdef\@acmBooktitle{#1}}
\acmBooktitle{}
\ifx\acmConference@name\@undefined\else
\acmBooktitle{Proceedings of \acmConference@name
       \ifx\acmConference@name\acmConference@shortname\else
       \ (\acmConference@shortname)\fi}
\fi
```

`\@editorsAbbrev` How to abbreviate editors

```
\def\@editorsAbbrev{(Ed.)}
```

`\@acmEditors` The list of editors

```
\def\@acmEditors{}
```

`\editor` Add a new editor to the list

```
\def\editor#1{\ifx\@acmEditors\@empty
    \gdef\@acmEditors{#1}%
  \else
    \gdef\@editorsAbbrev{(Eds.)}%
    \g@addto@macro\@acmEditors{\and#1}%
\fi}
```

`\subtitle` The subtitle macro

```
\def\subtitle#1{\def\@subtitle{#1}}
\subtitle{}
```

`\num@authorgroups` The total number of "groups". Each group is several authors with the same affiliations(s)

```
\newcount\num@authorgroups
\num@authorgroups=0\relax
```

`\num@authors` The total number of authors

```
\newcount\num@authors
\num@authors=0\relax
```

`\if@insideauthorgroup` Whether we are continuing an author group

```
\newif\if@insideauthorgroup
\@insideauthorgroupfalse
```

`\author` Adding an author to the list of authors and addresses.

Note that we want to typeset the link to the author's orcid if known. The problem is, we know the orcid only after the author is entered. The trick is based on the idea

that \csname...\endcsname is \relax unless defined. Therefore we typeset authors by the special macro \csname typeset@author\the\num@authors\endcsname, which is defined by \orcid command.

```
\renewcommand\author[2][]{%
 \IfSubStr{\detokenize{#2}}{,}{\ClassWarning{\@classname}{Do not put several
     authors in the same \string\author\space macro!}}{}%
 \global\advance\num@authors by 1\relax
 \if@insideauthorgroup\else
   \global\advance\num@authorgroups by 1\relax
   \global\@insideauthorgrouptrue
 \fi
 \ifx\addresses\@empty
   \if@ACM@anonymous
     \gdef\addresses{\@author{Anonymous Author(s)%
       \ifx\@acmSubmissionID\@empty\else\\Submission Id:
         \@acmSubmissionID\fi}}%
     \gdef\authors{Anonymous Author(s)}%
   \else
     \expandafter\gdef\expandafter\addresses\expandafter{%
       \expandafter\@author\expandafter{%
         \csname typeset@author\the\num@authors\endcsname{#2}}}%
     \gdef\authors{#2}%
   \fi
 \else
   \if@ACM@anonymous\else
   \expandafter\g@addto@macro\expandafter\addresses\expandafter{%
     \expandafter\and\expandafter\@author\expandafter{%
       \csname typeset@author\the\num@authors\endcsname{#2}}}%
     \g@addto@macro\authors{\and#2}%
   \fi
 \fi
 \if@ACM@anonymous
   \ifx\shortauthors\@empty
     \gdef\shortauthors{Anon.
       \ifx\@acmSubmissionID\@empty\else Submission Id:
       \@acmSubmissionID\fi}%
   \fi
 \else
   \def\@tempa{#1}%
   \ifx\@tempa\@empty
     \ifx\shortauthors\@empty
       \gdef\shortauthors{#2}%
     \else
       \g@addto@macro\shortauthors{\and#2}%
     \fi
   \else
     \ifx\shortauthors\@empty
       \gdef\shortauthors{#1}%
     \else
       \g@addto@macro\shortauthors{\and#1}%
     \fi
   \fi
 \fi}
```

\affiliation The macro \affiliation mimics \address from amsart. Note that it has an optional argument, which we use differently from amsart.

```
\newcommand{\affiliation}[2][]{%
  \global\@insideauthorgroupfalse
  \if@ACM@anonymous\else
    \g@addto@macro\addresses{\affiliation{#1}{#2}}%
  \fi}
```

\@ACM@affiliation@obeypunctuation Whether to use the author's punctuation (false by default, which adds American-style address punctuation)

```
\define@boolkey+{@ACM@affiliation@}[@ACM@affiliation@]{obeypunctuation}%
[true]{}{\ClassError{\@classname}{The option obeypunctuation can be either true or false}}
```

\additionalaffiliation Additional affiliations go to footnotes

```
\def\additionalaffiliation#1{\authornote{\@additionalaffiliation{#1}}}
```

\@additionalaffiliation Process \additionalaffiliation inside \authornote

```
\def\@additionalaffiliation#1{\bgroup
  \def\position##1{\ignorespaces}%
  \def\institution##1{##1\ignorespaces}%
  \def\department{\@ifnextchar[{\@department}{\@department[]}}%
  \def\@department[##1]##2{\unskip, ##2\ignorespaces}%
  \let\streetaddress\position
  \let\city\position
  \let\state\position
  \let\postcode\position
  \let\country\position
  Also with #1\unskip.\egroup}
```

\email The macro \email mimics \email from amsart. Again, it has an optional argument that we do not currently need but keep for possible future use.

```
\renewcommand{\email}[2][]{%
  \IfSubStr{#2}{,}{\ClassWarning{\@classname}{Do not put several
      addresses in the same \string\email\space macro!}}{}%
  \if@ACM@anonymous\else
    \g@addto@macro\addresses{\email{#1}{#2}}%
  \fi}
```

\orcid We redefine the command to typeset the current author

```
\def\orcid#1{\unskip\ignorespaces%
  \IfBeginWith{#1}{http}{%
    \expandafter\gdef\csname
        typeset@author\the\num@authors\endcsname##1{%
          \href{#1}{##1}}}{%
    \expandafter\gdef\csname
        typeset@author\the\num@authors\endcsname##1{%
          \href{https://orcid.org/#1}{##1}}}}
```

\authorsaddresses Setting up authors' addresses

```
\def\authorsaddresses#1{\def\@authorsaddresses{#1}}
\authorsaddresses{\@mkauthorsaddresses}
```

\@mktranslatedkeywords We have two argument: the language to typeset keywords and the keywords.

```
\newcommand\@mktranslatedkeywords[2]{\bgroup
  \selectlanguage{#1}%
  {\@specialsection{\keywordsname}%
    \noindent#2\par}\egroup}
```

\@titlenotes The title notes

```
\def\@titlenotes{}
```

\titlenote Adding a note to the title

```
\def\titlenote#1{%
  \g@addto@macro\@title{\footnotemark}%
  \if@ACM@anonymous
    \g@addto@macro\@titlenotes{%
      \stepcounter{footnote}\footnotetext{Title note}}%
  \else
    \g@addto@macro\@titlenotes{\stepcounter{footnote}\footnotetext{#1}}%
  \fi}
```

\@subtitlenotes The subtitle notes

```
\def\@subtitlenotes{}
```

\subtitlenote Adding a note to the subtitle

```
\def\subtitlenote#1{%
  \g@addto@macro\@subtitle{\footnotemark}%
  \if@ACM@anonymous
    \g@addto@macro\@subtitlenotes{%
      \stepcounter{footnote}\footnotetext{Subtitle note}}%
  \else
    \g@addto@macro\@subtitlenotes{%
      \stepcounter{footnote}\footnotetext{#1}}%
  \fi}
```

\@authornotes The author notes

```
\def\@authornotes{}
```

\authornote Adding a note to the author

```
\def\authornote#1{%
  \if@ACM@anonymous\else
    \g@addto@macro\addresses{\@authornotemark}%
    \g@addto@macro\@authornotes{%
      \stepcounter{footnote}\footnotetext{#1}}%
  \fi}
```

\authornotemark Adding a footnote mark to the authors

```
\newcommand\authornotemark[1][\relax]{%
  \ifx#1\relax\relax\relax
  \g@addto@macro\addresses{\@authornotemark}%
  \else
  \g@addto@macro\addresses{\@@authornotemark{#1}}%
  \fi}
```

`\acmVolume` The current volume

```
\def\acmVolume#1{\def\@acmVolume{#1}}
\acmVolume{1}
```

`\acmNumber` The current number

```
\def\acmNumber#1{\def\@acmNumber{#1}}
\acmNumber{1}
```

`\acmArticle` The current article

```
\def\acmArticle#1{\def\@acmArticle{#1}}
\acmArticle{}
```

`\acmArticleSeq` The sequence number

```
\def\acmArticleSeq#1{\def\@acmArticleSeq{#1}}
\acmArticleSeq{\@acmArticle}
```

`\acmYear` The current year

```
\def\acmYear#1{\def\@acmYear{#1}}
\acmYear{\the\year}
```

`\acmMonth` The current month

```
\def\acmMonth#1{\def\@acmMonth{#1}}
\acmMonth{\the\month}
```

`\@acmPubDate` The publication date

```
\def\@acmPubDate{\ifcase\@acmMonth\or
  January\or February\or March\or April\or May\or June\or
  July\or August\or September\or October\or November\or
  December\fi~\@acmYear}
```

`\acmPrice` The price

```
\def\acmPrice#1{\def\@acmPrice{#1}}
\acmPrice{15.00}
```

`\acmSubmissionID` The submission ID

```
\def\acmSubmissionID#1{\def\@acmSubmissionID{#1}}
\acmSubmissionID{}
```

`\acmISBN` The book ISBN

```
\def\acmISBN#1{\def\@acmISBN{#1}}
\acmISBN{978-x-xxxx-xxxx-x/YY/MM}
```

`\acmDOI` The paper DOI

```
\def\acmDOI#1{\def\@acmDOI{#1}}
\acmDOI{10.1145/nnnnnnn.nnnnnnn}
```

`\if@ACM@badge` Whether to print a badge. Note that either a left or right badge triggers it:

```
\newif\if@ACM@badge
\@ACM@badgefalse
```

`\@ACM@badge@width` The width of the badge

```
\newlength\@ACM@badge@width
\setlength\@ACM@badge@width{5pc}
```

\@ACM@title@width The width of the badge

```
\newlength\@ACM@title@width
```

\@ACM@badge@skip The space between the badge and the title

```
\newlength\@ACM@badge@skip
\setlength\@ACM@badge@skip{1pc}
```

\acmBadgeR Setting the right badge

```
\newcommand\acmBadgeR[2][]{\@ACM@badgetrue
  \def\@acmBadgeR@url{#1}%
  \def\@acmBadgeR@image{#2}}
\def\@acmBadgeR@url{}
\def\@acmBadgeR@image{}
```

\acmBadgeL Setting the left badge

```
\newcommand\acmBadgeL[2][]{\@ACM@badgetrue
  \def\@acmBadgeL@url{#1}%
  \def\@acmBadgeL@image{#2}}
\def\@acmBadgeL@url{}
\def\@acmBadgeL@image{}
```

\startPage The start page of the paper

```
\def\startPage#1{\def\@startPage{#1}}
\startPage{}
```

\terms Terms are obsolete. We use CCS now.

```
\def\terms#1{\ClassWarning{\@classname}{The command \string\terms{} is
    obsolete.  I am going to ignore it}}
```

\keywords Keywords are mostly obsolete. We use CCS now. Still it makes sense to keep them for compatibility.

```
\def\keywords#1{\def\@keywords{#1}}
\let\@keywords\@empty
```

```
\AtEndDocument{\if@ACM@nonacm\else\ifx\@keywords\@empty
  \ifnum\getrefnumber{TotPages}>2\relax
  \ClassWarningNoLine{\@classname}{ACM keywords are mandatory
    for papers over two pages}%
  \fi\fi\fi}
```

abstract The amsart package puts abstract in a box. Since we do not know whether we will use two-column mode, we prefer to save the text

```
\renewenvironment{abstract}{\Collect@Body\@saveabstract}{}
```

\@saveabstract And saving the abstract

```
\long\def\@saveabstract#1{\if@ACM@maketitle@typeset
  \ClassError{\@classname}{Abstract must be defined before maketitle
    command. Please move it!}\fi
  \long\gdef\@abstract{#1}}
\@saveabstract{}
```

\@lempty The long version of \@empty (to compare with \@abstract)

```
\long\def\@lempty{}
```

\if@ACM@printccs Whether to print CCS

```
\define@boolkey+{@ACM@topmatter@}[@ACM@]{printccs}[true]{%
  \if@ACM@printccs
    \ClassInfo{\@classname}{Printing CCS}%
  \else
    \ClassInfo{\@classname}{Suppressing CCS}%
 \fi}{\ClassError{\@classname}{The option printccs can be either true or false}}
```

\if@ACM@printacmref Whether to print the ACM bibstrip

```
\define@boolkey+{@ACM@topmatter@}[@ACM@]{printacmref}[true]{%
  \if@ACM@printacmref
    \ClassInfo{\@classname}{Printing bibformat}%
  \else
    \ClassInfo{\@classname}{Suppressing bibformat}%
 \fi}{\ClassError{\@classname}{The option printacmref can be either true or false}}

\AtEndDocument{\if@ACM@nonacm\else\if@ACM@printacmref\else
  \ifnum\getrefnumber{TotPages}>1\relax
  \ClassWarningNoLine{\@classname}{%
    ACM reference format is mandatory \MessageBreak
    for papers over one page. \MessageBreak
    Please add printacmref=true to the \MessageBreak
    \string\settopmatter\space command.}%
  \fi\fi\fi}
```

\if@ACM@printfolios Whether to print folios

```
\define@boolkey+{@ACM@topmatter@}[@ACM@]{printfolios}[true]{%
  \if@ACM@printfolios
    \ClassInfo{\@classname}{Printing folios}%
  \else
    \ClassInfo{\@classname}{Suppressing folios}%
 \fi}{\ClassError{\@classname}{The option printfolios can be either true or false}}
```

\@ACM@authorsperrow The number of authors per row. 0 means use the default algorithm.

```
\define@cmdkey{@ACM@topmatter@}[@ACM@]{authorsperrow}[0]{%
  \IfInteger{#1}{\ClassInfo{\@classname}{Setting authorsperrow to
      #1}}{\ClassWarning{\@classname}{The parameter authorsperrow must be
      numerical. Ignoring the input #1}\gdef\@ACM@authorsperrow{0}}}
```

\settopmatter The usual syntactic sugar

```
\def\settopmatter#1{\setkeys{@ACM@topmatter@}{#1}}
```

Now the settings

```
\settopmatter{printccs=true, printacmref=true}
\if@ACM@manuscript
  \settopmatter{printfolios=true}
\else
  \if@ACM@journal
    \settopmatter{printfolios=true}
  \else
    \settopmatter{printfolios=false}
  \fi
\fi
\settopmatter{authorsperrow=0}
```

`\@received` The container for the paper history

```
\def\@received{}
```

`\received` The `\received` command

```
\newcommand\received[2][]{\def\@tempa{#1}%
  \ifx\@tempa\@empty
    \ifx\@received\@empty
      \gdef\@received{Received #2}%
    \else
      \g@addto@macro{\@received}{; revised #2}%
    \fi
  \else
    \ifx\@received\@empty
      \gdef\@received{#1 #2}%
    \else
      \g@addto@macro{\@received}{; #1 #2}%
    \fi
  \fi}
\AtEndDocument{%
  \ifx\@received\@empty\else
    \par\bigskip\noindent\small\normalfont\@received\par
  \fi}
```

`\acmArticleType` Article type. We set up the color.

```
\define@choicekey+{ACM}{articletype}[\ACM@ArticleType\ACM@ArticleType@nr]{%
  Research,Review,Discussion,Invited,Position}[Review]{%
  \ifcase\ACM@ArticleType@nr
  \relax % Research
     \colorlet{@ACM@Article@color}{ACMBlue}%
  \or % Review
     \colorlet{@ACM@Article@color}{ACMOrange}%
  \or % Discussion
     \colorlet{@ACM@Article@color}{ACMGreen}%
  \or % Invited
     \colorlet{@ACM@Article@color}{ACMPurple}%
  \or % Position
     \colorlet{@ACM@Article@color}{ACMRed}%
  \fi
}{%
 \ClassError{\@classname}{Article Type must be Research, Review,\MessageBreak
   Discussion, Invited, or Position}}
\def\acmArticleType#1{\setkeys{ACM}{articletype=#1}}
\newenvironment{@ACM@color@frame}{%
  \def\FrameCommand{\hspace*{-6.5pc}%
    \colorbox{@ACM@Article@color!10!white}}%
  \MakeFramed {\advance\hsize -6.5pc\relax\FrameRestore}}{\endMakeFramed}
\if@ACM@acmcp
\acmArticleType{Research}%
\fi
```

`\acmCodeLink` The code link

```
\def\acmCodeLink#1{%
  \ifx\@acmCodeDataLink\@empty
     \gdef\@acmCodeDataLink{\url{#1}}%
```

```
  \else
     \g@addto@macro{\@acmCodeDataLink}{\\ \url{#1}}%
  \fi}
\def\@acmCodeDataLink{}
```

`\acmDataLink` The code link

```
\let\acmDataLink\acmCodeLink
```

3.17 Concepts system

We exclude CCSXML stuff generated by the ACM system:

```
\RequirePackage{comment}
\excludecomment{CCSXML}
```

`\@concepts` This is the storage macro and counter for concepts

```
\let\@concepts\@empty
\newcounter{@concepts}
```

`\ccsdesc` The first argument is the significance, the second is the concept(s)

```
\newcommand\ccsdesc[2][100]{%
  \ccsdesc@parse#1~#2~~\ccsdesc@parse@end}
```

`\ccsdesc@parse` The parser of the expression `Significance~General~Specific` (we need `textcomp` for `\textrightarrow`). Note that `Specific` can be empty!

```
\def\textrightarrow{$\rightarrow$}
\def\ccsdesc@parse#1~#2~#3~{%
  \stepcounter{@concepts}%
  \expandafter\ifx\csname CCS@General@#2\endcsname\relax
    \expandafter\gdef\csname CCS@General@#2\endcsname{\textbullet\
      \textbf{#2}}%
    \expandafter\gdef\csname CCS@Punctuation@#2\endcsname{; }%
    \expandafter\gdef\csname CCS@Specific@#2\endcsname{}%
  \g@addto@macro{\@concepts}{\csname CCS@General@#2\endcsname
    \csname CCS@Punctuation@#2\endcsname
    \csname CCS@Specific@#2\endcsname}%
  \fi
  \ifx#3\relax\relax\else
    \expandafter\gdef\csname CCS@Punctuation@#2\endcsname{
      \textrightarrow\ }%
   \expandafter\g@addto@macro\expandafter{\csname CCS@Specific@#2\endcsname}{%
     \addtocounter{@concepts}{-1}%
     \ifnum#1>499\textbf{#3}\else
     \ifnum#1>299\textit{#3}\else
     #3\fi\fi\ifnum\value{@concepts}=0.\else; \fi}%
  \fi
\ccsdesc@parse@finish}
```

```
\AtEndDocument{\if@ACM@nonacm\else\ifx\@concepts\@empty\relax
  \ifnum\getrefnumber{TotPages}>2\relax
  \ClassWarningNoLine{\@classname}{CCS concepts are mandatory
    for papers over two pages}%
  \fi\fi\fi}
```

`\ccdesc@parse@finish` Gobble everything to `\ccsdesc@parse@end`

```
\def\ccsdesc@parse@finish#1\ccsdesc@parse@end{}
```

3.18 Copyright system

This is from acmcopyright.sty

\if@printcopyright Whether to print a copyright symbol

```
\newif\if@printcopyright
\@printcopyrighttrue
```

\if@printpermission Whether to print the permission block

```
\newif\if@printpermission
\@printpermissiontrue
```

\if@acmowned Whether the ACM owns the rights to the paper

```
\newif\if@acmowned
\@acmownedtrue
```

Keys:

```
\define@choicekey*{ACM@}{acmcopyrightmode}[%
  \acm@copyrightinput\acm@copyrightmode]{none,%
    acmcopyright,acmlicensed,rightsretained,%
    usgov,usgovmixed,cagov,cagovmixed,licensedusgovmixed,%
    licensedcagov,licensedcagovmixed,othergov,licensedothergov,%
    iw3c2w3,iw3c2w3g,cc}{%
  \@printpermissiontrue
  \@printcopyrighttrue
  \@acmownedtrue
  \ifnum\acm@copyrightmode=0\relax % none
   \@printpermissionfalse
   \@printcopyrightfalse
   \@acmownedfalse
  \fi
  \ifnum\acm@copyrightmode=2\relax % acmlicensed
   \@acmownedfalse
  \fi
  \ifnum\acm@copyrightmode=3\relax % rightsretained
   \@acmownedfalse
   \AtBeginDocument{\acmPrice{}}%
  \fi
  \ifnum\acm@copyrightmode=4\relax % usgov
   \@printpermissiontrue
   \@printcopyrightfalse
   \@acmownedfalse
   \AtBeginDocument{\acmPrice{}}%
  \fi
  \ifnum\acm@copyrightmode=6\relax % cagov
   \@acmownedfalse
  \fi
  \ifnum\acm@copyrightmode=8\relax % licensedusgovmixed
   \@acmownedfalse
  \fi
  \ifnum\acm@copyrightmode=9\relax % licensedcagov
   \@acmownedfalse
  \fi
  \ifnum\acm@copyrightmode=10\relax % licensedcagovmixed
```

```
  \@acmownedfalse
 \fi
 \ifnum\acm@copyrightmode=11\relax % othergov
  \@acmownedtrue
 \fi
 \ifnum\acm@copyrightmode=12\relax % licensedothergov
  \@acmownedfalse
 \fi
 \ifnum\acm@copyrightmode=13\relax % iw3c2w3
  \@acmownedfalse
  \AtBeginDocument{\acmPrice{}}%
 \fi
 \ifnum\acm@copyrightmode=14\relax % iw3c2w3g
  \@acmownedfalse
  \AtBeginDocument{\acmPrice{}}%
 \fi
 \ifnum\acm@copyrightmode=15\relax % cc
  \@acmownedfalse
  \AtBeginDocument{\acmPrice{}}%
 \fi}
```

`\setcopyright` This is the syntactic sugar around setting keys.

```
\def\setcopyright#1{\setkeys{ACM@}{acmcopyrightmode=#1}}
\setcopyright{acmcopyright}
```

`\setcctype` The type of Creative Commons license used

```
\newcommand\setcctype[2][4.0]{%
 \def\ACM@cc@version{#1}%
 \def\ACM@cc@type{#2}}
\setcctype{by}
```

`\@copyrightowner` Here is the owner of the copyright

```
\def\@copyrightowner{%
 \ifcase\acm@copyrightmode\relax % none
 \or % acmcopyright
 Association for Computing Machinery.
 \or % acmlicensed
 Copyright held by the owner/author(s). Publication rights licensed to
 ACM\@.
 \or % rightsretained
 Copyright held by the owner/author(s).
 \or % usgov
 \or % usgovmixed
 Association for Computing Machinery.
 \or % cagov
 Crown in Right of Canada.
 \or %cagovmixed
 Association for Computing Machinery.
 \or %licensedusgovmixed
 Copyright held by the owner/author(s). Publication rights licensed to
 ACM\@.
 \or % licensedcagov
 Crown in Right of Canada. Publication rights licensed to
 ACM\@.
```

```
\or %licensedcagovmixed
Copyright held by the owner/author(s). Publication rights licensed to
ACM\@.
\or % othergov
Association for Computing Machinery.
\or % licensedothergov
Copyright held by the owner/author(s). Publication rights licensed to
ACM\@.
\or % ic2w3www
IW3C2 (International World Wide Web Conference Committee), published
under Creative Commons CC-BY~4.0 License.
\or % ic2w3wwwgoogle
IW3C2 (International World Wide Web Conference Committee), published
under Creative Commons CC-BY-NC-ND~4.0 License.
\or % cc
Copyright held by the owner/author(s).
\fi}
```

`\@formatdoi` Print a clickable DOI

```
\def\@formatdoi#1{\url{https://doi.org/#1}}
```

`\@ACM@copyright@check@cc` At present cC licenses can be used only for acmengage format or for non-acm stuff. This macro checks whether the CC license is applicable and generates an error if not.

```
\def\@ACM@copyright@check@cc{%
  \if@ACM@nonacm
     \ClassInfo{\@classname}{Using CC license with a non-acm
       material}%
  \else
     \if@ACM@engage
        \ClassInfo{\@classname}{Using CC license with ACM Enage
          material}%
      \else
      \ClassError{\@classname}{%
        Sorry, Creative Commons licenses are\MessageBreak
        currently not used with ACM publications\MessageBreak
        typeset by the authors}{Please use nonacm
           option or ACM Engage class to enable CC licenses}%
      \fi
  \fi}
```

`\@copyrightpermission` The canned permission block.

```
\def\@copyrightpermission{%
  \ifcase\acm@copyrightmode\relax % none
  \or % acmcopyright
   Permission to make digital or hard copies of all or part of this
   work for personal or classroom use is granted without fee provided
   that copies are not made or distributed for profit or commercial
   advantage and that copies bear this notice and the full citation on
   the first page. Copyrights for components of this work owned by
   others than ACM must be honored. Abstracting with credit is
   permitted. To copy otherwise, or republish, to post on servers or to
   redistribute to lists, requires prior specific permission
   and\hspace*{.5pt}/or  a fee. Request permissions from
   permissions@acm.org.
```

```
\or % acmlicensed
 Permission to make digital or hard copies of all or part of this
 work for personal or classroom use is granted without fee provided
 that copies are not made or distributed for profit or commercial
 advantage and that copies bear this notice and the full citation on
 the first page. Copyrights for components of this work owned by
 others than the author(s) must be honored. Abstracting with credit
 is permitted.  To copy otherwise, or republish, to post on servers
 or to  redistribute to lists, requires prior specific permission
 and\hspace*{.5pt}/or  a fee. Request permissions from
 permissions@acm.org.
\or % rightsretained
 Permission to make digital or hard copies of part or all of this work
 for personal or classroom use is granted without fee provided that
 copies are not made or distributed for profit or commercial advantage
 and that copies bear this notice and the full citation on the first
 page. Copyrights for third-party components of this work must be
 honored. For all other uses, contact the
 owner\hspace*{.5pt}/author(s).
\or % usgov
 This paper is authored by an employee(s) of the United States
 Government and is in the public domain. Non-exclusive copying or
 redistribution is allowed, provided that the article citation is
 given and the authors and agency are clearly identified as its
 source.
\or % usgovmixed
 ACM acknowledges that this contribution was authored or co-authored
 by an employee, contractor, or affiliate of the United States
 government. As such, the United States government retains a
 nonexclusive, royalty-free right to publish or reproduce this
 article, or to allow others to do so, for government purposes only.
\or % cagov
 This article was authored by employees of the Government of Canada.
 As such, the Canadian government retains all interest in the
 copyright to this work and grants to ACM a nonexclusive,
 royalty-free right to publish or reproduce this article, or to allow
 others to do so, provided that clear attribution is given both to
 the authors and the Canadian government agency employing them.
 Permission to make digital or hard copies for personal or classroom
 use is granted. Copies must bear this notice and the full citation
 on the first page.  Copyrights for components of this work owned by
 others than the Canadian Government must be honored. To copy
 otherwise, distribute, republish, or post, requires prior specific
 permission and\hspace*{.5pt}/or a fee. Request permissions from
 permissions@acm.org.
\or % cagovmixed
 ACM acknowledges that this contribution was co-authored by an
 affiliate of the national government of Canada. As such, the Crown
 in Right of Canada retains an equal interest in the copyright.
 Reprints must include clear attribution to ACM and the author's
 government agency affiliation.  Permission to make digital or hard
 copies for personal or classroom use is granted.  Copies must bear
 this notice and the full citation on the first page. Copyrights for
 components of this work owned by others than ACM must be honored.
```

```
  To copy otherwise, distribute, republish, or post, requires prior
  specific permission and\hspace*{.5pt}/or a fee. Request permissions
  from permissions@acm.org.
 \or % licensedusgovmixed
  Publication rights licensed to ACM\@. ACM acknowledges that this
  contribution was authored or co-authored by an employee, contractor
  or affiliate of the United States government. As such, the
  Government retains a nonexclusive, royalty-free right to publish or
  reproduce this article, or to allow others to do so, for Government
  purposes only.
 \or % licensedcagov
  This article was authored by employees of the Government of Canada.
  As such, the Canadian government retains all interest in the
  copyright to this work and grants to ACM a nonexclusive,
  royalty-free right to publish or reproduce this article, or to allow
  others to do so, provided that clear attribution is given both to
  the authors and the Canadian government agency employing them.
  Permission to make digital or hard copies for personal or classroom
  use is granted. Copies must bear this notice and the full citation
  on the first page.  Copyrights for components of this work owned by
  others than the Canadian Government must be honored. To copy
  otherwise, distribute, republish, or post, requires prior specific
  permission and\hspace*{.5pt}/or a fee. Request permissions from
  permissions@acm.org.
 \or % licensedcagovmixed
  Publication rights licensed to ACM\@. ACM acknowledges that this
  contribution was authored or co-authored by an employee, contractor
  or affiliate of the national government of Canada. As such, the
  Government retains a nonexclusive, royalty-free right to publish or
  reproduce this article, or to allow others to do so, for Government
  purposes only.
 \or % othergov
  ACM acknowledges that this contribution was authored or co-authored
  by an employee, contractor or affiliate of a national government. As
  such, the Government retains a nonexclusive, royalty-free right to
  publish or reproduce this article, or to allow others to do so, for
  Government purposes only.
 \or % licensedothergov
  Publication rights licensed to ACM\@. ACM acknowledges that this
  contribution was authored or co-authored by an employee, contractor
  or affiliate of a national government. As such, the Government
  retains a nonexclusive, royalty-free right to publish or reproduce
  this article, or to allow others to do so, for Government purposes
  only.
\or % iw3c2w3
  This paper is published under the Creative Commons Attribution~4.0
  International (CC-BY~4.0) license. Authors reserve their rights to
  disseminate the work on their personal and corporate Web sites with
  the appropriate attribution.
\or % iw3c2w3g
  This paper is published under the Creative Commons
  Attribution-NonCommercial-NoDerivs~4.0 International
  (CC-BY-NC-ND~4.0) license. Authors reserve their rights to
  disseminate the work on their personal and corporate Web sites with
```

```
  the appropriate attribution.
\or % CC
  \@ACM@copyright@check@cc
  \IfEq{\ACM@cc@type}{zero}{%
   \def\ACM@CC@Url{https://creativecommons.org/publicdomain/zero/1.0/legalcode}}{%
 \edef\ACM@CC@Url{https://creativecommons.org/licenses/\ACM@cc@type/\ACM@cc@version/legalcode}}%
  \href{\ACM@CC@Url}{\includegraphics[height=5ex]{doclicense-CC-\ACM@cc@type-88x31}}\\
  \href{\ACM@CC@Url}{%
  This work is licensed under a Creative Commons
  \IfEq{\ACM@cc@type}{zero}{CC0 1.0 Universal}{%
    \IfEq{\ACM@cc@type}{by}{Attribution}{}%
    \IfEq{\ACM@cc@type}{by-sa}{Attribution-ShareAlike}{}%
    \IfEq{\ACM@cc@type}{by-nd}{Attribution-NoDerivatives}{}%
    \IfEq{\ACM@cc@type}{by-nc}{Attribution-NonCommercial}{}%
    \IfEq{\ACM@cc@type}{by-nc-sa}{Attribution-NonCommercial-ShareAlike}{}%
   \IfEq{\ACM@cc@type}{by-nc-nd}{Attribution-NonCommercial-NoDerivatives}{}%
    ~\IfEq{\ACM@cc@version}{4.0}{4.0 International}{3.0 Unported}%
  }
  License.}%
\fi}
```

`\copyrightyear` By default, the copyright year is the same as `\acmYear`, but one can override this:

```
\def\copyrightyear#1{\def\@copyrightyear{#1}}
\copyrightyear{\@acmYear}
```

`\@teaserfigures` The teaser figures container

```
\def\@teaserfigures{}
```

`teaserfigure` The teaser figure

```
\newenvironment{teaserfigure}{\Collect@Body\@saveteaser}{}
```

`\@saveteaser` Saving the teaser

```
\long\def\@saveteaser#1{\g@addto@macro\@teaserfigures{\@teaser{#1}}}
```

`\thanks` We redefine amsart `\thanks` so the anonymous key works

```
\renewcommand{\thanks}[1]{%
  \@ifnotempty{#1}{%
    \if@ACM@anonymous
      \g@addto@macro\thankses{\thanks{A note}}%
   \else
    \g@addto@macro\thankses{\thanks{#1}}%
   \fi}}
```

`\anon` We provide `\anon` command, which blinds parts of the text if the package option anonymous is set

```
\newcommand{\anon}[2][ANONYMIZED]{%
  \if@ACM@anonymous%
    {\color{ACMOrange}#1}%
  \else%
    #2%
  \fi}
```

3.19 Maketitle hook

The current LaTeX provides a nice `lthooks` mechanism. However, since it is relatively new, we will use oldfashioned approach—at least for now.

`\@beginmaketitlehook` The hook

```
\ifx\@beginmaketitlehook\@undefined
  \let\@beginmaketitlehook\@empty
\fi
```

`\AtBeginMaketitle` Adding to the hook

```
\def\AtBeginMaketitle{\g@addto@macro\@beginmaketitlehook}
```

3.20 ACM Engage top matter

`\@acmengagemetadata` The special metadata for ACM engage course materials

```
\def\@acmengagemetadata{}
```

`\setengagemetadata` Adding topic to engage metadata

```
\def\setengagemetadata#1#2{%
  \g@addto@macro{\@acmengagemetadata}{%
    \@setengagemetadata{#1}{#2}}}
```

3.21 Typesetting top matter

`\mktitle@bx` Some of our formats use a two-column design. Some use a one-column design. In all cases we use a wide title. Thus we typeset the top matter in a special box to be used in the construction `\@twocolumn[`⟨*box*⟩`]`.

```
\newbox\mktitle@bx
```

`\maketitle` The (in)famous `\maketitle`. Note that in `sigchi-a` mode, authors are *not* in the title box.

Another note: there is a subtle difference between author notes, title notes and thanks. The latter two refer to the paper itself and therefore belong to the copyright/permission block. By the way, this was the default behavior of the old ACM classes.

```
\def\maketitle{\@beginmaketitlehook
  \@ACM@maketitle@typesettrue
  \if@ACM@anonymous
    % Anonymize omission of \author-s
    \ifnum\num@authorgroups=0\author{}\fi
  \fi
  \begingroup
  \let\@vspace\@vspace@orig
  \let\@vspacer\@vspacer@orig
  \let\@footnotemark\@footnotemark@nolink
  \let\@footnotetext\@footnotetext@nolink
  \renewcommand\thefootnote{\@fnsymbol\c@footnote}%
  \hsize=\textwidth
  \def\@makefnmark{\hbox{\@textsuperscript{\@thefnmark}}}%
  \@mktitle\if@ACM@sigchiamode\else\@mkauthors\fi\@mkteasers
  \@printtopmatter
  \if@ACM@sigchiamode\@mkauthors\fi
```

```
\setcounter{footnote}{0}%
\def\@makefnmark{\hbox{\@textsuperscript{\normalfont\@thefnmark}}}%
\@titlenotes
\@subtitlenotes
\@authornotes
\let\@makefnmark\relax
\let\@thefnmark\relax
\let\@makefntext\noindent
\ifx\@empty\thankses\else
  \footnotetextauthorsaddresses{%
    \def\par{\let\par\@par}\parindent\z@\@setthanks}%
\fi
\if@ACM@acmcp\else
  \ifx\@empty\@authorsaddresses\else
     \if@ACM@anonymous\else
       \if@ACM@journal@bibstrip
         \footnotetextauthorsaddresses{%
           \def\par{\let\par\@par}\parindent\z@\@setauthorsaddresses}%
       \fi
     \fi
  \fi
\fi
\if@ACM@nonacm
  \ifnum\acm@copyrightmode=15\relax % cc
     \footnotetextcopyrightpermission{\@copyrightpermission}%
  \fi
\else
  \if@ACM@acmcp\else
  \footnotetextcopyrightpermission{%
  \if@ACM@authordraft
      \raisebox{-2ex}[\z@][\z@]{\makebox[0pt][l]{\large\bfseries
          Unpublished working draft. Not for distribution.}}%
     \color[gray]{0.9}%
  \fi
  \parindent\z@\parskip0.1\baselineskip
  \if@ACM@authorversion\else
    \if@printpermission\@copyrightpermission\par\fi
  \fi
  \if@ACM@manuscript\else
     \if@ACM@journal@bibstrip\else % Print the conference information
       \if@ACM@engage
          {\itshape \@acmBooktitle, \@acmYear.}\par
       \else
    {\itshape \acmConference@shortname, \acmConference@date, \acmConference@venue}\par
       \fi
     \fi
  \fi
  \if@printcopyright
    \copyright\ \@copyrightyear\ \@copyrightowner\\
  \else
    \@copyrightyear.\
  \fi
  \if@ACM@manuscript
    Manuscript submitted to ACM\\
```

```
  \else
    \if@ACM@authorversion
        This is the author's version of the work. It is posted here for
        your personal use. Not for redistribution. The definitive Version
        of Record was published in
        \if@ACM@journal@bibstrip
          \emph{\@journalName}%
        \else
          \emph{\@acmBooktitle}%
        \fi
        \ifx\@acmDOI\@empty
        .
        \else
          , \@formatdoi{\@acmDOI}.
        \fi\\
      \else
        \if@ACM@nonacm\else
          \if@ACM@journal@bibstrip
            \@permissionCodeOne/\@acmYear/\@acmMonth-ART\@acmArticle
            \ifx\@acmPrice\@empty\else\ \$\@acmPrice\fi\\
            \@formatdoi{\@acmDOI}%
          \else % Conference
            \ifx\@acmISBN\@empty\else ACM~ISBN~\@acmISBN
            \ifx\@acmPrice\@empty.\else\dots\$\@acmPrice\fi\\\fi
            \ifx\@acmDOI\@empty\else\@formatdoi{\@acmDOI}\fi%
          \fi
        \fi
      \fi
    \fi}%
  \fi
  \fi
\endgroup
\if@ACM@engage\@typesetengagemetadata\fi
\setcounter{footnote}{0}%
\@mkabstract
\ifx\@translatedabstracts\@empty\else
\@translatedabstracts\fi
\if@ACM@printccs
\ifx\@concepts\@empty\else\bgroup
    {\@specialsection{CCS Concepts}%
       \noindent\@concepts\par}\egroup
   \fi
 \fi
 \if@ACM@acmcp\else
   \ifx\@keywords\@empty\else\bgroup
      {\@specialsection{\keywordsname}%
         \noindent\@keywords\par}\egroup
   \fi
  \ifx\@translatedkeywords\@empty\else
     \@translatedkeywords
  \fi
\fi
\let\metadata@authors=\authors
\nxandlist{, }{, }{, }\metadata@authors
```

```
  \def\@ACM@checkaffil{}%
  \hypersetup{%
    pdfauthor={\metadata@authors},
    pdftitle={\@title},
    pdfsubject={\@concepts},
    pdfkeywords={\@keywords},
    pdfcreator={LaTeX with acmart
      \csname ver@acmart.cls\endcsname\space
      and hyperref
      \csname ver@hyperref.sty\endcsname}}%
  \andify\authors
  \andify\shortauthors
  \global\let\authors=\authors
  \global\let\shortauthors=\shortauthors
  \if@ACM@printacmref
     \@mkbibcitation
  \fi
  \global\@topnum\z@ % this prevents floats from falling
                     % at the top of page 1
  \global\@botnum\z@ % we do not want them to be on the bottom either
  \@printendtopmatter
  \@afterindentfalse
  \@afterheading
  \if@ACM@acmcp
    \set@ACM@acmcpbox
    \AtEndDocument{\end@ACM@color@frame}%
    \@ACM@color@frame
  \fi
}
```

`\set@ACM@acmcpbox` Setting infobox for acmcp

```
\newbox\@ACM@acmcpbox
\def\set@ACM@acmcpbox{%
  \bgroup
  \hsize=5pc
  \global\setbox\@ACM@acmcpbox=\vtop to \textheight{%
    \setlength{\parindent}{\z@}%
    {\Large LOGO\par}%
    \scriptsize
    \vfill
    \ifx\@acmCodeDataLink\@empty\else
    Code and data links:\\ \@acmCodeDataLink\par\vfill
    \fi
    \ifx\@keywords\@empty\else Keywords:
    \@keywords\par\vfill
    \fi
    \ifx\@empty\@authorsaddresses\else\@setauthorsaddresses\vfill\fi
  }
\egroup}
```

`\@specialsection` This macro starts sections for proceedings and uses `\small` for journals

```
\def\@specialsection#1{%
  \let\@vspace\@vspace@orig
  \let\@vspacer\@vspacer@orig
```

```
  \ifcase\ACM@format@nr
  \relax % manuscript
    \par\medskip\small\noindent#1: %
  \or % acmsmall
    \par\medskip\small\noindent#1: %
  \or % acmlarge
    \par\medskip\small\noindent#1: %
  \or % acmtog
    \par\medskip\small\noindent#1: %
  \or % sigconf
    \section*{#1}%
  \or % siggraph
    \section*{#1}%
  \or % sigplan
     \noindentparagraph*{#1:~}%
  \or % sigchi
    \section*{#1}%
  \or % sigchi-a
    \section*{#1}%
  \or % acmengage
    \section*{#1}%
  \or % acmcp
    \section*{#1}%
    \fi
  \let\@vspace\@vspace@acm
  \let\@vspacer\@vspacer@acm
}
```

\@printtopmatter The printing of top matter starts a new page and uses the given title box. Note that for sigchi-a we print badges here rather than in \mktitle since we want them in the margins.

Note that if there are too many authors, \mktitle@bx might overflow the page. Therefore we start with checking this and if this happens, we split the box and print it page by page.

```
\def\@printtopmatter{%
  \ifx\@startPage\@empty
     \gdef\@startPage{1}%
  \else
     \setcounter{page}{\@startPage}%
  \fi
  \@tempdima=\ht\mktitle@bx
  \advance\@tempdima by \dp\mktitle@bx
  \ifdim\@tempdima>0.9\textheight
    \loop
      \setbox\@tempboxa=\vsplit \mktitle@bx to 0.9\textheight
      \thispagestyle{firstpagestyle}%
      \noindent\unvbox\@tempboxa
      \clearpage
      \@tempdima=\ht\mktitle@bx
      \advance\@tempdima by \dp\mktitle@bx
    \ifdim\@tempdima>0.9\textheight\repeat
  \fi
  \thispagestyle{firstpagestyle}%
  \noindent
```

```
  \ifcase\ACM@format@nr
  \relax % manuscript
    \box\mktitle@bx\par
  \or % acmsmall
    \box\mktitle@bx\par
  \or % acmlarge
    \box\mktitle@bx\par
  \or % acmtog
    \twocolumn[\box\mktitle@bx]%
  \or % sigconf
    \twocolumn[\box\mktitle@bx]%
  \or % siggraph
    \twocolumn[\box\mktitle@bx]%
  \or % sigplan
    \twocolumn[\box\mktitle@bx]%
  \or % sigchi
    \twocolumn[\box\mktitle@bx]%
  \or % sigchi-a
    \par\box\mktitle@bx\par\bigskip
    \if@ACM@badge
       \marginpar{\noindent
         \ifx\@acmBadgeL@image\@empty\else
           \href{\@acmBadgeL@url}{%
             \includegraphics[width=\@ACM@badge@width]{\@acmBadgeL@image}}%
            \hskip\@ACM@badge@skip
          \fi
         \ifx\@acmBadgeR@image\@empty\else
           \href{\@acmBadgeR@url}{%
             \includegraphics[width=\@ACM@badge@width]{\@acmBadgeR@image}}%
          \fi}%
    \fi
  \or % acmengage
    \twocolumn[\box\mktitle@bx]%
  \or % acmcp
     \box\mktitle@bx\par
  \fi
}
```

\@mktitle The title of the article

```
\def\@mktitle{%
  \ifcase\ACM@format@nr
  \relax % manuscript
    \@mktitle@i
  \or % acmsmall
    \@mktitle@i
  \or % acmlarge
    \@mktitle@i
  \or % acmtog
    \@mktitle@i
  \or % sigconf
    \@mktitle@iii
  \or % siggraph
    \@mktitle@iii
  \or % sigplan
```

```
    \@mktitle@iii
  \or % sigchi
    \@mktitle@iii
  \or % sigchi-a
    \@mktitle@iv
  \or % acmengage
    \@mktitle@iii
  \or % acmcp
    \@mktitle@i
  \fi
}
```

`\@titlefont` The font to typeset the title

```
\def\@titlefont{%
  \ifcase\ACM@format@nr
  \relax % manuscript
    \LARGE\sffamily\bfseries
  \or % acmsmall
    \LARGE\sffamily\bfseries
  \or % acmlarge
    \LARGE\sffamily\bfseries
  \or % acmtog
    \Huge\sffamily
  \or % sigconf
    \Huge\sffamily\bfseries
  \or % siggraph
    \Huge\sffamily\bfseries
  \or % sigplan
    \Huge\bfseries
  \or % sigchi
    \Huge\sffamily\bfseries
  \or % sigchi-a
     \Huge\bfseries
  \or % acmengage
    \Huge\sffamily\bfseries
  \or % acmcp
    \LARGE\sffamily\bfseries
  \fi}
```

`\@subtitlefont` The font to typeset the subtitle

```
\def\@subtitlefont{\normalsize
  \ifcase\ACM@format@nr
  \relax % manuscript
    \mdseries
  \or % acmsmall
    \mdseries
  \or % acmlarge
    \mdseries
  \or % acmtog
     \LARGE
  \or % sigconf
     \LARGE\mdseries
  \or % siggraph
     \LARGE\mdseries
```

```
  \or % sigplan
     \LARGE\mdseries
  \or % sigchi
     \LARGE\mdseries
  \or % sigchi-a
     \mdseries
  \or % acmengage
     \LARGE\mdseries
  \or % acmcp
    \mdseries
  \fi}
```

\@mktitle@i The version of \mktitle for most journals

```
\def\@mktitle@i{\hsize=\textwidth
  \if@ACM@acmcp
    \advance\hsize by -6pc%
  \fi
  \@ACM@title@width=\hsize
  \ifx\@acmBadgeL@image\@empty\else
    \advance\@ACM@title@width by -\@ACM@badge@width
    \advance\@ACM@title@width by -\@ACM@badge@skip
  \fi
  \ifx\@acmBadgeR@image\@empty\else
    \advance\@ACM@title@width by -\@ACM@badge@width
    \advance\@ACM@title@width by -\@ACM@badge@skip
  \fi
  \setbox\mktitle@bx=\vbox{\noindent\@titlefont
    \ifx\@acmBadgeL@image\@empty\else
      \raisebox{-.5\baselineskip}[\z@][\z@]{\href{\@acmBadgeL@url}{%
          \includegraphics[width=\@ACM@badge@width]{\@acmBadgeL@image}}}%
      \hskip\@ACM@badge@skip
    \fi
    \if@ACM@acmcp
    \vspace*{108.5\p@}\par\noindent
    \fi
    \parbox[t]{\@ACM@title@width}{\raggedright
      \@titlefont\noindent
      \@title\@translatedtitle%
  \ifx\@subtitle\@empty\else
    \par\noindent{\@subtitlefont\@subtitle\@translatedsubtitle}%
  \fi}%
  \ifx\@acmBadgeR@image\@empty\else
    \hskip\@ACM@badge@skip
    \raisebox{-.5\baselineskip}[\z@][\z@]{\href{\@acmBadgeR@url}{%
        \includegraphics[width=\@ACM@badge@width]{\@acmBadgeR@image}}}%
  \fi
  \par\bigskip}}%
```

\@mktitle@ii The version of \mktitle for TOG. Since v1.06, this is subsumed by the \mktitle@i macro

\@mktitle@iii The version of \@mktitle for SIG proceedings. Note that since the title is centered, we leave space for the left badge even if only the right badge is defined.

```
\def\@mktitle@iii{\hsize=\textwidth
```

```
    \setbox\mktitle@bx=\vbox{\@titlefont\centering
      \@ACM@title@width=\hsize
      \if@ACM@badge
        \advance\@ACM@title@width by -2\@ACM@badge@width
        \advance\@ACM@title@width by -2\@ACM@badge@skip
        \parbox[b]{\@ACM@badge@width}{\strut
          \ifx\@acmBadgeL@image\@empty\else
            \raisebox{-.5\baselineskip}[\z@][\z@]{\href{\@acmBadgeL@url}{%
             \includegraphics[width=\@ACM@badge@width]{\@acmBadgeL@image}}}%
          \fi}%
        \hskip\@ACM@badge@skip
      \fi
      \parbox[t]{\@ACM@title@width}{\centering\@titlefont
        \@title\@translatedtitle%
        \ifx\@subtitle\@empty\else
          \par\noindent{\@subtitlefont\@subtitle\@translatedsubtitle}
        \fi
      }%
      \if@ACM@badge
        \hskip\@ACM@badge@skip
        \parbox[b]{\@ACM@badge@width}{\strut
          \ifx\@acmBadgeR@image\@empty\else
            \raisebox{-.5\baselineskip}[\z@][\z@]{\href{\@acmBadgeR@url}{%
             \includegraphics[width=\@ACM@badge@width]{\@acmBadgeR@image}}}%
          \fi}%
      \fi
      \par\bigskip}}%
```

\@mktitle@iv The version of \@mktitle for sigchi-a

```
\def\@mktitle@iv{\hsize=\textwidth
    \setbox\mktitle@bx=\vbox{\raggedright\leftskip5pc\@titlefont
      \noindent\leavevmode\leaders\hrule height 2pt\hfill\kern0pt\par
      \noindent\@title\@translatedtitle%
     \ifx\@subtitle\@empty\else
       \par\noindent\@subtitlefont\@subtitle\@translatedsubtitle%
     \fi
     \par\bigskip}}%
```

\@ACM@addtoaddress This macro adds an item to the address using the following rules:

1. If we start a paragraph, add the item
2. Otherwise, add a comma and the item
3. However, the comma is deleted if it is at the end of a line. We use the magic \cleaders trick for this.

```
\newbox\@ACM@commabox
\def\@ACM@addtoaddress#1{%
  \ifvmode\else
    \if@ACM@affiliation@obeypunctuation\else
    \setbox\@ACM@commabox=\hbox{, }%
    \unskip\cleaders\copy\@ACM@commabox\hskip\wd\@ACM@commabox
  \fi\fi
  #1}
```

\institution
\position
\department
\streetaddress
\city
\state
\postcode
\country

Theoretically we can define the macros for \affiliation inside the \@mkauthors-style commands. However, this would lead to a strange error if an author uses them outside \affiliation. Of course we can make them produce an error message, but…

```
\def\streetaddress#1{\unskip\ignorespaces}
\def\postcode#1{\unskip\ignorespaces}
\if@ACM@journal
  \def\position#1{\unskip\ignorespaces}
  \def\institution#1{\global\@ACM@instpresenttrue
    \unskip~#1\ignorespaces}
  \def\city#1{\global\@ACM@citypresenttrue\unskip\ignorespaces}
  \def\state#1{\unskip\ignorespaces}
  \newcommand\department[2][0]{\unskip\ignorespaces}
  \def\country#1{\StrDel{#1}{ }[\@tempa]%
    \ifx\@tempa\@empty\else
    \global\@ACM@countrypresenttrue\fi
    \if@ACM@affiliation@obeypunctuation\else, \fi#1\ignorespaces}
\else
  \def\position#1{\if@ACM@affiliation@obeypunctuation#1\else#1\par\fi}%
  \def\institution#1{\global\@ACM@instpresenttrue
    \if@ACM@affiliation@obeypunctuation#1\else#1\par\fi}%
  \newcommand\department[2][0]{\if@ACM@affiliation@obeypunctuation
    #2\else#2\par\fi}%
% \def\streetaddress#1{\if@ACM@affiliation@obeypunctuation#1\else#1\par\fi}%
  \def\city#1{\global\@ACM@citypresenttrue\@ACM@addtoaddress{#1}}%
  \let\state\@ACM@addtoaddress
% \def\postcode#1{\if@ACM@affiliation@obeypunctuation#1\else\unskip\space#1\fi}%
  \def\country#1{\global\@ACM@countrypresenttrue\@ACM@addtoaddress{#1}}%
\fi
```

\@mkauthors

Typesetting the authors

```
\def\@mkauthors{\begingroup
  \hsize=\textwidth
  \ifcase\ACM@format@nr
  \relax % manuscript
    \@mkauthors@i
  \or % acmsmall
    \@mkauthors@i
  \or % acmlarge
    \@mkauthors@i
  \or % acmtog
    \@mkauthors@i
  \or % sigconf
    \@mkauthors@iii
  \or % siggraph
    \@mkauthors@iii
  \or % sigplan
    \@mkauthors@iii
  \or % sigchi
    \@mkauthors@iii
  \or % sigchi-a
    \@mkauthors@iv
  \or % acmengage
    \@mkauthors@iii
  \or % acmcp
```

```
    \@mkauthors@i
  \fi
  \endgroup
}
```

`\@authorfont` Somehow different conferences use different fonts for author names. Why?

```
\def\@authorfont{\Large\sffamily}
```

`\@affiliationfont` Font for affiliations

```
\def\@affiliationfont{\normalsize\normalfont}
```

Adjusting fonts for different formats

```
\ifcase\ACM@format@nr
\relax % manuscript
\or % acmsmall
  \def\@authorfont{\large\sffamily}
  \def\@affiliationfont{\small\normalfont}
\or % acmlarge
\or % acmtog
  \def\@authorfont{\LARGE\sffamily}
  \def\@affiliationfont{\large}
\or % sigconf
  \def\@authorfont{\LARGE}
  \def\@affiliationfont{\large}
\or % siggraph
  \def\@authorfont{\normalsize\normalfont}
  \def\@affiliationfont{\normalsize\normalfont}
\or % sigplan
  \def\@authorfont{\Large\normalfont}
  \def\@affiliationfont{\normalsize\normalfont}
\or % sigchi
  \def\@authorfont{\bfseries}
  \def\@affiliationfont{\mdseries}
\or % sigchi-a
  \def\@authorfont{\bfseries}
  \def\@affiliationfont{\mdseries}
\or % acmengage
  \def\@authorfont{\LARGE}
  \def\@affiliationfont{\large}
\or % acmcp
  \def\@authorfont{\large\sffamily}
  \def\@affiliationfont{\small\normalfont}
\fi
```

`\@typeset@author@line` At this point we have `\@currentauthors` and `\@currentaffiliations`. We typeset them in the journal style

```
\def\@typeset@author@line{%
  \andify\@currentauthors\par\noindent
  \@currentauthors\def\@currentauthors{}%
  \ifx\@currentaffiliations\@empty\else
    \andify\@currentaffiliations
      \unskip, {\@currentaffiliations}\par
  \fi
  \def\@currentaffiliations{}}
```

\if@ACM@instpresent Whether the given affiliation has institution

```
\newif\if@ACM@instpresent
\@ACM@instpresenttrue
```

\if@ACM@citypresent Whether the given affiliation has city

```
\newif\if@ACM@citypresent
\@ACM@citypresenttrue
```

\if@ACM@countrypresent Whether the given affiliation has country

```
\newif\if@ACM@countrypresent
\@ACM@countrypresenttrue
```

\@ACM@resetaffil Reset affiliation flags

```
\def\@ACM@resetaffil{%
  \global\@ACM@instpresentfalse
  \global\@ACM@citypresentfalse
  \global\@ACM@countrypresentfalse
}
```

\@ACM@checkaffil Check affiliation flags

```
\def\@ACM@checkaffil{%
  \if@ACM@instpresent\else
 \ClassWarningNoLine{\@classname}{No institution present for an affiliation}%
  \fi
  \if@ACM@citypresent\else
  \ClassWarningNoLine{\@classname}{No city present for an affiliation}%
  \fi
  \if@ACM@countrypresent\else
  \ClassError{\@classname}{No country present for an affiliation}{ACM
    requires each author to indicate their country using country macro.}%
  \fi
}
```

\@mkauthors@i This version is used in most journal formats. Note that \and between authors with the same affiliation becomes ␣and␣:

```
\def\@mkauthors@i{%
  \def\@currentauthors{}%
  \def\@currentaffiliations{}%
  \global\let\and\@typeset@author@line
  \def\@author##1{%
    \ifx\@currentauthors\@empty
      \gdef\@currentauthors{\@authorfont\MakeTextUppercase{##1}}%
    \else
       \g@addto@macro{\@currentauthors}{\and\MakeTextUppercase{##1}}%
    \fi
    \gdef\and{}}%
  \def\email##1##2{}%
  \def\affiliation##1##2{%
    \def\@tempa{##2}\ifx\@tempa\@empty\else
       \ifx\@currentaffiliations\@empty
          \gdef\@currentaffiliations{%
            \setkeys{@ACM@affiliation@}{obeypunctuation=false}%
            \setkeys{@ACM@affiliation@}{##1}%
```

```
            \@ACM@resetaffil
            \@affiliationfont##2\@ACM@checkaffil}%
       \else
         \g@addto@macro{\@currentaffiliations}{\and
           \setkeys{@ACM@affiliation@}{obeypunctuation=false}%
           \setkeys{@ACM@affiliation@}{##1}\@ACM@resetaffil
           ##2\@ACM@checkaffil}%
       \fi
    \fi
     \global\let\and\@typeset@author@line}%
  \if@ACM@acmcp
    \advance\hsize by -6pc%
  \fi
  \global\setbox\mktitle@bx=\vbox{\noindent\unvbox\mktitle@bx\par\medskip
    \noindent\addresses\@typeset@author@line
   \par\medskip}%
}
```

`\@mkauthors@ii` The `\@mkauthors@ii` command was the version used in `acmtog`. It is no longer necessary.

`\author@bx` The box to put an individual author in

```
\newbox\author@bx
```

`\author@bx@wd` The width of the author box

```
\newdimen\author@bx@wd
```

`\author@bx@sep` The separation between author boxes

```
\newskip\author@bx@sep
\author@bx@sep=1pc\relax
```

`\@typeset@author@bx` Typesetting the box with authors. Note that in `sigchi-a` the box is not centered.

```
\def\@typeset@author@bx{\bgroup\hsize=\author@bx@wd
  \def\and{\par}\normalbaselines
  \global\setbox\author@bx=\vtop{\if@ACM@sigchiamode\else\centering\fi
    \@authorfont\@currentauthors\par\@affiliationfont
    \@currentaffiliation}\egroup
  \box\author@bx\hspace{\author@bx@sep}%
  \gdef\@currentauthors{}%
  \gdef\@currentaffiliation{}}
```

`\@mkauthors@iii` The `sigconf` version. Here we use a centered design with each author in a separate box.

```
\def\@mkauthors@iii{%
```

First, we need to determine the design of the author strip. The boxes are separated by `\author@bx@sep` plus two `\author@bx@sep` margins. This means that each box must be of width $(\texttt{\textwidth} - \texttt{\author@bx@sep})/N - \texttt{\author@bx@sep}$, where N is the number of boxes per row.

```
  \author@bx@wd=\textwidth\relax
  \advance\author@bx@wd by -\author@bx@sep\relax
  \ifnum\@ACM@authorsperrow>0\relax
    \divide\author@bx@wd by \@ACM@authorsperrow\relax
  \else
    \ifcase\num@authorgroups
```

```
    \relax % 0?
    \or  % 1=one author per row
    \or  % 2=two authors per row
       \divide\author@bx@wd by \num@authorgroups\relax
    \or  % 3=three authors per row
       \divide\author@bx@wd by \num@authorgroups\relax
    \or  % 4=two authors per row (!)
       \divide\author@bx@wd by 2\relax
    \else % three authors per row
       \divide\author@bx@wd by 3\relax
    \fi
  \fi
  \advance\author@bx@wd by -\author@bx@sep\relax
```

Now, parsing of `\addresses`:

```
  \gdef\@currentauthors{}%
  \gdef\@currentaffiliation{}%
  \def\@author##1{\ifx\@currentauthors\@empty
    \gdef\@currentauthors{\par##1}%
  \else
    \g@addto@macro\@currentauthors{\par##1}%
  \fi
  \gdef\and{}}%
  \def\email##1##2{\ifx\@currentaffiliation\@empty
    \gdef\@currentaffiliation{\bgroup
      \mathchardef\UrlBreakPenalty=10000\nolinkurl{##2}\egroup}%
  \else
    \g@addto@macro\@currentaffiliation{\par\bgroup
      \mathchardef\UrlBreakPenalty=10000\nolinkurl{##2}\egroup}%
  \fi}%
  \def\affiliation##1##2{\ifx\@currentaffiliation\@empty
    \gdef\@currentaffiliation{%
      \setkeys{@ACM@affiliation@}{obeypunctuation=false}%
      \setkeys{@ACM@affiliation@}{##1}\@ACM@resetaffil
      ##2\@ACM@checkaffil}%
  \else
    \g@addto@macro\@currentaffiliation{\par
      \setkeys{@ACM@affiliation@}{obeypunctuation=false}%
      \setkeys{@ACM@affiliation@}{##1}\@ACM@resetaffil
      ##2\@ACM@checkaffil}%
  \fi
  \global\let\and\@typeset@author@bx
}%
```

Actual typesetting is done by the `\and` macro:

```
  \hsize=\textwidth
  \global\setbox\mktitle@bx=\vbox{\noindent
    \unvbox\mktitle@bx\par\medskip\leavevmode
    \lineskip=1pc\relax\centering\hspace*{-1em}%
    \addresses\let\and\@typeset@author@bx\and\par\bigskip}}
```

`\@mkauthors@iv` The `sigchi-a` version. We put authors in the main text with no more than 2 authors per line, unless overriden.

```
\def\@mkauthors@iv{%
```

First, we need to determine the design of the author strip. The boxes are separated by \author@bx@sep plus two \author@bx@sep margins. This means that each box must be of width (\textwidth − \author@bx@sep)/N − \author@bx@sep, where N is the number of boxes per row.

```
\author@bx@wd=\columnwidth\relax
\advance\author@bx@wd by -\author@bx@sep\relax
\ifnum\@ACM@authorsperrow>0\relax
  \divide\author@bx@wd by \@ACM@authorsperrow\relax
\else
  \ifcase\num@authorgroups
  \relax % 0?
  \or  % 1=one author per row
  \else  % 2=two authors per row
     \divide\author@bx@wd by 2\relax
  \fi
\fi
\advance\author@bx@wd by -\author@bx@sep\relax
```

Now, parsing of \addresses:

```
\gdef\@currentauthors{}%
\gdef\@currentaffiliation{}%
\def\@author##1{\ifx\@currentauthors\@empty
  \gdef\@currentauthors{\par##1}%
\else
  \g@addto@macro\@currentauthors{\par##1}%
\fi
\gdef\and{}}%
\def\email##1##2{\ifx\@currentaffiliation\@empty
  \gdef\@currentaffiliation{\nolinkurl{##2}}%
\else
  \g@addto@macro\@currentaffiliation{\par\nolinkurl{##2}}%
\fi}%
\def\affiliation##1##2{\ifx\@currentaffiliation\@empty
  \gdef\@currentaffiliation{%
    \setkeys{@ACM@affiliation@}{obeypunctuation=false}%
    \setkeys{@ACM@affiliation@}{##1}\@ACM@resetaffil
    ##2\@ACM@checkaffil}%
\else
  \g@addto@macro\@currentaffiliation{\par
    \setkeys{@ACM@affiliation@}{obeypunctuation=false}%
    \setkeys{@ACM@affiliation@}{##1}\@ACM@resetaffil
    ##2\@ACM@checkaffil}%
\fi
\global\let\and\@typeset@author@bx}%
%
```

Actual typesetting is done by the \and macro

```
  \bgroup\hsize=\columnwidth
  \par\raggedright\leftskip=\z@
  \lineskip=1pc\noindent
  \addresses\let\and\@typeset@author@bx\and\par\bigskip\egroup}
```

\@mkauthorsaddresses Typesetting authors' addresses in the footnote style

```
\def\@mkauthorsaddresses{%
```

```
  \ifnum\num@authors>1\relax
  Authors' \else Author's \fi
  \ifnum\num@authorgroups>1\relax
  addresses: \else address: \fi
  \bgroup
  \def\streetaddress##1{\unskip, ##1}%
  \def\postcode##1{\unskip, ##1}%
  \def\position##1{\unskip\ignorespaces}%
  \gdef\@ACM@institution@separator{, }%
 \def\institution##1{\unskip\@ACM@institution@separator ##1\gdef\@ACM@institution@separator{ and }
  \def\city##1{\unskip, ##1}%
  \def\state##1{\unskip, ##1}%
  \renewcommand\department[2][0]{\unskip\@addpunct, ##2}%
  \def\country##1{\unskip, ##1}%
  \def\and{\unskip; \gdef\@ACM@institution@separator{, }}%
  \def\@author##1{##1}%
  \def\email##1##2{\unskip, \nolinkurl{##2}}%
  \addresses
  \egroup}

\AtEndDocument{\if@ACM@nonacm\else\if@ACM@journal
  \ifx\@authorsaddresses\@empty
  \ClassWarningNoLine{\@classname}{Authors'
    addresses are mandatory for ACM journals}%
  \fi\fi\fi}
```

`\@setaddresses` This is an `amsart` macro that we do not need.

```
\def\@setaddresses{}
```

`\@authornotemark` Adding a footnote mark to authors. This version adds a "normal" footnote mark.

```
\def\@authornotemark{\g@addto@macro\@currentauthors{\footnotemark\relax}}
```

`\@@authornotemark` Adding a footnote mark to authors with a given number

```
\def\@@authornotemark#1{\g@addto@macro\@currentauthors{\footnotemark[#1]}}
```

`\@mkteasers` Typesetting the teasers

```
\def\@mkteasers{%
  \ifx\@teaserfigures\@empty\else
    \def\@teaser##1{\par\bigskip\bgroup
      \captionsetup{type=figure}##1\egroup\par}
    \global\setbox\mktitle@bx=\vbox{\noindent\unvbox\mktitle@bx\par
      \noindent\@Description@presentfalse
      \@teaserfigures\par\if@Description@present\else
         \global\@undescribed@imagestrue
         \ClassWarning{\@classname}{A possible image without
           description}\fi
    \medskip}%
  \fi}
```

`\@mkabstract` Typesetting the abstract

```
\def\@mkabstract{\bgroup
  \ifx\@abstract\@lempty\else
  {\phantomsection\addcontentsline{toc}{section}{\abstractname}%
    \if@ACM@journal
```

```
      \everypar{\setbox\z@\lastbox\everypar{}}\small
    \else
      \section*{\abstractname}%
    \fi
   \ignorespaces\@abstract\par}%
  \fi\egroup}
```

`\@mktranslatedabstract` Typesetting a translated abstract

```
\def\@mktranslatedabstract#1{\selectlanguage{#1}%
    \if@ACM@journal
       \everypar{\setbox\z@\lastbox\everypar{}}\small
    \else
       \section*{\abstractname}%
    \fi
   \ignorespaces}
```

`\@mkbibcitation` Print the `bibcitation` format

```
\def\@mkbibcitation{\bgroup
  \let\@vspace\@vspace@orig
  \let\@vspacer\@vspacer@orig
 \def\@pages@word{\ifnum\getrefnumber{TotPages}=1\relax page\else pages\fi}%
  \def\footnotemark{}%
  \def\\{\unskip{} \ignorespaces}%
  \def\footnote{\ClassError{\@classname}{Please do not use footnotes
      inside a \string\title{} or \string\author{} command! Use
      \string\titlenote{} or \string\authornote{} instead!}}%
  \def\@article@string{\ifx\@acmArticle\@empty{\ }\else,
    Article~\@acmArticle\ \fi}%
  \par\medskip\small\noindent{\bfseries ACM Reference Format:}\par\nobreak
  \noindent\bgroup
    \def\\{\unskip{}, \ignorespaces}\authors\egroup. \@acmYear. \@title
  \ifx\@subtitle\@empty. \else: \@subtitle. \fi
  \if@ACM@nonacm\else
    % The 'nonacm' option disables 'printacmref' by default,
    % and the present \@mkbibcitation definition is never used
    % in this case. The conditional remains useful if the user
    % explicitly sets \settopmatter{printacmref=true}.
    \if@ACM@journal@bibstrip
       \textit{\@journalNameShort}
       \@acmVolume, \@acmNumber \@article@string (\@acmPubDate),
       \ref{TotPages}~\@pages@word.
    \else
       In \textit{\@acmBooktitle}%
       \ifx\@acmEditors\@empty\textit{.}\else
         \andify\@acmEditors\textit{, }\@acmEditors~\@editorsAbbrev.%
       \fi\
       ACM, New York, NY, USA%
         \@article@string\unskip, \ref{TotPages}~\@pages@word.
    \fi
  \fi
  \ifx\@acmDOI\@empty\else\@formatdoi{\@acmDOI}\fi
\par\egroup}
```

`\@printendtopmatter` End the top matter

```
\def\@printendtopmatter{%
  \let\@vspace\@vspace@orig
  \let\@vspacer\@vspacer@orig
  \par\bigskip
  \let\@vspace\@vspace@acm
  \let\@vspacer\@vspacer@acm
  }
```

`\@setthanks` We redefine `\\@setthanks` using `\long`

```
\def\@setthanks{\long\def\thanks##1{\par##1\@addpunct.}\thankses}
```

`\@setauthorsaddresses`

```
\def\@setauthorsaddresses{\@authorsaddresses\unskip\@addpunct.}
```

`\@typesetengagemetadata` Typesetting special metadata for ACM Engage

```
\def\@typesetengagemetadata{%
  \def\@setengagemetadata##1##2{\par\noindent\textbf{##1} ##2\par}%
  \@acmengagemetadata}
```

3.22 Headers and Footers

We use `fancyhdr` for our headers and footers:

```
\RequirePackage{fancyhdr}
```

`\ACM@restore@pagestyle` The following code by Ross Moore protects against changes by the `totpages` package:

```
\let\ACM@ps@plain\ps@plain
\let\ACM@ps@myheadings\ps@myheadings
\let\ACM@ps@headings\ps@headings
\def\ACM@restore@pagestyle{%
  \let\ps@plain\ACM@ps@plain
  \let\ps@myheadings\ACM@ps@myheadings
  \let\ps@headings\ACM@ps@headings}
\AtBeginDocument{\ACM@restore@pagestyle}
```

`\ACM@linecount@bx` This is the box displayed in review mode

```
\if@ACM@review
  \newsavebox{\ACM@linecount@bx}
  \newlength\ACM@linecount@bxht
  \newcount\ACM@linecount
  \ACM@linecount\@ne\relax
  \def\ACM@mk@linecount{%
    \savebox{\ACM@linecount@bx}[4em][t]{\parbox[t]{4em}{\normalfont
        \normalsize
        \setlength{\ACM@linecount@bxht}{0pt}%
        \loop{\color{red}\scriptsize\the\ACM@linecount}\\
        \global\advance\ACM@linecount by \@ne
        \addtolength{\ACM@linecount@bxht}{\baselineskip}%
        \ifdim\ACM@linecount@bxht<\textheight\repeat
        {\color{red}\scriptsize\the\ACM@linecount}\hfill
        \global\advance\ACM@linecount by \@ne}}}
\fi
```

\ACM@linecountL How to display the box on the left

```
\def\ACM@linecountL{%
  \if@ACM@review
  \ACM@mk@linecount
  \begin{picture}(0,0)%
    \put(-26,-22){\usebox{\ACM@linecount@bx}}%
  \end{picture}%
  \fi}
```

\ACM@linecountR How to display the box on the right. In one column formats we do not step the numbers.

```
\def\ACM@linecountR{%
  \if@ACM@review
    \ifcase\ACM@format@nr
    \relax % manuscript
         \relax
       \or % acmsmall
         \relax
       \or % acmlarge
         \relax
       \or % acmtog
          \ACM@mk@linecount
       \or % sigconf
          \ACM@mk@linecount
       \or % siggraph
          \ACM@mk@linecount
       \or % sigplan
          \ACM@mk@linecount
       \or % sigchi
          \ACM@mk@linecount
       \or % sigchi-a
          \ACM@mk@linecount
       \or % acmengage
          \ACM@mk@linecount
       \or % acmcp
         \relax
    \fi
    \begin{picture}(0,0)%
      \put(20,-22){\usebox{\ACM@linecount@bx}}%
     \end{picture}%
  \fi}
```

\ACM@timestamp The timestamp system

```
\if@ACM@timestamp
 % Subtracting 30 from \time gives us the effect of rounding down despite
 % \numexpr rounding to nearest
 \newcounter{ACM@time@hours}
 \setcounter{ACM@time@hours}{\numexpr (\time - 30) / 60 \relax}
 \newcounter{ACM@time@minutes}
\setcounter{ACM@time@minutes}{\numexpr \time - \theACM@time@hours * 60 \relax}
 \newcommand\ACM@timestamp{%
   \footnotesize%
   \ifx\@acmSubmissionID\@empty\relax\else
   Submission ID: \@acmSubmissionID.{ }%
   \fi
```

```
    \the\year-\two@digits{\the\month}-\two@digits{\the\day}{ }%
    \two@digits{\theACM@time@hours}:\two@digits{\theACM@time@minutes}{. }%
    Page \thepage\ of \@startPage--\pageref*{TotPages}.%
  }
\fi
```

`\@shortauthors` Even if the author redefined `\shortauthors`, we do not print it in the headers when in anonymous mode:

```
\def\@shortauthors{%
  \if@ACM@anonymous
    Anon.
    \ifx\@acmSubmissionID\@empty\else Submission Id: \@acmSubmissionID\fi
  \else\shortauthors\fi}
```

`\@headfootfont` The font to typeset header and footer text.

```
\def\@headfootfont{\sffamily\footnotesize}
```

`standardpagestyle` The page style for all pages but the first one The page style for all pages but the first one

```
\AtBeginDocument{%
\fancypagestyle{standardpagestyle}{%
  \fancyhf{}%
  \renewcommand{\headrulewidth}{\z@}%
  \renewcommand{\footrulewidth}{\z@}%
  \def\@acmArticlePage{%
    \ifx\@acmArticle\empty%
      \if@ACM@printfolios\thepage\fi%
    \else%
      \@acmArticle\if@ACM@printfolios:\thepage\fi%
    \fi%
  }%
  \if@ACM@journal@bibstrip
    \ifcase\ACM@format@nr
    \relax % manuscript
      \fancyhead[LE]{\ACM@linecountL\if@ACM@printfolios\thepage\fi}%
      \fancyhead[RO]{\if@ACM@printfolios\thepage\fi}%
      \fancyhead[RE]{\@shortauthors}%
      \fancyhead[LO]{\ACM@linecountL\shorttitle}%
      \if@ACM@nonacm\else%
        \fancyfoot[RO,LE]{\footnotesize Manuscript submitted to ACM}
      \fi%
    \or % acmsmall
      \fancyhead[LE]{\ACM@linecountL\@headfootfont\@acmArticlePage}%
      \fancyhead[RO]{\@headfootfont\@acmArticlePage}%
      \fancyhead[RE]{\@headfootfont\@shortauthors}%
      \fancyhead[LO]{\ACM@linecountL\@headfootfont\shorttitle}%
      \if@ACM@nonacm\else%
     \fancyfoot[RO,LE]{\footnotesize \@journalNameShort, Vol. \@acmVolume, No.
       \@acmNumber, Article \@acmArticle.  Publication date: \@acmPubDate.}%
      \fi
    \or % acmlarge
      \fancyhead[LE]{\ACM@linecountL\@headfootfont
      \@acmArticlePage\quad\textbullet\quad\@shortauthors}%
      \fancyhead[LO]{\ACM@linecountL}%
```

```
    \fancyhead[RO]{\@headfootfont
      \shorttitle\quad\textbullet\quad\@acmArticlePage}%
    \if@ACM@nonacm\else%
   \fancyfoot[RO,LE]{\footnotesize \@journalNameShort, Vol. \@acmVolume, No.
     \@acmNumber, Article \@acmArticle.  Publication date: \@acmPubDate.}%
    \fi
  \or % acmtog
    \fancyhead[LE]{\ACM@linecountL\@headfootfont
      \@acmArticlePage\quad\textbullet\quad\@shortauthors}%
    \fancyhead[LO]{\ACM@linecountL}%
    \fancyhead[RE]{\ACM@linecountR}%
    \fancyhead[RO]{\@headfootfont
      \shorttitle\quad\textbullet\quad\@acmArticlePage\ACM@linecountR}%
    \if@ACM@nonacm\else%
   \fancyfoot[RO,LE]{\footnotesize \@journalNameShort, Vol. \@acmVolume, No.
     \@acmNumber, Article \@acmArticle.  Publication date: \@acmPubDate.}%
    \fi
  \else % Proceedings
    \fancyfoot[C]{\if@ACM@printfolios\footnotesize\thepage\fi}%
    \fancyhead[LO]{\ACM@linecountL\@headfootfont\shorttitle}%
    \fancyhead[RE]{\@headfootfont\@shortauthors\ACM@linecountR}%
    \if@ACM@nonacm
      \fancyhead[LE]{\ACM@linecountL}%
      \fancyhead[RO]{\ACM@linecountR}%
    \else%
      \if@ACM@engage
        \fancyhead[LE]{\ACM@linecountL\@headfootfont\footnotesize
          EngageCSEdu. \ifx\@acmDOI\@empty\else\@formatdoi{\@acmDOI}\fi}%
        \fancyhead[RO]{\@headfootfont
          EngageCSEdu. \ifx\@acmDOI\@empty\else\@formatdoi{\@acmDOI}\fi
          \ACM@linecountR}%
      \else
        \fancyhead[LE]{\ACM@linecountL\@headfootfont\footnotesize
          \acmConference@shortname,
          \acmConference@date, \acmConference@venue}%
        \fancyhead[RO]{\@headfootfont
          \acmConference@shortname,
          \acmConference@date, \acmConference@venue\ACM@linecountR}%
       \fi
    \fi
  \fi
\else % Proceedings
  \fancyfoot[C]{\if@ACM@printfolios\footnotesize\thepage\fi}%
  \fancyhead[LO]{\ACM@linecountL\@headfootfont\shorttitle}%
  \fancyhead[RE]{\@headfootfont\@shortauthors\ACM@linecountR}%
  \if@ACM@nonacm
    \fancyhead[LE]{\ACM@linecountL}%
    \fancyhead[RO]{\ACM@linecountR}%
  \else%
    \if@ACM@engage
      \fancyhead[LE]{\ACM@linecountL\@headfootfont
        EngageCSEdu. \ifx\@acmDOI\@empty\else\@formatdoi{\@acmDOI}\fi}%
      \fancyhead[RO]{\@headfootfont
        EngageCSEdu. \ifx\@acmDOI\@empty\else\@formatdoi{\@acmDOI}\fi
```

```
3024          \ACM@linecountR}%
3025      \else
3026        \fancyhead[LE]{\ACM@linecountL\@headfootfont
3027          \acmConference@shortname,
3028          \acmConference@date, \acmConference@venue}%
3029        \fancyhead[RO]{\@headfootfont
3030          \acmConference@shortname,
3031          \acmConference@date, \acmConference@venue\ACM@linecountR}%
3032       \fi
3033    \fi
3034  \fi
3035  \if@ACM@sigchiamode
3036     \fancyheadoffset[L]{\dimexpr(\marginparsep+\marginparwidth)}%
3037  \fi
3038  \if@ACM@timestamp
3039     \fancyfoot[LO,RE]{\ACM@timestamp}
3040  \fi
3041  \if@ACM@acmcp
3042  \renewcommand{\footrulewidth}{0.1\p@}%
3043  \fancyheadoffset[L]{46pt}%
3044  \fancyhead[L]{\makebox[\z@][l]{%
3045      \raisebox{-\dimexpr(0.25\textheight*\ACM@ArticleType@nr)}{%
3046      \rotatebox{90}{\colorbox{@ACM@Article@color}{\color{white}%
3047          \strut\ACM@ArticleType~Article}}}}%
3048    \ACM@linecountL}%
3049  \fancyhead[R]{\makebox[\z@][r]{\box\@ACM@acmcpbox}}%
3050  \fancyfoot[L,C]{}%
3051  \fancyfoot[R]{\footnotesize
3052    \@journalName, Volume~\@acmVolume, Issue~\@acmNumber,
3053    \ifx\@acmArticle\@empty\else Article~\@acmArticle\fi\space
3054    (\@acmPubDate)\ifx\@acmDOI\@empty\else\\\@formatdoi{\@acmDOI}\fi}
3055  \fi
3056 }%
3057 \pagestyle{standardpagestyle}
3058 }
```

`\@folio@wd` `\@folio@ht` `\@folio@voffset` `\@folio@max` Folio blob width, height, offsets and max number

```
3059 \newdimen\@folio@wd
3060 \@folio@wd=\z@
3061 \newdimen\@folio@ht
3062 \@folio@ht=\z@
3063 \newdimen\@folio@voffset
3064 \@folio@voffset=\z@
3065 \def\@folio@max{1}
3066 \ifcase\ACM@format@nr
3067 \relax % manuscript
3068 \or % acmsmall
3069   \@folio@wd=45.75pt\relax
3070   \@folio@ht=1.25in\relax
3071   \@folio@voffset=.2in\relax
3072   \def\@folio@max{8}
3073 \or % acmlarge
3074   \@folio@wd=43.25pt\relax
3075   \@folio@ht=79pt\relax
```

```
  \@folio@voffset=.55in\relax
  \def\@folio@max{10}
\fi
```

`\@folioblob` The macro to typeset the folio blob.

```
\def\@folioblob{\@tempcnta=0\@acmArticleSeq\relax
  \ifnum\@tempcnta=0\relax\else
```

First, we calculate `\@acmArticleSeq` modulo `\@folio@max`

```
  \loop
     \ifnum\@tempcnta>\@folio@max\relax
      \advance\@tempcnta by - \@folio@max
   \repeat
    \advance\@tempcnta by -1\relax
    \@tempdima=\@folio@ht\relax
    \multiply\@tempdima by \the\@tempcnta\relax
    \advance\@tempdima by -\@folio@voffset\relax
    \begin{picture}(0,0)
    \makebox[\z@]{\raisebox{-\@tempdima}{%
        \rlap{%
          \raisebox{-0.45\@folio@ht}[\z@][\z@]{%
            \rule{\@folio@wd}{\@folio@ht}}}%
        \parbox{\@folio@wd}{%
          \centering
          \textcolor{white}{\LARGE\sffamily\bfseries\@acmArticle}}}}
  \end{picture}\fi}

```

`firstpagestyle` The page style for the first page only.

```
\AtBeginDocument{%
\fancypagestyle{firstpagestyle}{%
  \fancyhf{}%
  \renewcommand{\headrulewidth}{\z@}%
  \renewcommand{\footrulewidth}{\z@}%
  \if@ACM@journal@bibstrip
    \ifcase\ACM@format@nr
    \relax % manuscript
      \fancyhead[L]{\ACM@linecountL}%
      \fancyfoot[RO,LE]{\if@ACM@printfolios\small\thepage\fi}%
      \if@ACM@nonacm\else%
        \fancyfoot[RE,LO]{\footnotesize Manuscript submitted to ACM}%
      \fi%
    \or % acmsmall
      \if@ACM@nonacm\else%
     \fancyfoot[RO,LE]{\footnotesize \@journalNameShort, Vol. \@acmVolume, No.
        \@acmNumber, Article \@acmArticle.  Publication date:
        \@acmPubDate.}%
      \fi%
      \fancyhead[LE]{\ACM@linecountL\@folioblob}%
      \fancyhead[LO]{\ACM@linecountL}%
      \fancyhead[RO]{\@folioblob}%
      \fancyheadoffset[RO,LE]{0.6\@folio@wd}%
    \or % acmlarge
      \if@ACM@nonacm\else%
```

```
    \fancyfoot[RO,LE]{\footnotesize \@journalNameShort, Vol. \@acmVolume, No.
      \@acmNumber, Article \@acmArticle.  Publication date:
      \@acmPubDate.}%
    \fi%
    \fancyhead[RO]{\@folioblob}%
    \fancyhead[LE]{\ACM@linecountL\@folioblob}%
    \fancyhead[LO]{\ACM@linecountL}%
    \fancyheadoffset[RO,LE]{1.4\@folio@wd}%
  \or % acmtog
    \if@ACM@nonacm\else%
    \fancyfoot[RO,LE]{\footnotesize \@journalNameShort, Vol. \@acmVolume, No.
      \@acmNumber, Article \@acmArticle.  Publication date:
      \@acmPubDate.}%
    \fi%
    \fancyhead[L]{\ACM@linecountL}%
    \fancyhead[R]{\ACM@linecountR}%
  \else % Conference proceedings
    \fancyhead[L]{\ACM@linecountL}%
    \fancyhead[R]{\ACM@linecountR}%
    \fancyfoot[C]{\if@ACM@printfolios\footnotesize\thepage\fi}%
  \fi
\else
  \fancyhead[L]{\ACM@linecountL}%
  \fancyhead[R]{\ACM@linecountR}%
  \fancyfoot[C]{\if@ACM@printfolios\footnotesize\thepage\fi}%
\fi
\if@ACM@timestamp
  \ifnum\ACM@format@nr=0\relax % Manuscript
  \fancyfoot[LO,RE]{\ACM@timestamp\quad
    \if@ACM@nonacm\else
      \footnotesize Manuscript submitted to ACM
    \fi}
  \else
  \fancyfoot[LO,RE]{\ACM@timestamp}
  \fi
\fi
\if@ACM@acmcp
\renewcommand{\footrulewidth}{0.1\p@}%
\fancyheadoffset[L]{46pt}%
\fancyhead[L]{\makebox[\z@][l]{%
    \raisebox{-\dimexpr(0.25\textheight*\ACM@ArticleType@nr)}{%
    \rotatebox{90}{\colorbox{@ACM@Article@color}{\color{white}%
        \strut\ACM@ArticleType~Article}}}}%
  \ACM@linecountL}%
\fancyhead[R]{\makebox[\z@][r]{\box\@ACM@acmcpbox}}%
\fancyfoot[L,C]{}%
\fancyfoot[R]{\footnotesize
  \@journalName, Volume~\@acmVolume, Issue~\@acmNumber,
  \ifx\@acmArticle\@empty\else Article~\@acmArticle\fi\space
  (\@acmPubDate)\ifx\@acmDOI\@empty\else\\\@formatdoi{\@acmDOI}\fi}
\fi
}}
```

3.23 Sectioning

\ACM@NRadjust Ross Moore's macro.

Initially \ACM@sect@format@ just passes through its #1 argument unchanged. When a sectioning macro such as \section occurs, the \ACM@NRadjust redefines \ACM@sect@format@ to expand into the styling commands; e.g., \@secfont. Then \Sectionformat is temporarily redefined to produce \realSectionformat{\ACM@sect@format{#1}}{#2}, which ultimately becomes \Sectionformat{\@secfont{#1}}{#2}. This is done to allow \Sectionformat to be variable, as may be needed in particular circumstances. Its current expansion is saved as \realSectionformat which is used with the modified 1st argument, then \Sectionformat is reverted to its former expansion.

To style the section-number, the line #1{} is used at the end of \ACM@NRadjust. This imposes style-changing commands for fonts and sizes, but any \MakeUppercase acts on just the {}. It's a bit hacky, by essentially assuming that only numbers occur here, not letters to be case-changed. (This should be acceptable in a class-file, as it ought to be possible to change the case elsewhere, if that was ever desired.) Also, it can result in \@adddotafter being called too soon, so a slight adjustment is made, via \ACM@adddotafter, which now tests whether its argument is empty. But the coding has to allow for other packages to have also patched \@adddotafter.

```
\def\ACM@NRadjust#1{%
 \begingroup
  \expandafter\ifx\csname Sectionformat\endcsname\relax
  % do nothing when  \Sectionformat  is unknown
   \def\next{\endgroup #1}%
 \else
  \def\next{\endgroup
   \let\realSectionformat\Sectionformat
   \def\ACM@sect@format@{#1}%
   \let\Sectionformat\ACM@NR@adjustedSectionformat
 %%  next lines added 2018-06-17 to ensure section number is styled
   \let\real@adddotafter\@adddotafter
   \let\@adddotafter\ACM@adddotafter
   #1{}% imposes the styles, but nullifies  \MakeUppercase
   \let\@adddotafter\real@adddotafter
  }%
 \fi \next
}
```

\ACM@NR@adjustedSectionformat

```
\def\ACM@NR@adjustedSectionformat#1#2{%
 \realSectionformat{\ACM@sect@format{#1}}{#2}%
 \let\Sectionformat\realSectionformat}
\DeclareRobustCommand{\ACM@sect@format}{\ACM@sect@format@}
\def\ACM@sect@format@null#1{#1}
\let\ACM@sect@format@\ACM@sect@format@null
\AtBeginDocument{%
 \expandafter\ifx\csname LTX@adddotafter\endcsname\relax
  \let\LTX@adddotafter\@adddotafter
 \fi
}
```

\ACM@adddotafter

```
\def\ACM@adddotafter#1{\ifx\relax#1\relax\else\LTX@adddotafter{#1}\fi}
```

Sectioning is different for different levels

```
\renewcommand\section{\@startsection{section}{1}{\z@}%
  {-.75\baselineskip \@plus -2\p@ \@minus -.2\p@}%
  {.25\baselineskip}%
  {\ACM@NRadjust\@secfont}}
\renewcommand\subsection{\@startsection{subsection}{2}{\z@}%
  {-.75\baselineskip \@plus -2\p@ \@minus -.2\p@}%
  {.25\baselineskip}%
  {\ACM@NRadjust\@subsecfont}}
\renewcommand\subsubsection{\@startsection{subsubsection}{3}{\z@}%
  {-.5\baselineskip \@plus -2\p@ \@minus -.2\p@}%
  {-3.5\p@}%
  {\ACM@NRadjust{\@subsubsecfont\@adddotafter}}}
\renewcommand\paragraph{\@startsection{paragraph}{4}{\parindent}%
  {-.5\baselineskip \@plus -2\p@ \@minus -.2\p@}%
  {-3.5\p@}%
  {\ACM@NRadjust{\@parfont\@adddotafter}}}
\newcommand\noindentparagraph{\@startsection{paragraph}{4}{\z@}%
  {-.5\baselineskip \@plus -2\p@ \@minus -.2\p@}%
  {-3.5\p@}%
  {\ACM@NRadjust{\@parfont}}}

\renewcommand\part{\@startsection{part}{9}{\z@}%
  {-10\p@ \@plus -4\p@ \@minus -2\p@}%
  {4\p@}%
  {\ACM@NRadjust\@parfont}}
```

\section@raggedright Special version of \raggedright compatible with \MakeUppercase

```
\def\section@raggedright{\@rightskip\@flushglue
  \rightskip\@rightskip
  \leftskip\z@skip
  \parindent\z@}
```

\@secfont Fonts for sections etc. are different for different formats.

\@subsecfont

\@subsubsecfont

\@parfont

```
\def\@secfont{\sffamily\bfseries\section@raggedright\MakeTextUppercase}
\def\@subsecfont{\sffamily\bfseries\section@raggedright}
\def\@subsubsecfont{\sffamily\itshape}
\def\@parfont{\itshape}
\setcounter{secnumdepth}{3}
\ifcase\ACM@format@nr
\relax % manuscript
\or % acmsmall
\or % acmlarge
 \def\@secfont{\sffamily\large\section@raggedright\MakeTextUppercase}
 \def\@subsecfont{\sffamily\large\section@raggedright}
\or % acmtog
 \def\@secfont{\sffamily\large\section@raggedright\MakeTextUppercase}
 \def\@subsecfont{\sffamily\large\section@raggedright}
\or % sigconf
 \def\@secfont{\bfseries\Large\section@raggedright\MakeTextUppercase}
 \def\@subsecfont{\bfseries\Large\section@raggedright}
```

```
\or % siggraph
 \def\@secfont{\sffamily\bfseries\Large\section@raggedright\MakeTextUppercase}
 \def\@subsecfont{\sffamily\bfseries\Large\section@raggedright}
\or % sigplan
 \def\@secfont{\bfseries\Large\section@raggedright}
 \def\@subsecfont{\bfseries\section@raggedright}
 \def\@subsubsecfont{\bfseries\section@raggedright}
 \def\@parfont{\bfseries\itshape}
 \def\@subparfont{\itshape}
\or % sigchi
 \setcounter{secnumdepth}{1}
 \def\@secfont{\sffamily\bfseries\section@raggedright\MakeTextUppercase}
 \def\@subsecfont{\sffamily\bfseries\section@raggedright}
\or % sigchi-a
 \setcounter{secnumdepth}{0}
 \def\@secfont{\sffamily\bfseries\section@raggedright\MakeTextUppercase}
 \def\@subsecfont{\sffamily\bfseries\section@raggedright}
\or % acmengage
 \def\@secfont{\bfseries\Large\section@raggedright\MakeTextUppercase}
 \def\@subsecfont{\bfseries\Large\section@raggedright}
\or %acmcp
\fi
```

`\@adddotafter` Add punctuation after a sectioning command

```
\def\@adddotafter#1{#1\@addpunct{.}}
```

`\@addspaceafter` Add space after a sectioning command

```
\def\@addspaceafter#1{#1\@addpunct{\enspace}}
```

```
\if@ACM@acmcp
   \setcounter{secnumdepth}{-1}%
\fi
```

3.24 TOC lists

`\@dotsep` Related to the `\tableofcontents` are all the horizontal fillers. Base LaTeX defines `\@dottedtocline`, which we should not disable. Yet, this command expects `\@dotsep` to be defined but leaves this to the class implementation. Since `amsart` does not provide this, we copy the standard variant from `article` here.

```
\providecommand*\@dotsep{4.5}
```

3.25 Theorems

`\@acmplainbodyfont` The font to typeset the body of the `acmplain` theorem style.

```
\def\@acmplainbodyfont{\itshape}
```

`\@acmplainindent` The amount to indent the `acmplain` theorem style.

```
\def\@acmplainindent{\parindent}
```

`\@acmplainheadfont` The font to typeset the head of the `acmplain` theorem style.

```
\def\@acmplainheadfont{\scshape}
```

\@acmplainnotefont The font to typeset the note of the acmplain theorem style.

```
\def\@acmplainnotefont{\@empty}
```

Customization of the acmplain theorem style:

```
\ifcase\ACM@format@nr
\relax % manuscript
\or % acmsmall
\or % acmlarge
\or % acmtog
\or % sigconf
\or % siggraph
\or % sigplan
  \def\@acmplainbodyfont{\itshape}
  \def\@acmplainindent{\z@}
  \def\@acmplainheadfont{\bfseries}
  \def\@acmplainnotefont{\normalfont}
\or % sigchi
\or % sigchi-a
\or % acmengage
\or % acmcp
\fi
```

acmplain The acmplain theorem style

```
\newtheoremstyle{acmplain}%
  {.5\baselineskip\@plus.2\baselineskip
    \@minus.2\baselineskip}% space above
  {.5\baselineskip\@plus.2\baselineskip
    \@minus.2\baselineskip}% space below
  {\@acmplainbodyfont}% body font
  {\@acmplainindent}% indent amount
  {\@acmplainheadfont}% head font
  {.}% punctuation after head
  {.5em}% spacing after head
  {\thmname{#1}\thmnumber{ #2}\thmnote{ {\@acmplainnotefont(#3)}}}% head spec
```

\@acmdefinitionbodyfont The font to typeset the body of the acmdefinition theorem style.

```
\def\@acmdefinitionbodyfont{\normalfont}
```

\@acmdefinitionindent The amount to indent the acmdefinition theorem style.

```
\def\@acmdefinitionindent{\parindent}
```

\@acmdefinitionheadfont The font to typeset the head of the acmdefinition theorem style.

```
\def\@acmdefinitionheadfont{\itshape}
```

\@acmdefinitionnotefont The font to typeset the note of the acmdefinition theorem style.

```
\def\@acmdefinitionnotefont{\@empty}
```

Customization of the acmdefinition theorem style:

```
\ifcase\ACM@format@nr
\relax % manuscript
\or % acmsmall
\or % acmlarge
\or % acmtog
```

```
\or % sigconf
\or % siggraph
\or % sigplan
  \def\@acmdefinitionbodyfont{\normalfont}
  \def\@acmdefinitionindent{\z@}
  \def\@acmdefinitionheadfont{\bfseries}
  \def\@acmdefinitionnotefont{\normalfont}
\or % sigchi
\or % sigchi-a
\or % acmengage
\or % acmcp
\fi
```

acmdefinition The acmdefinition theorem style

```
\newtheoremstyle{acmdefinition}%
  {.5\baselineskip\@plus.2\baselineskip
    \@minus.2\baselineskip}% space above
  {.5\baselineskip\@plus.2\baselineskip
    \@minus.2\baselineskip}% space below
  {\@acmdefinitionbodyfont}% body font
  {\@acmdefinitionindent}% indent amount
  {\@acmdefinitionheadfont}% head font
  {.}% punctuation after head
  {.5em}% spacing after head
  {\thmname{#1}\thmnumber{ #2}\thmnote{ {\@acmdefinitionnotefont(#3)}}}% head spec
```

Make acmplain the default theorem style.

```
\theoremstyle{acmplain}
```

Delay defining the theorem environments until after other packages have been loaded. In particular, the cleveref package must be loaded before the theorem environments are defined in order to show the correct environment name (see https://github.com/borisveytsman/acmart/issues/138). The acmthm option is used to suppress the definition of any theorem environments. Also, to avoid obscure errors arising from these environment definitions conflicting with environments defined by the user or by user-loaded packages, we only define environments that have not yet been defined.

```
\AtEndPreamble{%
  \if@ACM@acmthm
  \theoremstyle{acmplain}
  \@ifundefined{theorem}{%
  \newtheorem{theorem}{Theorem}[section]
  }{}
  \@ifundefined{conjecture}{%
  \newtheorem{conjecture}[theorem]{Conjecture}
  }{}
  \@ifundefined{proposition}{%
  \newtheorem{proposition}[theorem]{Proposition}
  }{}
  \@ifundefined{lemma}{%
  \newtheorem{lemma}[theorem]{Lemma}
  }{}
  \@ifundefined{corollary}{%
  \newtheorem{corollary}[theorem]{Corollary}
```

```
  }{}
  \theoremstyle{acmdefinition}
  \@ifundefined{example}{%
  \newtheorem{example}[theorem]{Example}
  }{}
  \@ifundefined{definition}{%
  \newtheorem{definition}[theorem]{Definition}
  }{}
  \fi
  \theoremstyle{acmplain}
}
```

\@proofnamefont The font to typeset the proof name.

```
\def\@proofnamefont{\scshape}
```

\@proofindent Whether or not to indent proofs.

```
\def\@proofindent{\indent}
```

Customization of the proof environment.

```
\ifcase\ACM@format@nr
\relax % manuscript
\or % acmsmall
\or % acmlarge
\or % acmtog
\or % sigconf
\or % siggraph
\or % sigplan
  \def\@proofnamefont{\itshape}
  \def\@proofindent{\noindent}
\or % sigchi
\or % sigchi-a
\or % acmengage
\or % acmcp
\fi
```

proof We want some customization of the proof environment.

```
\renewenvironment{proof}[1][\proofname]{\par
  \pushQED{\qed}%
  \normalfont \topsep6\p@\@plus6\p@\relax
  \trivlist
  \item[\@proofindent\hskip\labelsep
        {\@proofnamefont #1\@addpunct{.}}]\ignorespaces
}{%
  \popQED\endtrivlist\@endpefalse
}
```

3.26 Balancing columns

We need balancing only if the user did not disable it, and we use a two column format. Note that pbalance uses a different mechanism.

```
\AtEndPreamble{%
  \if@ACM@pbalance
    \global\@ACM@balancefalse
```

```
    \ifcase\ACM@format@nr
    \relax % manuscript
       \or % acmsmall
       \or % acmlarge
       \or % acmtog
          \RequirePackage{pbalance}%
       \or % sigconf
          \RequirePackage{pbalance}%
       \or % siggraph
          \RequirePackage{pbalance}%
       \or % sigplan
          \RequirePackage{pbalance}%
       \or % sigchi
          \RequirePackage{pbalance}%
       \or % sigchi-a
       \or % acmengage
          \RequirePackage{pbalance}%
       \or % acmcp
    \fi
  \fi
  \if@ACM@balance
    \ifcase\ACM@format@nr
    \relax % manuscript
         \global\@ACM@balancefalse
       \or % acmsmall
         \global\@ACM@balancefalse
       \or % acmlarge
         \global\@ACM@balancefalse
       \or % acmtog
          \RequirePackage{balance}%
       \or % sigconf
          \RequirePackage{balance}%
       \or % siggraph
          \RequirePackage{balance}%
       \or % sigplan
          \RequirePackage{balance}%
       \or % sigchi
          \RequirePackage{balance}%
       \or % sigchi-a
          \global\@ACM@balancefalse
       \or % acmengage
          \RequirePackage{balance}%
       \or % acmcp
         \global\@ACM@balancefalse
    \fi
  \fi
}
\AtEndDocument{%
  \if@ACM@balance
  \if@twocolumn
  \balance
  \fi\fi}
```

3.27 Acknowledgments

\acksname

```
\newcommand\acksname{Acknowledgments}
```

\acks This is a comment-like structure

```
\specialcomment{acks}{%
  \begingroup
  \section*{\acksname}
  \phantomsection\addcontentsline{toc}{section}{\acksname}
}{%
  \endgroup
}
```

\grantsponsor We just typeset the name of the sponsor

```
\def\grantsponsor#1#2#3{#2}
```

\grantnum

```
\newcommand\grantnum[3][]{#3%
  \def\@tempa{#1}\ifx\@tempa\@empty\else\space(\url{#1})\fi}
```

3.28 Conditional typesetting

We use the comment package for conditional typesetting:

```
\AtEndPreamble{%
\if@ACM@screen
  \includecomment{screenonly}
  \excludecomment{printonly}
\else
  \excludecomment{screenonly}
  \includecomment{printonly}
\fi
\if@ACM@anonymous
  \excludecomment{anonsuppress}
  \excludecomment{acks}
\else
  \includecomment{anonsuppress}
\fi}
```

3.29 Additional bibliography commands

\showeprint The command \showeprint has two arguments: the (optional) prefix and the eprint number. Right now the only prefix we understand is the (lowercase) word ‘arxiv’.

```
\newcommand\showeprint[2][arxiv]{%
  \def\@tempa{#1}%
  \ifx\@tempa\@empty\def\@tempa{arxiv}\fi
  \def\@tempb{arxiv}%
  \ifx\@tempa\@tempb\relax
     arXiv:\href{https://arxiv.org/abs/#2}{#2}%
  \else
     \def\@tempb{arXiv}%
     \ifx\@tempa\@tempb\relax
       arXiv:\href{https://arxiv.org/abs/#2}{#2}%
```

```
    \else
      #1:#2%
    \fi
  \fi}
```

3.30 Index

\theindex Standard amsart uses plain page style in index pages. This clashes with line numbering for review option, so we redefine it.

```
\def\theindex{\@restonecoltrue\if@twocolumn\@restonecolfalse\fi
  \columnseprule\z@ \columnsep 35\p@
  \@indextitlestyle
  \let\item\@idxitem
  \parindent\z@  \parskip\z@\@plus.3\p@\relax
  \raggedright
  \hyphenpenalty\@M
  \footnotesize}
```

3.31 End of Class

\vspace We do not disable \vspace, but add warning to it

```
\let\@vspace@orig=\@vspace
\let\@vspacer@orig=\@vspacer
\apptocmd{\@vspace}{\ClassWarning{\@classname}{\string\vspace\space should
    only be used to provide space above/below surrounding
    objects}}{}{}
\apptocmd{\@vspacer}{\ClassWarning{\@classname}{\string\vspace\space should
    only be used to provide space above/below surrounding
    objects}}{}{}
\let\@vspace@acm=\@vspace
\let\@vspacer@acm=\@vspacer
```

\ACM@origbaselinestretch We produce an error if the user tries to change \baselinestretch

```
\let\ACM@origbaselinestretch\baselinestretch
\AtEndDocument{\ifx\baselinestretch\ACM@origbaselinestretch\else
  \ClassError{\@classname}{An attempt to redefine
    \string\baselinestretch\space detected.  Please do not do this for
    ACM submissions!}\fi}


\normalsize\normalfont\frenchspacing
⟨/class⟩
```

References

[1] UK TEX Users Group. UK list of TEX frequently asked questions. https://texfaq.org, 2019.

[2] Michael Downes and Barbara Beeton. *The amsart, amsproc, and amsbook document classes*. American Mathematical Society, August 2004. http://www.ctan.org/pkg/amslatex.

[3] Johannes L. Braams and Javier Bezos. *Babel*, 2022. http://www.ctan.org/pkg/babel.

[4] Cristophe Fiorio. *algorithm2e.sty—package for algorithms*, October 2015. http://www.ctan.org/pkg/algorithm2e.

[5] Rogério Brito. *The algorithms bundle*, August 2009. http://www.ctan.org/pkg/algorithms.

[6] Carsten Heinz, Brooks Moses, and Jobst Hoffmann. *The Listings Package*, June 2015. http://www.ctan.org/pkg/listings.

[7] Simon Fear. *Publication quality tables in LATEX*, April 2005. http://www.ctan.org/pkg/booktabs.

[8] Association for Computing Machinery. *ACM Visual Identity Standards*, 2007. http://identitystandards.acm.org.

[9] Axel Sommerfeldt. *The subcaption package*, April 2013. http://www.ctan.org/pkg/subcaption.

[10] Boris Veytsman, Bern Schandl, Lee Netherton, and C. V. Radhakrishnan. *A package to create a nomenclature*, September 2005. http://www.ctan.org/pkg/nomencl.

[11] Nicola L. C. Talbot. *User Manual for glossaries.sty v4.44*, December 2019. http://www.ctan.org/pkg/glossaries.

[12] David Carlisle. *The textcase package*, October 2004. http://www.ctan.org/pkg/textcase.

Change History

1.48
General: Added prologue option to xcolor 50
Bib code cleanup (Zack Weinberg) 35
Documentation update (siggraph) . 35
1.49
General: New journal: DTRAP 35
1.53
General: New journals: PACMCGIT, TIOT, TDSCI 35
Rearranged docs 35
1.54
General: Moved footnote stuff before hyperref call (Ross Moore) 35
1.56
General: Documented \Description 35
1.57
General: Booktabs package is now the default 35
1.58
General: Changes in samples (Enrico Gregorio) 35
New journal: HEALTH. TDS is renamed to TDSCI 35
1.60
General: New option: urlbreakonhyphens 35
\if@ACM@urlbreakonhyphens: introduced macro 36
1.62
General: New journal: TELO 35
1.63
General: New journal: FACMP 35
New journal: TQUANT 35
1.63a
General: Move: TQUANT to TQC . . 35
1.64
General: Putting abstract after \maketitle now causes an error . 35
1.65
General: New journal: DGOV 35
1.66
General: ACM reference format is now mandatory for papers over one page; CCS concepts and keywords are now mandatory for papers over two pages 35
Authors' addresses are mandatory for journal articles 35
\@mkauthorsaddresses: Added warning for missing addresses . . 97
\ccsdesc@parse: Added warning for missing concepts 75
\if@ACM@printacmref: Added warning for longer papers 73
\keywords: Added warning for missing keywords 72
1.69
\vspace: Added the changed command to avoid grouping . . . 114
1.70
General: Name change for TDS 59
1.71
General: Bibliography change: volume for @inproceedings is now in brackets together with series . . . 35
LuaTeX now uses the OTF versions of fonts 35
Retired sigchi and sigchi-a 35
1.75
General: Documentation update . . . 35
1.78
General: Documentation update: Word count 35
1.79
General: Updated indormation for TAP, TCPS, TEAC 59
1.80
General: Added DLT and FAC 59
1.82
General: Updated abbreviations and codes for several journals 59
1.84
General: New journals: JDS, GAMES 35, 59
1.85
General: Added CC licenses 35
Added: acmengage 48
New journal: JRC 59
\@mkauthors: Added: acmengage . . 91
\@mktitle: Added: acmengage 87
\@parfont: Added: acmengage 107
\@printtopmatter: Added: acmengage 86
\@specialsection: Added: acmengage 85
\@subtitlefont: Added: acmengage 88
\@titlefont: Added: acmengage . . 88
\ACM@linecountR: Added: acmengage 100
format: New format: acmengage . . . 36
\parskip: Added: acmengage 52

1.87
General: New journals: ACMJCSS, JATS, TORS 59
format: New format: acmcp 36
1.88
General: Added ISSN for ACMJCSS . 59
Added ISSN for GAMES 59
Added PACMNET 59

v1.00
General: First released version 35
v1.01
General: Changed hyperref colors in screen mode (closes https://github.com/borisveytsman/acmart/issues/1) 35
Defined ACM colors 35
Explicitly put draft option (closes https://github.com/borisveytsman/acmart/issues/4) 38
Set headheight to 1pc for all formats (closes https://github.com/borisveytsman/acmart/issues/5) 35
v1.02
General: Added TOPS and TSC (closes https://github.com/borisveytsman/acmart/issues/12) 35
Documentation changes (closes https://github.com/borisveytsman/acmart/issues/13) 35
v1.03
General: Added anonsuppress environment 35
Added authorversion option (closes https://github.com/borisveytsman/acmart/issues/9) 35
\@formatdoi: Added macro 78
\if@ACM@authorversion: Added macro 37
\maketitle: Added special case of authorversion 82
v1.04
General: Updated bibliography for siggraph 35
\acmArticleSeq: Name change by Matthew Fluet 71
\acmDOI: Name change by Matthew Fluet 71
\acmISBN: Name change by Matthew Fluet 71
v1.05
General: Added processing doi numbers for acmsiggraph and doi numbers for sigproc.bib 35
Patched \setcitestyle command; closes https://github.com/borisveytsman/acmart/issues/19 35
v1.06
\@ACM@badge@skip: Added macro . . 72
\@ACM@badge@width: Added macro . 71
\@ACM@title@width: Added macro . 72
\@mktitle@i: Added processing badges 89
Made generic 89
\@mktitle@ii: Now this macro is obsolete 89
\@mktitle@iii: Added processing badges 89
Made more generic 89
\@mktitle@iv: Made more generic . 90
\@printtopmatter: Added processing badges 86
\@subtitlefont: Added macro 88
\@titlefont: Added macro 88
\acmBadgeL: Added macro 72
\acmBadgeR: Added macro 72
\if@ACM@badge: Added macro 71
v1.07
\maketitle: Corrected a bug with abstract footnotes 82
Corrected a bug with permssion and footnotes order 82
v1.08
General: SIGPLAN reformatting by Matthew Fluet 35
Typos corrected (Tobias Pape) . . . 35
v1.09
General: Revert SIGPLAN caption rules 35
v1.10
General: Changes of 'licensedothergov' wording 76
\maketitle: Corrected a bug with doi in manuscript and author vertsion, https://github.com/borisveytsman/acmart/issues/36 82
standardpagestyle: Reversed folios location 101

v1.11
General: Customization of ACM theorem styles and proof environment by Matthew Fluet . . 35
v1.12
General: Added graceful behavior when libertine fonts are absent . . 53
Documentation updates 35
\@marginfigure: Now centering by default 57
\@margintable: Now centering by default 57
\@parfont: Moved to \section@raggedright 107
\copyrightpermissionfootnoterule: Added macro 52
\descriptionlabel: Redefined 59
\footnoterule: Made shorter 53
\if@ACM@natbib@override: Added macro 37
\if@ACM@newfonts: Added macro . . 54
\maketitle: Moved thankses to copyrightpermission box 82
\section@raggedright: Introduced macro 107
v1.13
General: Font adjustments for acmsmall 92
Increased font size for ACM Large 40
Print bibliographic information by default for the proceedings 73
\@mpfootnotetext: Made minipage footnotes centered 48
\bibliographystyle: Redefined macro 49
\bibstyle@acmauthoryear: Added macro 43
\bibstyle@acmnumeric: Added macro 43
\if@ACM@printfolios: Added macro 73
standardpagestyle: Added headers for sigs 101
Expanded headers for sigchi-a . . . 101
Suppressed folios if sig 101
v1.14
General: \citestyle updates (Matthew Fluet) 35
Patched \citestyle 41
\bibstyle@acmauthoryear: Moved def of \bibstyle@acmauthoryear before use 43
\bibstyle@acmnumeric: Moved def of \bibstyle@numeric before use . . 43
v1.15
\@ACM@addtoaddress: Added macro 90
\@mkauthors@iii: New authors system 94
\@shortauthors: Introduced macro . 101
\@typeset@author@bx: Moved to separate macro 94
\acks: Added macro 113
\affiliation: Added code for author groups 68
\author: Added code for author groups 67
\city: Added macro 91
\country: Added macro 91
\department: Added macro 91
\grantnum: Added macro 113
\grantsponsor: Added macro 113
\if@insideauthorgroup: Introduced macro 67
\institution: Added macro 91
\num@authorgroups: Renamed 67
\orcid: Introduced macro 69
\position: Added macro 91
\postcode: Added macro 91
\state: Added macro 91
\streetaddress: Added macro 91
standardpagestyle: Better handling of anonymous mode 101
v1.16
General: Formatting header/footer (Matthew Fluet) 35
\@headfootfont: Added macro 101
standardpagestyle: Customize header/footer text font 101
v1.17
General: Slightly decreased margins for sigs 50
\@makefnmark: Redefined 48
\@mkauthors: TOG now uses the same authors block as other journals . . 91
\@mkauthors@ii: Deleted 94
\@mkbibcitation: Added \nobreak 98
Changed format for sigs 98
\acmArticle: The default is now numerical 71
\acmMonth: The default must be numerical. Closes #50. 71
\acmNumber: The default is now numerical 71
\acmVolume: The default is now numerical 71
\acmYear: The default is now numerical 71
\description: Decreased indent . . . 59

\grantnum: Added url 113
\grantsponsor: Renamed 113
\if@ACM@printacmref: Renamed from \if@ACM@printbib 73
standardpagestyle: Added paper title to sigs 101
v1.18
General: Natbib is now the default for all formats 35
\@mkauthors@i: Now we andify affiliations 93
\@typeset@author@line: Added macro 92
v1.19
General: Include 'Abstract', 'Acknowledgements', and 'References' in PDF bookmarks (Matthew Fluet) 35
Include 'References' in PDF bookmarks (Matthew Fluet) 41
\@mkabstract: Include 'Abstract' in PDF bookmarks (Matthew Fluet) . 97
\acks: Include 'Acknowledgements' in PDF bookmarks (Matthew Fluet) 113
v1.20
General: Bug fixes for bst 35
\@mkabstract: Deleted spurious space 97
v1.21
\showeprint: Added macro 113
v1.22
General: More bibliography changes for Aptara 35
v1.23
General: Add PACMPL journal option 35
v1.24
General: Add IMWUT journal option 59
v1.25
General: Updated PACMPL 59
v1.26
General: Corrected \shortcite bug . 35
Documentation typos fixed (thanks to Stephen Spencer) 35
v1.27
\if@ACM@printccs: Typo corrected . 73
v1.28
General: Corrected option natbib behavior 43
Got rid of warnings in pdf keywords 48
\ccsdesc@parse: Change from \to to \textrightarrow (Matteo Riondato) 75
v1.29
General: Increased head to 13pt 50
\@mkabstract: Removed spurious indentation (John Wickerson) . . . 97
\ccsdesc@parse: Add spacing after bullet and around rightarrow; semicolon separators no longer in bold/italic (John Wickerson) 75
standardpagestyle: Corrected printfolios (Matthew Fluet) 101
v1.30
General: Added \frenchspacing . . . 114
Bibtex style now recognizes https:// in doi 35
Switched to T1: looks like libertine has problems with \l in OT1 . . . 54
Updated IMWUT and PACMPL . . 59
\department: Added optional parameter 91
v1.31
General: Documentation changes . . . 35
\@additionalaffiliation: Added macro 69
\@mkbibcitation: Disabled linebreak 98
\@startsection: Added \tochangmeasure 45
Redefined macro 47
\@textbottom: Redefined 53
\acmMonth: The default now is the current month (Matteo Riondato) 71
\acmYear: The default now is the current year (Matteo Riondato) . . 71
\additionalaffiliation: Added macro 69
\l@subsection: Redefined macro . . 47
\l@subsubsection: Redefined macro 47
v1.32
General: Added POMACS journal option 35
Format siggraph is now obsolete . 35
\@formatdoi: New doi format 78
v1.33
General: Added acmart-preload-hook 35
Added cmap and glyphtounicode . 53
BibTeX comma before articleno bug corrected 35
BibTeX crossref bug corrected . . . 35
BibTeX numpages bug corrected . 35
Documentation updates 35
Moved \citename definition for non-natbib bibliography, so a package may redefine it 49
Switched to Type 1 fonts for libertine even if OTF-capable engine is used (Kai Mindermann) . 54

\@ACM@addtoaddress: Added obeypunctuation code 90
\@mkauthors@i: Added obeypunctuation code 93
\@mkauthors@iii: Added obeypunctuation code 94
\@mkauthors@iv: Added obeypunctuation code 95
\@subtitlefont: Added \normalsize 88
\ACM@linecountL: Renamed macro . 100
\ACM@linecountR: Added macro . . . 100
\ACM@timestamp: Added current page number 100
Added macro (Michael D. Adams) . 100
Added submission id 100
\acmSubmissionID: Added macro . . 71
\city: Added obeypunctuation code 91
\country: Added obeypunctuation code 91
\department: Added obeypunctuation code 91
\if@ACM@affiliation@obeypunctuation: Added macro 69
\if@ACM@authordraft: Added macro 38
\if@ACM@natbib@override: Deleted macro 37
\if@ACM@timestamp: Added macro (Michael D. Adams) 38
\institution: Added obeypunctuation code 91
firstpagestyle: Added right linecount for two-column formats 104
Added timestamp (Michael D. Adams) 104
\maketitle: Fixed the bug with figures on top and bottom of the title page, thanks to David Epstein 82
\position: Added obeypunctuation code 91
\postcode: Added obeypunctuation code 91
\state: Added obeypunctuation code 91
\streetaddress: Added obeypunctuation code 91
standardpagestyle: Added right linecount for two-column formats 101
Added timestamp (Michael D. Adams) 101
v1.34
\@mkbibcitation: Deleted DOI from doi numbers 98
\ACM@linecount@bx: Rulers now are continuous 99
\ACM@linecountL: Rulers now are continuous 100
\ACM@linecountR: Rulers now are continuous 100
\maketitle: Added date to the bibstrip in conf proceedings 82
Deleted 'DOI' from doi numbers . 82
Rearranged bibstrip 82
The \terms command is now obsolete 82
\terms: The \terms command now just produces a warning 72
v1.35
General: BibTeX bug fixed: et al. . . . 35
If the copyright is set to usgov or rigtsretained, the price is suppressed 76
\bibstyle@acmauthoryear: Square brackets for author-year style . . . 43
v1.36
General: Added PACMHCI journal options 59
Added the possibility to adjust number of author boxes per row in conference formats 35
\@ACM@authorsperrow: Added macro 73
\@mkauthors@iii: Added authorsperrow overrride 94
\@mkauthors@iv: Added authorsperrow overrride 95
\if@ACM@authordraft: Corrected typo, thanks to bargteil 38
v1.37
General: Reduce list indentation (Matthew Fluet) 58
Set \normalparindent; Reduce list indentation (Matthew Fluet) 35
\description: Reduce list indentation (Matthew Fluet) 59
\descriptionlabel: Reduce list indentation (Matthew Fluet) 59
\normalparindent: Set \normalparindent (Matthew Fluet) 52
v1.38
General: Increase default font size for SIGPLAN 35, 40
v1.39
\@@authornotemark: Added macro . 97
\authornotemark: Added macro . . . 70
v1.40
General: Added 'textcase' package . . 41
Added heightrounded to geometry 50

Added new copyright version: licensedcagov 35
Added package cleveref 35
Added Ross Moore code for glyphtounicode 53
Bibliography changes 35
\@copyrightowner: Added new copyright version: licensedcagov . 77
\@copyrightpermission: Added new copyright version: licensedcagov . 78
\@mkauthors@i: Switched to MakeTextUppercase 93
\@parfont: Switched to MakeTextUppercase 107
\ACM@linecount@bx: Work around a bug in xcolor: looks like cmyk colors in boxes do not work 99
\ccdesc@parse@finish: Added macro 75
\city: We now do not print this even in SIG 91
\country: Fixed bugs with extra spaces 91
\l@subsection: Redefined macro . . 47
\postcode: We now do not print this even in SIG 91
\state: We now do not print this even in SIG 91
\streetaddress: We now do not print this even in SIG 91
v1.41
General: Added new badges 35
v1.42
General: Deleted ACM badges 35
v1.43
\@startsection: Added \makeatletter 47
\country: Added comma before country for journals 91
v1.44
General: Added package refcount . . . 35
Deleted package cleveref 35
Put theorem defs in a separate style 35
\@acmBooktitle: Added macro 67
\@acmEditors: Added macro 67
\@editorsAbbrev: Added macro . . . 67
\@folioblob: Suppress the blob if acmArticleSeq is empty 104
\@mkbibcitation: If the paper has just one page, use ‘page’ instead of ‘pages’ 98
\ACM@restore@pagestyle: Added macro 99
\acmArticle: The default is now empty 71
\acmArticleSeq: Now acmArticle might be empty 71
\acmBooktitle: Added macro 67
\editor: Added macro 67
\if@ACM@acmthm: Added macro 36
\maketitle: Empty DOI or ISBN are not printed (by Michael Ekstrand) 82
v1.45
\@folioblob: Switched \bfseries\sffamily to \sffamily\bfseries 104
\@parfont: Switched \bfseries\sffamily to \sffamily\bfseries 107
\@titlefont: Switched \bfseries\sffamily to \sffamily\bfseries 88
v1.46
General: Added etoolbox 35
Bst file bug fixes: label width is calculated correctly 35
Delayed hypersetup since journal options may change screen mode 48
PACM now set screen to true 59
Restore theorem defs to class file . 35
\@mkauthorsaddresses: Introduced macro 96
\@mkbibcitation: Added subtitle . . 98
\@printendtopmatter: Made it \par\bigskip uniformly 98
\@printtopmatter: Deleted rule . . . 86
\@setauthorsaddresses: Introduced macro 99
\ACM@linecount@bx: Rearranged the code to get rid of spurious underfull messages (Benjamin Byholm) 99
\author: Started counting authors . . 67
\authorsaddresses: Introduced macro 69
\country: Corrected spacing for institution 91
\if@ACM@acmthm: Modified description 36
\liningnums: Workaround for compatibility with fontspec 54
\maketitle: Added authors’ addresses 82
Thankses go before authors’ addresses 82
\num@authors: Introduced macro . . 67
v1.47
General: New journal: THRI 35

v1.48
General: \citeyear no longer behaves like \citeyearpar 49
Code prettying (Michael D. Adams) 35
Initial support for Biblatex (Daniel Thomas) 35
Misc entries in the bibliography no longer produce a separate date . . 35
Typos fixed (Jamie Davis) 35
\@headfootfont: Deleted unnecessary switch (Michael D. Adams) 101
\@mkabstract: Removed spurious indentation if abstract is followed by an empty line 97
\ACM@timestamp: Fromatting change (Michael D. Adams) 100
\if@ACM@review: Review mode now switches on folios 36
\maketitle: Added acmart and version info to pdfcreator tag . . . 82
Added language and doctitle attributes to PDF (Andreas Reichinger) 82
Suppressed empty DOI (Serguei Mokhov) 82
v1.50
\@copyrightpermission: New copyright statements for iw3c2w3[g] 78
v1.51
General: Corrected the bug with price suppression 76
Suppress price if the copyright is set to iw3c2w3 or iw3c2w3g 76
XeTeX now uses OTF fonts (Joachim Breitner) 54
firstpagestyle: We now use journal abbreviation for footers 104
standardpagestyle: We now use journal abbreviation for footers . 101
v1.52
\@copyrightowner: Rewording of licenses 77
\@copyrightpermission: Another rewording of copyright statements for iw3c2w3[g] 78
v1.53
General: Added PACMCGIT, TIOT, TDSCI 59
v1.54
General: Added Ross's patch for sectioning 107
Deleted indent for subsubsection . 107
XeTeX now uses T1 encoding . . . 54
\@mkbibcitation: Bug corrected (Ross Moore) 98
\@shortauthors: Added submission id in anonymous mode 101
\ACM@adddotafter: Added macro . . 107
\ACM@NR@adjustedSectionformat: Added macro 106
\ACM@NRadjust: Added macro 106
\author: Added submission id in anonymous mode 67
\if@ACM@nonacm: Added macro 37
v1.55
General: Now we use purple color for links 48
Table captions for SIGCHI now use the same font size as figure captions (Luis Leiva) 56
Typo corrected (Zack Weinberg) . 41
\@mkbibcitation: Bug corrected . . . 98
\maketitle: Fixes topnum 82
v1.56
General: Looks like XeTeX requires explicit monotype font declaration 54
Make two-column layouts flush (Philip Quinn) 50
\@marginfigure: Added checking for description 57
\@mkteasers: Added check for description 97
\acksname: Added macro (Philip Quinn) 113
\ccsdesc@parse: End the concepts list with a period (Philip Quinn) . 75
\Description: Added macro 55
\if@Description@present: Added macro 55
\if@undescribed@images: Added macro 55
v1.57
\ACM@origbaselinestretch: Added check whether the user changed \baselinestretch 114
\author: Added warning if \author has comma 67
\email: Added warning if \author has comma 69
\if@ACM@balance: Added macro . . . 37
\vspace: Added warning 114
v1.58
General: Added HEALTH. TDSCI is renamed to TDS 59
Suppressed \addtocounter in pdf subject 48

\@dblfloat: Deleted spurious \vspace warning 57
\@marginfigure: Deleted spurious \vspace warning 57
\@margintable: Deleted spurious \vspace warning 57
\@mkbibcitation: Deleted spurious \vspace warning 98
\@printendtopmatter: Deleted spurious \vspace warning 98
\@sidebar: Deleted spurious \vspace warning 56
\maketitle: Original \vspace inside \maketitle 82
\vspace: Preserved old versions as \@vspace@orig and \@vspace@orig 114
v1.59
\acmConference: Setting \@ACM@journal@bibstrip 66
\acmJournal: Setting \@ACM@journal@bibstrip 66
\if@ACM@journal@bibstrip: Introduced macro 39
firstpagestyle: Added logic for conference papers using journal format 104
Moved page styles to \AtBeginDocument 104
standardpagestyle: Added logic for conference papers using journal format 101
Moved page styles to \AtBeginDocument 101
v1.60
\@headfootfont: Moved to footnotesize 101
v1.61
\@typeset@author@bx: Added \normalbaselines 94
v1.64
\ACM@linecount@bx: Bug fix: made the spacing on the left and the right size equal 99
\if@ACM@maketitle@typeset: Introduced macro 59
\maketitle: Added a switch setting to show that \maketitle is typeset . 82
v1.65
\@mkauthorsaddresses: Deleted cs@addpunct 96
v1.66
General: Patching algorithm and algorithm* to prevent spurious space warnings 55
\@specialsection: Suppress warnings about \vspace 85
v1.67
General: Patching lstlisting and lstlisting* to prevent spurious space warnings 55
\@parfont: Deleted redefinitions of sections 107
\@specialsection: Paragraph inside group does not print its argument. Added a bugfix 85
v1.68
General: New command for unindent paras 107
\@specialsection: Deleted grouping altogether 85
v1.69
General: No dots for unindented paragraphs 107
\@printendtopmatter: Deleted grouping 98
\@specialsection: Changed dot to colon for sigplan 85
\ACM@linecountR: Do not increase numbers in one column format . 100
\ccsdesc@parse: Use math right arrow in text 75
v1.71
\l@subsubsection: Bug fixed (thanks to Andrew Black) 47
v1.72
General: Added hyperxmp 48
\author: Added \detokenize (Kuldeep S. Meel) 67
\maketitle: Do not andify authors for pdf metadata (Scott Pakin) . . . 82
v1.73
General: Patching minted and minted* to prevent spurious space warnings 55
\@ACM@checkaffil: Added macro . . 93
\@ACM@resetaffil: Added macro . . 93
\@mkauthors@i: Check the presence of required elements for affiliations 93
\@mkauthors@iii: Check the presence of required elements for affiliations 94
\@mkauthors@iv: Check the presence of required elements for affiliations 95
\city: Check the presence in affil . . 91
\country: Check the presence in affil 91

\if@ACM@citypresent: Added macro 93
\if@ACM@countrypresent: Added macro 93
\if@ACM@instpresent: Added macro 93
\institution: Check the presence in affil 91
\maketitle: Do not check again the presense of address fields 82
v1.74
General: Changed the order of font loading 54
v1.75
\@ACM@checkaffil: Changed warning to error for country 93
\@beginmaketitlehook: Introduced macro 82
\AtBeginMaketitle: Introduced macro 82
\maketitle: Added \@beginmaketitlehook 82
v1.76
General: Moved hyperxmp before hyperref, see https://github.com/borisveytsman/acmart/issues/425 48
\author: Added code for orcid links . 67
\if@ACM@pbalance: Added macro . . 37
\maketitle: Put \par inside group for keywords 82
\orcid: Added code for orcid links . . 69
standardpagestyle: Fixed bug with no line numbers for nonacm . . . 101
v1.77
\@mkauthorsaddresses: New separator of institutions 96
v1.78
\@mkauthors@i: Unboxing \mktitle@bx 93
\@mkauthors@iii: Unboxing \mktitle@bx 94
\@mkteasers: Unboxing \mktitle@bx 97
\@printtopmatter: Added processing the overflowing title box 86
\@specialsection: Again suppressed \vspace warning 85
v1.82
\anon: Introduced macro 81
v1.83
General: Use babel for multilanguage papers 43
\@mkabstract: I13n 97
\@mktitle@i: Added \translatedtitle and \translatedsubtitle 89
\@mktitle@iii: Added \translatedtitle and \translatedsubtitle 89
\@mktitle@iv: Added \translatedtitle and \translatedsubtitle 90
\@mktranslatedabstract: Added macro 98
\@mktranslatedkeywords: Added macro 70
\@translatedabstracts: Added macro 45
\@translatedkeywords: Added macro 45
\@translatedsubtitle: Added macro 45
\@translatedtitle: Added macro . . 44
\ACM@lang@check: Added macro . . . 44
\ACM@languages: Introduced macro . 38
\maketitle: I13n 82
translatedabstract: Added macro 45
\translatedkeywords: Added macro 45
\translatedsubtitle: Added macro 45
\translatedtitle: Added macro . . 44
v1.85
General: Added CC licenses 76
\@acmengagemetadata: Introduced macro 82
\@copyrightowner: Added CC licenses 77
\@copyrightpermission: Added CC licenses 78
\@typesetengagemetadata: Introduced macro 99
\if@ACM@engage: Introduced macro . 39
\maketitle: acmengage 82
\setcctype: Added macro 77
\setengagemetadata: Introduced macro 82
v1.86
\country: Error if country is empty . 91
standardpagestyle: Special treatment of ACM Engage materials 101
v1.87
General: Added ‘framed’ package for acmcp 41
No numbering sections for ACMCP 108
\@ACM@copyright@check@cc: Added macro 78
\@copyrightpermission: CC licenses now are allowed only for non-acm or ACM engage publications 78

\@mkauthors@i: Special treatment for acmcp 93
\@mktitle@i: Special treatment for acmcp 89
\acmArticleType: Introduced macro 74
\acmCodeLink: Added possibility to have several links 74
Introduced macro 74
\acmDataLink: Introduced macro . . 75
Now this is the same as the code link 75
\if@ACM@acmcp: Introduced macro . . 39
firstpagestyle: Special treatment for acmcp 104
\maketitle: CC license are allowed for non-acm publications 82
\set@ACM@acmcpbox: Added macro . 85
standardpagestyle: Special treatment of ACMCP 101
v1.88
\@mktitle@i: Moved down title for acmcp 89

Index

Numbers written in italic refer to the page where the corresponding entry is described; numbers underlined refer to the code line of the definition; numbers in roman refer to the code lines where the entry is used.

Symbols

\$ 2162, 2166
\- 610
\@ 1854, 1866, 1869, 1872, 1877, 1975, 1996, 2009
\@@authornotemark 1590, 2773
\@@par 476, 533
\@ACM@acmcpbox 2226, 2230, 3049, 3168
\@ACM@acmcpfalse . . . 169
\@ACM@acmcptrue 226
\@ACM@addtoaddress . 2477, 2505, 2506, 2508
\@ACM@authorsperrow 1677, 2652, 2653, 2705, 2706
\@ACM@badge@skip 1621, 2318, 2414, 2418, 2424, 2436, 2446, 2452, 2461
\@ACM@badge@width 1618, 2317, 2322, 2413, 2417, 2423, 2438, 2445, 2447, 2450, 2462, 2465
\@ACM@badgefalse . . . 1617
\@ACM@badgetrue 1623, 1628
\@ACM@balancefalse 3401, 3425, 3427, 3429, 3441, 3445
\@ACM@checkaffil 2197, 2590, 2621, 2626, 2688, 2693, 2733, 2738
\@ACM@citypresentfalse 2587
\@ACM@citypresenttrue . . . 2491, 2505, 2582
\@ACM@color@frame . . 2223
\@ACM@commabox 2477, 2481, 2482
\@ACM@copyright@check@cc 1888, 2027
\@ACM@countrypresentfalse 2588
\@ACM@countrypresenttrue . . . 2496, 2508, 2584
\@ACM@engagefalse . . 167
\@ACM@engagetrue . . . 223
\@ACM@institution@separator . . . 2755, 2756, 2761
\@ACM@instpresentfalse 2586
\@ACM@instpresenttrue . . . 2489, 2500, 2580
\@ACM@journal@bibstripfalse 232, 1442
\@ACM@journal@bibstriptrue 230, 1428
\@ACM@journalfalse 211, 213, 215, 217, 219, 222
\@ACM@journaltrue . . 203, 205, 207, 209, 225
\@ACM@labelwidth 1001, 1004, 1012, 1017, 1043
\@ACM@maketitle@typesetfalse 1050
\@ACM@maketitle@typesettrue 2073
\@ACM@manuscriptfalse 198
\@ACM@manuscripttrue 196
\@ACM@newfontsfalse 831, 834, 837
\@ACM@newfontstrue . 828
\@ACM@printacmreffalse 95, 227
\@ACM@printfoliostrue 78
\@ACM@resetaffil . . . 2585, 2620, 2625, 2687, 2692, 2732, 2737
\@ACM@reviewtrue . . . 140
\@ACM@screentrue 1166, 1210, 1216, 1226, 1232
\@ACM@sigchiamodefalse 200
\@ACM@sigchiamodetrue 220
\@ACM@timestamptrue 139
\@ACM@title@width 1620, 2411, 2413, 2414, 2417, 2418, 2429, 2443, 2445, 2446, 2454
\@DeclareACMFormat 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49
\@Description@presentfalse . . 873, 876, 951, 2779
\@Description@presenttrue 867, 870
\@M . 476, 515, 533, 542, 3499
\@abstract 1648, 2787, 2794
\@acmArticle 1596, 1599, 2161, 2812, 2813, 2941, 2944, 2964, 2974, 2985, 3053, 3096, 3115, 3125, 3135, 3172
\@acmArticlePage . . . 2940, 2958, 2959, 2968, 2971, 2978, 2982
\@acmArticleSeq 1598, 3079
\@acmBadgeL@image 1630, 1632, 2315, 2317, 2412, 2421, 2423, 2448, 2450
\@acmBadgeL@url . 1629, 1631, 2316, 2422, 2449
\@acmBadgeR@image 1625, 1627, 2320, 2322, 2416, 2435, 2438, 2463, 2465
\@acmBadgeR@url . 1624, 1626, 2321, 2437, 2464
\@acmBooktitle 1448, 2130, 2151, 2828
\@acmCodeDataLink 1738, 1739, 1741, 1743, 2235, 2236
\@acmDOI . . 1614, 2153, 2156, 2163, 2167, 2836, 2997, 2999, 3021, 3023, 3054, 3173
\@acmEditors 1456, 1457, 1458, 1461, 2829, 2830
\@acmISBN 1612, 2165
\@acmMonth 1602, 1604, 2161
\@acmNumber 1594, 2825, 2964, 2974, 2985, 3052, 3115, 3125, 3135, 3171
\@acmPrice 1608, 2162, 2166
\@acmPubDate 1604, 2825, 2964,

2974, 2985, 3054, 3116, 3126, 3136, 3173
\@acmSubmissionID 1482, 1483, 1502, 1503, 1610, 2921, 2922, 2932
\@acmVolume 1592, 2825, 2963, 2973, 2984, 3052, 3114, 3124, 3134, 3171
\@acmYear . . 1600, 1607, 2046, 2130, 2161, 2816
\@acmdefinitionbodyfont . . . 3312, 3324, 3338
\@acmdefinitionheadfont . . . 3314, 3326, 3340
\@acmdefinitionindent . . . 3313, 3325, 3339
\@acmdefinitionnotefont . . . 3315, 3327, 3343
\@acmengagemetadata . . . 2067, 2069, 2849
\@acmownedfalse 1797, 1800, 1803, 1809, 1813, 1816, 1819, 1822, 1828, 1831, 1835, 1839
\@acmownedtrue 1784, 1793, 1825
\@acmplainbodyfont . . . 3280, 3292, 3306
\@acmplainheadfont . . . 3282, 3294, 3308
\@acmplainindent 3281, 3293, 3307
\@acmplainnotefont . . . 3283, 3295, 3311
\@adddotafter 3187, 3188, 3190, 3202, 3217, 3221, 3274
\@additionalaffiliation 1528, 1529
\@addpunct . 2759, 2845, 2846, 3274, 3275, 3395
\@addspaceafter 3275
\@affiliationfont 2539, 2544, 2548, 2551, 2554, 2557, 2560, 2563, 2566, 2569, 2621, 2644
\@afterheading . 507, 2219
\@afterindentfalse 453, 2218
\@afterindenttrue . . 451
\@article@string 2812, 2825, 2833
\@author 1481, 1487, 1494, 2606, 2671, 2718, 2762
\@authorfont 2538, 2543, 2547, 2550, 2553, 2556, 2559, 2562, 2565, 2568, 2608, 2644
\@authornotemark 1582, 1588, 2772
\@authornotes 1579, 1583, 2093
\@authorsaddresses 1554, 2102, 2241, 2767, 2846
\@auxout 646
\@begindocumenthook 642
\@beginmaketitlehook . . . 2063, 2066, 2072
\@botnum 2216
\@citestyle 308
\@classname 24, 26, 35, 53, 55, 56, 61, 63, 64, 69, 71, 72, 77, 80, 81, 86, 88, 89, 94, 100, 101, 105, 109, 114, 116, 117, 122, 124, 125, 130, 132, 133, 138, 142, 143, 161, 171, 177, 183, 260, 419, 443, 829, 832, 835, 872, 881, 884, 954, 1167, 1211, 1217, 1227, 1233, 1423, 1425, 1472, 1527, 1541, 1635, 1641, 1646, 1653, 1655, 1656, 1659, 1661, 1662, 1665, 1673, 1675, 1676, 1678, 1679, 1727, 1775, 1890, 1894, 1897, 2592, 2595, 2598, 2768, 2782, 2809, 3503, 3506, 3513
\@clubpenalty 521
\@concepts . 1747, 1759, 1773, 2181, 2183, 2201
\@copyrightowner 1848, 2137
\@copyrightpermission . . . 1904, 2113, 2125
\@copyrightyear 2045, 2137, 2139
\@currbox . . . 980, 981, 982
\@currentaffiliation 2645, 2648, 2670, 2677, 2678, 2681, 2684, 2685, 2690, 2717, 2724, 2725, 2727, 2729, 2730, 2735
\@currentaffiliations 2574, 2575, 2576, 2578, 2604, 2616, 2617, 2623
\@currentauthors 2572, 2573, 2603, 2607, 2608, 2610, 2644, 2647, 2669, 2671, 2672, 2674, 2716, 2718, 2719, 2721, 2772, 2773
\@currentlabel . 560, 574
\@dblarg 462
\@dblfloat 963
\@department . . 1532, 1533
\@dotsep 3279
\@editorsAbbrev 1455, 1460, 2830
\@empty 155, 234, 378, 418, 466, 1439, 1457, 1479, 1482, 1500, 1502, 1507, 1508, 1514, 1638, 1639, 1695, 1696, 1702, 1709, 1738, 1747, 1773, 2064, 2097, 2102, 2153, 2162, 2165, 2166, 2167, 2178, 2181, 2187, 2191, 2235, 2238, 2241, 2275, 2315, 2320, 2412, 2416, 2421, 2432, 2435, 2448, 2456, 2463, 2473, 2495, 2574, 2607, 2615, 2616, 2671, 2677, 2684, 2718, 2724, 2729, 2767, 2775, 2812, 2817, 2829, 2836, 2921, 2932, 2997, 2999, 3021, 3023, 3053, 3054, 3172, 3173, 3283, 3315, 3464, 3481

\@endfloatbox 966
\@endpefalse 3397
\@endwidefloatbox 966, 974
\@finalstrut . . . 565, 578
\@float 968
\@flushglue 3231
\@fnsymbol 2083
\@folio@ht 3059, 3086, 3092, 3093
\@folio@max 3059, 3082, 3083
\@folio@voffset 3059, 3088
\@folio@wd 3059, 3093, 3094, 3121, 3131
\@folioblob 3079, 3118, 3120, 3128, 3129
\@footnotemark . 582, 2081
\@footnotemark@nolink 582, 2081
\@footnotetext 556, 583, 2082
\@footnotetext@nolink 583, 2082
\@for 284
\@formatdoi 1887, 2156, 2163, 2167, 2836, 2997, 2999, 3021, 3023, 3054, 3173
\@fps 967
\@fpsadddefault 967
\@gobble 306, 350
\@hangfrom 475, 532
\@headfootfont 2934, 2958, 2959, 2960, 2961, 2967, 2970, 2977, 2981, 2989, 2990, 2996, 2998, 3002, 3005, 3013, 3014, 3020, 3022, 3026, 3029
\@idxitem 3496
\@ifnextchar 1532
\@ifnotempty 2051
\@ifnum 322, 324
\@ifstar 460
\@ifundefined 3348, 3351, 3354, 3357, 3360, 3364, 3367
\@iiiparbox 792
\@indextitlestyle . . 3495
\@input 544
\@insideauthorgroupfalse 1470, 1522
\@insideauthorgrouptrue 1477
\@journalCode 1051, 1167, 1211, 1217, 1227, 1233, 1423
\@journalCode@nr 1051, 1123, 1429
\@journalName 1125, 1129, 1133, 1137, 1141, 1145, 1149, 1154, 1158, 1162, 1169, 1173, 1177, 1181, 1186, 1190, 1194, 1198, 1203, 1207, 1213, 1219, 1223, 1229, 1235, 1239, 1243, 1248, 1252, 1256, 1260, 1264, 1268, 1272, 1276, 1280, 1284, 1288, 1292, 1296, 1300, 1304, 1308, 1312, 1316, 1320, 1324, 1328, 1332, 1336, 1340, 1344, 1348, 1353, 1358, 1362, 1366, 1371, 1375, 1379, 1383, 1387, 1391, 1395, 1399, 1403, 1407, 1411, 1415, 1419, 1430, 1431, 2149, 3052, 3171
\@journalNameShort 1126, 1130, 1134, 1138, 1142, 1146, 1150, 1155, 1159, 1164, 1170, 1174, 1178, 1182, 1187, 1191, 1195, 1199, 1204, 1208, 1214, 1220, 1224, 1230, 1236, 1240, 1244, 1249, 1253, 1257, 1261, 1265, 1269, 1273, 1277, 1281, 1285, 1289, 1293, 1297, 1301, 1305, 1309, 1313, 1317, 1321, 1325, 1329, 1333, 1337, 1341, 1345, 1349, 1354, 1359, 1363, 1367, 1372, 1376, 1380, 1384, 1388, 1392, 1396, 1400, 1404, 1408, 1412, 1416, 1420, 1431, 2824, 2963, 2973, 2984, 3114, 3124, 3134
\@keywords 1637, 1638, 1639, 2187, 2189, 2202, 2238, 2239
\@latex@error 352
\@lempty 1650, 2787
\@listI 1025, 1029
\@listi 1022, 1029
\@listii 1030
\@listiii 1033
\@listiv 1035
\@listv 1037
\@listvi 1039
\@m 464
\@makefnmark . . . 555, 580, 2085, 2090, 2094
\@makefntext 555, 564, 577, 2096
\@marginfigure . 946, 947
\@margintable . . 957, 958
\@minipagefalse . 789, 976
\@minus 3207, 3211, 3215, 3219, 3223, 3228, 3303, 3305, 3335, 3337
\@mkabstract . . 2177, 2786
\@mkauthors 2086, 2088, 2510
\@mkauthors@i 2514, 2516, 2518, 2520, 2534, 2602
\@mkauthors@ii 2637
\@mkauthors@iii 2522, 2524, 2526, 2528, 2532, 2649
\@mkauthors@iv 2530, 2702
\@mkauthorsaddresses 1555, 2746
\@mkbibcitation 2212, 2803
\@mkteasers . . . 2086, 2774
\@mktitle 2086, 2331
\@mktitle@i 2334, 2336, 2338, 2340, 2354, 2407
\@mktitle@ii 2441
\@mktitle@iii 2342, 2344, 2346, 2348, 2352, 2441
\@mktitle@iv . . 2350, 2469
\@mktranslatedabstract 441, 2796
\@mktranslatedkeywords 438, 1556
\@mpargs 792

\@mparswitchfalse . . 738
\@mpfootins 569, 570, 784, 785, 787
\@mpfootnotetext . . . 568
\@ne . 310, 314, 318, 320, 632, 2863, 2869, 2873
\@nil 329
\@nobreakfalse . 509, 549
\@noskipsecfalse . . . 513
\@noskipsectrue 510
\@pages@word 2806, 2826, 2833
\@par 2099, 2106
\@parboxrestore 573
\@parfont 3221, 3225, 3230, 3235
\@permissionCodeOne 1127, 1131, 1135, 1139, 1143, 1147, 1151, 1156, 1160, 1165, 1171, 1175, 1179, 1183, 1188, 1192, 1196, 1200, 1205, 1209, 1215, 1221, 1225, 1231, 1237, 1241, 1245, 1250, 1254, 1258, 1262, 1266, 1270, 1274, 1278, 1282, 1286, 1290, 1294, 1298, 1302, 1306, 1310, 1314, 1318, 1322, 1326, 1330, 1334, 1338, 1342, 1346, 1350, 1355, 1360, 1364, 1368, 1373, 1377, 1381, 1385, 1389, 1393, 1397, 1401, 1405, 1409, 1413, 1417, 1421, 1432, 2161
\@permissionCodeTwo 1152, 1184, 1201, 1246, 1351, 1356, 1369, 1433
\@plus 542, 550, 793, 3207, 3211, 3215, 3219, 3223, 3228, 3302, 3304, 3334, 3336, 3392, 3497
\@printcopyrightfalse 1796, 1808
\@printcopyrighttrue 1780, 1792
\@printendtopmatter 2217, 2838
\@printpermissionfalse 1795
\@printpermissiontrue . . . 1782, 1791, 1807
\@printtopmatter 2087, 2274
\@proofindent 3374, 3384, 3394
\@proofnamefont 3373, 3383, 3395
\@received . 1693, 1696, 1697, 1699, 1702, 1703, 1705, 1709, 1710
\@restonecolfalse . . 3493
\@restonecoltrue . . . 3493
\@rightskip . . . 3231, 3232
\@saveabstract 1644, 1645
\@saveteaser . . 2048, 2049
\@savetranslatedabstract 441, 442
\@seccntformat . 469, 526
\@secfont 3209, 3235
\@secpenalty 458
\@sect 462, 463
\@setaddresses 2771
\@setauthorsaddresses . . . 2106, 2241, 2846
\@setengagemetadata 2070, 2848
\@setthanks . . . 2099, 2845
\@shortauthors 2929, 2952, 2960, 2968, 2978, 2990, 3014
\@sidebar 942, 943
\@specialsection . . . 1558, 2182, 2188, 2244
\@ssect 461, 527
\@startPage 1633, 2275, 2276, 2278, 2926
\@startsection . 447, 539, 3206, 3210, 3214, 3218, 3222, 3227
\@starttoc 539
\@subparfont 3260
\@subsecfont . . 3213, 3235
\@subsubsecfont 3217, 3235
\@subtitle . 1463, 1571, 2432, 2433, 2456, 2457, 2473, 2474, 2817
\@subtitlefont 2382, 2433, 2457, 2474
\@subtitlenotes 1569, 1573, 1576, 2092
\@svsec . 466, 469, 475, 490
\@svsechd . . . 488, 516, 536
\@teaser 2049, 2776
\@teaserfigures 2047, 2049, 2775, 2780
\@tempa 284, 285, 287, 289, 291, 293, 295, 297, 299, 301, 303, 305, 307, 309, 311, 313, 315, 317, 319, 321, 323, 325, 327, 329, 332, 334, 336, 338, 340, 342, 1506, 1507, 1694, 1695, 2494, 2495, 2615, 3464, 3480, 3481, 3483, 3487
\@tempb 285, 287, 289, 291, 293, 295, 297, 299, 301, 303, 305, 307, 309, 311, 313, 315, 317, 319, 321, 323, 325, 327, 332, 334, 336, 338, 340, 342, 3482, 3483, 3486, 3487
\@tempboxa . 792, 2284, 2286
\@tempc . 330, 331, 333, 335, 337, 339, 341, 343
\@tempcnta . 3079, 3080, 3082, 3083, 3085, 3087
\@tempdima 2280, 2281, 2282, 2288, 2289, 2290, 3086, 3087, 3088, 3090
\@tempskipa 450, 452, 453, 458, 471, 472, 503, 504, 506, 518, 519, 528, 529
\@textbottom 793
\@textsuperscript 580, 2085, 2090
\@texttop 794
\@thefnmark . 561, 575, 580, 2085, 2090, 2095
\@title . . . 1562, 2200, 2431, 2455, 2472, 2816
\@titlefont 2357, 2420, 2430, 2442, 2454, 2470
\@titlenotes 1560, 1564, 1567, 2091
\@tochangmeasure 480, 493

\@toclevel 464
\@tocline . . . 552, 553, 554
\@topnum 2214
\@translatedabstracts . 439, 446, 2178, 2179
\@translatedkeywords . 436, 438, 2191, 2192
\@translatedsubtitle 433, 435, 2433, 2457, 2474
\@translatedtitle 430, 432, 2431, 2455, 2472
\@typeset@author@bx 2641, 2695, 2701, 2740, 2745
\@typeset@author@line 2571, 2605, 2629, 2634
\@typesetengagemetadata 2175, 2847
\@undefined 642, 860, 1450, 2063
\@undescribed@imagesfalse 869
\@undescribed@imagestrue . . 880, 883, 953, 2781
\@vspace 874, 877, 885, 887, 889, 891, 893, 895, 897, 899, 901, 903, 943, 948, 958, 964, 2079, 2245, 2271, 2804, 2839, 2842, 3501, 3503, 3509
\@vspace@acm 2271, 2842, 3509
\@vspace@orig 874, 877, 885, 887, 889, 891, 893, 895, 897, 899, 901, 903, 943, 948, 958, 964, 2079, 2245, 2804, 2839, 3501
\@vspacer 875, 878, 886, 888, 890, 892, 894, 896, 898, 900, 902, 904, 944, 949, 959, 965, 2080, 2246, 2272, 2805, 2840, 2843, 3502, 3506, 3510
\@vspacer@acm 2272, 2843, 3510
\@vspacer@orig . 875, 878, 886, 888, 890, 892, 894, 896, 898, 900, 902, 904, 944, 949, 959, 965, 2080, 2246, 2805, 2840, 3502
\@width 773, 780
\@xp 546, 547
\@xsect 501, 502, 538
\\ 663, 672, 1482, 1741, 2031, 2137, 2142, 2157, 2162, 2166, 2236, 2808, 2816, 2868, 3054, 3173
\{ 292
\} 292
\␣ . . . 1453, 1755, 1765, 2137, 2139, 2162, 2812, 2813, 2831, 2926

A

\abstract 1644
abstract (env.) *18*
\abstractname . . 376, 389, 2788, 2792, 2800
\acks 3455
acks (env.) *24*
\acksname 387, 398, 406, 414, 3454, 3457, 3458
\ACM@adddotafter 3188, 3205
\ACM@ArticleType 1712, 3047, 3166
\ACM@ArticleType@nr 1712, 1714, 3045, 3164
\ACM@cc@type . . . 1846, 2028, 2030, 2031, 2034, 2035, 2036, 2037, 2038, 2039, 2040
\ACM@CC@Url 2029, 2030, 2031, 2032
\ACM@cc@version 1845, 2030, 2041
\acm@copyrightinput 1786
\acm@copyrightmode 1786, 1794, 1799, 1802, 1806, 1812, 1815, 1818, 1821, 1824, 1827, 1830, 1834, 1838, 1849, 1905, 2112
\ACM@fontsize 146, 234, 237, 239, 241, 243, 245, 247, 249, 251, 253, 255, 257, 260, 261
\ACM@format 32, 161
\ACM@format@nr . . 32, 161, 170, 176, 182, 195, 201, 235, 593, 678, 757, 795, 915, 984, 2247, 2294, 2332, 2358, 2383, 2512, 2540, 2884, 2948, 3066, 3105, 3151, 3240, 3284, 3316, 3375, 3402, 3423
\ACM@lang@check 417, 431, 434, 437, 445
\ACM@languages 153, 378, 380, 418
\ACM@linecount 2862, 2863, 2868, 2869, 2872, 2873
\ACM@linecount@bx 2859, 2879, 2909
\ACM@linecount@bxht 2861, 2867, 2870, 2871
\ACM@linecountL 2875, 2950, 2953, 2958, 2961, 2967, 2969, 2977, 2979, 2989, 2992, 2996, 3002, 3013, 3016, 3020, 3026, 3048, 3107, 3118, 3119, 3129, 3130, 3138, 3141, 3146, 3167
\ACM@linecountR . 2882, 2980, 2982, 2990, 2993, 3000, 3007, 3014, 3017, 3024, 3031, 3139, 3142, 3147
\ACM@mk@linecount 2864, 2877, 2892, 2894, 2896, 2898, 2900, 2902, 2904
\ACM@NR@adjustedSectionformat 3185, 3194
\ACM@NRadjust 3176, 3209, 3213, 3217, 3221, 3225, 3230
\ACM@origbaselinestretch 3511
\ACM@ps@headings 2853, 2857
\ACM@ps@myheadings 2852, 2856
\ACM@ps@plain . 2851, 2855
\ACM@restore@pagestyle 2851
\ACM@sect@format 3195, 3197

\ACM@sect@format@ . . . 3184, 3197, 3199
\ACM@sect@format@null 3198, 3199
\ACM@timestamp 2912, 3039, 3152, 3157
\acmArticle 14, 1596
\acmArticleSeq . 15, 1598
\acmArticleType . 20, 1712
\acmBadgeL 15, 1628
\acmBadgeR 15, 1623
\acmBooktitle . . . 9, 1448
\acmCodeLink 20, 1737, 1744
\acmConference . . 9, 1434
\acmConference@date 1437, 2132, 3004, 3007, 3028, 3031
\acmConference@name 1436, 1450, 1451, 1452
\acmConference@shortname 1435, 1439, 1440, 1452, 1453, 2132, 3003, 3006, 3027, 3030
\acmConference@venue 1438, 2132, 3004, 3007, 3028, 3031
\acmDataLink . . . 20, 1744
\acmdefinition 3333
\acmDOI 15, 1614
\acmISBN 15, 1612
\acmJournal 9, 1427
\acmMonth 14, 1602
\acmNumber 14, 1594
\acmplain 3301
\acmPrice 15, 1608, 1804, 1810, 1832, 1836, 1840
\acmSubmissionID 15, 1610
\acmVolume 14, 1592
\acmYear 14, 1600
\addcontentsline 280, 482, 495, 2788, 3458
\additionalaffiliation 11, 1528
\addpenalty 458
\addresses 1479, 1481, 1486, 1493, 1524, 1544, 1582, 1588, 1590, 2634, 2701, 2745, 2764
\addto . . 381, 392, 400, 408
\addtocounter . . 586, 1767
\addtolength 1010, 1011, 1012, 1016, 1017, 2870
\addvspace 458, 550
\advance 1026, 1031, 1034, 1036, 1038, 1040, 1474, 1476, 1733, 2281, 2289, 2409, 2413, 2414, 2417, 2418, 2445, 2446, 2631, 2651, 2668, 2704, 2715, 2869, 2873, 3083, 3085, 3088
\affiliation 10, 1521, 2614, 2684, 2729
\and 1461, 1494, 1496, 1511, 1517, 2605, 2610, 2612, 2623, 2629, 2642, 2676, 2695, 2701, 2723, 2740, 2745, 2761
\andify 2207, 2208, 2572, 2575, 2830
\anon 24, 2057
anonsuppress (env.) . . . 24
\apptocmd 3503, 3506
\AtBeginDocument . 78, 95, 227, 635, 643, 1002, 1804, 1810, 1832, 1836, 1840, 2858, 2935, 3099, 3200
\AtBeginEnvironment . . . 873, 876, 885, 887, 889, 891, 893, 895, 897, 899, 901, 903
\AtBeginMaketitle 31, 2066
\AtEndDocument 871, 1639, 1663, 1708, 1773, 2222, 2766, 3449, 3512
\AtEndEnvironment 879, 882
\AtEndPreamble . 608, 861, 3345, 3399, 3465
\author 10, 1471, 2075, 2076, 2810
\author@bx 2637, 2643, 2646
\author@bx@sep 2639, 2646, 2651, 2668, 2704, 2715
\author@bx@wd 2638, 2641, 2650, 2651, 2653, 2659, 2661, 2663, 2665, 2668, 2703, 2704, 2706, 2712, 2715
\authornote 14, 1528, 1580, 2811
\authornotemark . 14, 1586
\authors 1484, 1489, 1496, 2195, 2207, 2209, 2816
\authorsaddresses 14, 1554

B

\balance 3452
\baselineskip 2123, 2422, 2437, 2449, 2464, 2870, 3207, 3208, 3211, 3212, 3215, 3219, 3223, 3302, 3303, 3304, 3305, 3334, 3335, 3336, 3337
\baselinestretch 3511, 3512, 3514
\begin . 19, 2878, 2908, 3089
\begingroup 473, 516, 530, 539, 631, 2078, 2510, 3177, 3456
\bfseries 1041, 2119, 2360, 2362, 2364, 2368, 2370, 2372, 2374, 2376, 2378, 2380, 2559, 2562, 2814, 3096, 3235, 3236, 3250, 3251, 3253, 3254, 3256, 3257, 3258, 3259, 3263, 3264, 3267, 3268, 3270, 3271, 3294, 3326
\bgroup . 446, 943, 947, 958, 964, 1529, 1556, 2181, 2187, 2228, 2641, 2678, 2681, 2742, 2751, 2776, 2786, 2803, 2815
\bibfont 282
\bibliofont 282
\bibliographystyle . 641
\bibsection 278
\bibstyle 306, 308, 350, 646
\bibstyle@acmauthoryear 356
\bibstyle@acmnumeric 362
\bigskip . . 1710, 2312, 2440, 2468, 2476, 2701, 2745, 2776, 2841
\box 981, 2296, 2298, 2300, 2302, 2304, 2306, 2308,

2310, 2312, 2326, 2328, 2646, 3049, 3168

C

\c@footnote 2083
\c@secnumdepth 465, 479, 483, 492, 496
\captionsenglish . . . 381
\captionsetup . . 907, 909, 911, 913, 922, 924, 927, 929, 932, 934, 944, 950, 959, 2777
\captionsfrench 392
\captionsgerman 400
\captionsspanish . . . 408
\ccdesc@parse@finish 1778
\ccsdesc *16*, 1749
\ccsdesc@parse 1750, 1751
\ccsdesc@parse@end 1750, 1778
\ccsdesc@parse@finish 1772, 1778
CCSXML (env.) *16*
\centering 543, 576, 662, 671, 951, 960, 2442, 2454, 2643, 2700, 3095
\changes 146
\cite . . . 624, 625, 636, 640
\citeA 630
\citealt 629
\citeANP 626
\citeauthor 626
\citeN 624
\citename 637
\citeNN 627
\citeNP 629
\citep 625
\citestyle . . . *25*, 348, 368
\citeyear 628
\citeyearNP 628
\citeyearpar . . . 627, 640
\city . . *11*, 1535, 2485, 2757
\ClassError 35, 419, 443, 1425, 1527, 1646, 1656, 1662, 1676, 1727, 1897, 2598, 2809, 3513
\ClassInfo . . 161, 260, 1423, 1653, 1655, 1659, 1661, 1673, 1675, 1678, 1890, 1894
\ClassWarning 26, 171, 177, 183, 829, 832, 835, 881, 884, 954, 1472, 1541, 1635, 1679, 2782, 3503, 3506
\ClassWarningNoLine . 872, 1641, 1665, 1775, 2592, 2595, 2768
\cleaders 2482
\clearpage 2287
\clubpenalty . . . 515, 521
\CodelineIndex 16
\Collect@Body 440, 942, 946, 957, 1644, 2048
\color 2059, 2121, 2868, 2872, 3046, 3165
\color@begingroup 563, 576
\color@endbox 979
\color@endgroup 566, 579, 790
\colorbox . 1732, 3046, 3165
\colorlet 1716, 1718, 1720, 1722, 1724
\columnsep 3494
\columnseprule 3494
\columnwidth . . . 572, 773, 965, 2703, 2742
\contentsnamefont . . 543
\copy 2482
\copyright 2137
\copyrightpermissionfootnoterule 772
\copyrightyear . *18*, 2045
\country *11*, 1538, 2485, 2760
\csname 350, 478, 480, 484, 491, 493, 497, 526, 546, 547, 561, 575, 1488, 1495, 1548, 1551, 1754, 1755, 1757, 1758, 1759, 1760, 1761, 1764, 1766, 2204, 2206, 3178, 3201
\CurrentOption 148, 149, 150, 151, 152, 158, 159

D

\day 2924
\DeclareNewFootnote 776, 778
\DeclareOptionX 38, 148, 149, 150, 151, 152, 154, 158, 159
\DeclareRobustCommand 630, 3197
\DeclareTextFontCommand 862
\def 24, 38, 147, 153, 237, 239, 241, 243, 245, 247, 249, 251, 253, 255, 257, 285, 287, 289, 291, 293, 295, 297, 299, 301, 303, 305, 307, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 321, 323, 325, 327, 328, 332, 334, 336, 338, 340, 342, 430, 433, 436, 439, 442, 447, 463, 488, 502, 526, 527, 536, 539, 552, 553, 554, 555, 557, 568, 580, 586, 587, 588, 589, 590, 610, 641, 772, 779, 781, 793, 943, 947, 958, 964, 967, 971, 974, 992, 993, 994, 995, 1025, 1030, 1033, 1035, 1037, 1039, 1125, 1126, 1127, 1129, 1130, 1131, 1133, 1134, 1135, 1137, 1138, 1139, 1141, 1142, 1143, 1145, 1146, 1147, 1149, 1150, 1151, 1152, 1154, 1155, 1156, 1158, 1159, 1160, 1162, 1164, 1165, 1169, 1170, 1171, 1173, 1174, 1175, 1177, 1178, 1179, 1181, 1182, 1183, 1184, 1186, 1187, 1188, 1190, 1191, 1192, 1194, 1195, 1196, 1198, 1199, 1200, 1201, 1203, 1204, 1205, 1207, 1208, 1209, 1213, 1214, 1215, 1219, 1220, 1221, 1223, 1224, 1225, 1229, 1230, 1231, 1235, 1236, 1237, 1239, 1240, 1241, 1243,

1244, 1245, 1246, 1248, 1249, 1250, 1252, 1253, 1254, 1256, 1257, 1258, 1260, 1261, 1262, 1264, 1265, 1266, 1268, 1269, 1270, 1272, 1273, 1274, 1276, 1277, 1278, 1280, 1281, 1282, 1284, 1285, 1286, 1288, 1289, 1290, 1292, 1293, 1294, 1296, 1297, 1298, 1300, 1301, 1302, 1304, 1305, 1306, 1308, 1309, 1310, 1312, 1313, 1314, 1316, 1317, 1318, 1320, 1321, 1322, 1324, 1325, 1326, 1328, 1329, 1330, 1332, 1333, 1334, 1336, 1337, 1338, 1340, 1341, 1342, 1344, 1345, 1346, 1348, 1349, 1350, 1351, 1353, 1354, 1355, 1356, 1358, 1359, 1360, 1362, 1363, 1364, 1366, 1367, 1368, 1369, 1371, 1372, 1373, 1375, 1376, 1377, 1379, 1380, 1381, 1383, 1384, 1385, 1387, 1388, 1389, 1391, 1392, 1393, 1395, 1396, 1397, 1399, 1400, 1401, 1403, 1404, 1405, 1407, 1408, 1409, 1411, 1412, 1413, 1415, 1416, 1417, 1419, 1420, 1421, 1427, 1429, 1430, 1431, 1432, 1433, 1448, 1455, 1456, 1457, 1463, 1506, 1528, 1529, 1530, 1531, 1532, 1533, 1546, 1554, 1560, 1561, 1569, 1570, 1579, 1580, 1592, 1594, 1596, 1598, 1600, 1602, 1604, 1608, 1610, 1612, 1614, 1624, 1625, 1626, 1627, 1629, 1630, 1631, 1632, 1633, 1635, 1637, 1645, 1650, 1681, 1693, 1694, 1729, 1731, 1737, 1743, 1751, 1752, 1778, 1842, 1845, 1846, 1848, 1887, 1888, 1904, 2029, 2045, 2047, 2049, 2066, 2067, 2068, 2072, 2085, 2090, 2099, 2106, 2197, 2227, 2244, 2274, 2331, 2357, 2382, 2407, 2441, 2469, 2478, 2485, 2486, 2488, 2489, 2491, 2492, 2494, 2499, 2500, 2504, 2505, 2507, 2508, 2510, 2538, 2539, 2543, 2544, 2547, 2548, 2550, 2551, 2553, 2554, 2556, 2557, 2559, 2560, 2562, 2563, 2565, 2566, 2568, 2569, 2571, 2573, 2578, 2585, 2590, 2602, 2603, 2604, 2606, 2613, 2614, 2615, 2641, 2642, 2649, 2671, 2677, 2684, 2702, 2718, 2724, 2729, 2746, 2752, 2753, 2754, 2756, 2757, 2758, 2760, 2761, 2762, 2763, 2771, 2772, 2773, 2774, 2776, 2786, 2796, 2803, 2806, 2807, 2808, 2809, 2812, 2816, 2838, 2845, 2846, 2847, 2848, 2854, 2864, 2875, 2882, 2929, 2934, 2940, 3065, 3072, 3077, 3079, 3176, 3180, 3182, 3184, 3194, 3198, 3205, 3231, 3235, 3236, 3237, 3238, 3244, 3245, 3247, 3248, 3250, 3251, 3253, 3254, 3256, 3257, 3258, 3259, 3260, 3263, 3264, 3267, 3268, 3270, 3271, 3274, 3275, 3280, 3281, 3282, 3283, 3292, 3293, 3294, 3295, 3312, 3313, 3314, 3315, 3324, 3325, 3326, 3327, 3373, 3374, 3383, 3384, 3462, 3464, 3480, 3481, 3482, 3486, 3493

\define@boolkey 51, 59, 67, 75, 84, 92, 104, 108, 112, 120, 128, 136, 1526, 1651, 1657, 1671

\define@choicekey 32, 1051, 1712, 1785

\define@cmdkey 1677

\definecolor 650, 651, 652, 653, 654, 655, 656, 657

\department *11*, 1532, 2485, 2759

\Description *23*, 870

\description 1042

\descriptionlabel 1041, 1044

\detokenize 1472

\dimexpr 962, 981, 3036, 3045, 3164

\divide 2653, 2659, 2661, 2663, 2665, 2706, 2712

\do 284, 610

\do@url@hyp 610

\DocInput 20

\documentclass 8, 424, 426

\dots 2166

\dp 2281, 2289

E

\edef 148, 149, 150, 151, 152, 464, 2030

\editor *9*, 1457

\egroup 446, 791, 945, 956, 960,

972, 978, 1539, 1559, 2183, 2189, 2243, 2645, 2679, 2682, 2745, 2765, 2777, 2795, 2816, 2837

\else . . . 54, 62, 70, 79, 87, 99, 115, 123, 131, 141, 197, 231, 330, 351, 372, 379, 384, 395, 403, 411, 457, 464, 467, 479, 483, 487, 492, 496, 508, 520, 535, 618, 634, 640, 642, 665, 667, 784, 848, 853, 879, 882, 912, 952, 1418, 1444, 1450, 1452, 1459, 1475, 1482, 1485, 1491, 1492, 1502, 1505, 1510, 1513, 1516, 1523, 1543, 1566, 1575, 1581, 1589, 1639, 1654, 1660, 1663, 1674, 1685, 1688, 1698, 1701, 1704, 1709, 1740, 1763, 1768, 1769, 1770, 1773, 1892, 1896, 2054, 2060, 2086, 2097, 2101, 2102, 2103, 2115, 2116, 2124, 2127, 2128, 2131, 2138, 2143, 2150, 2155, 2158, 2159, 2162, 2164, 2165, 2166, 2167, 2178, 2181, 2186, 2187, 2191, 2235, 2238, 2241, 2277, 2315, 2320, 2412, 2416, 2421, 2432, 2435, 2448, 2456, 2463, 2473, 2479, 2480, 2495, 2497, 2498, 2499, 2501, 2503, 2504, 2507, 2574, 2591, 2594, 2597, 2609, 2615, 2622, 2643, 2654, 2664, 2673, 2680, 2689, 2707, 2711, 2720, 2726, 2734, 2748, 2750, 2766, 2775, 2780, 2787, 2791, 2799, 2806, 2812, 2817, 2818, 2827, 2829, 2836, 2921, 2932, 2933, 2943, 2954, 2962, 2972, 2983, 2987, 2994, 2997, 2999, 3001, 3011, 3018, 3021, 3023, 3025, 3053, 3054, 3080, 3109, 3113, 3123, 3133, 3140, 3145, 3153, 3156, 3172, 3173, 3181, 3205, 3464, 3469, 3476, 3485, 3489, 3512

\email *10*, 1540, 2613, 2677, 2724, 2763

\emph 2149, 2151

\empty 2941

\EnableCrossrefs 18

\end . . . 21, 2880, 2910, 3097

\end@ACM@color@frame 2222

\end@dblfloat 970

\end@float 972

\endcsname 349, 350, 478, 480, 484, 491, 493, 497, 526, 546, 547, 561, 575, 1488, 1495, 1549, 1552, 1754, 1755, 1757, 1758, 1759, 1760, 1761, 1764, 1766, 2204, 2206, 3178, 3201

\enddescription 1048

\endgroup . . . 477, 516, 534, 549, 2174, 2536, 3180, 3182, 3460

\endlist 1046, 1048

\endMakeFramed 1733

\endminipage 781

\endtrivlist 3397

\enspace 3275

environments:

abstract *18*

acks *24*

anonsuppress *24*

CCSXML *16*

marginfigure *33*

margintable *33*

printonly *23*

screenonly *23*

sidebar *33*

teaserfigure *18*

translatedabstract *21*

\everypar 456, 511, 522, 2790, 2798

\excludecomment . 1746, 3468, 3470, 3474, 3475

\ExecuteOptionsX 50, 58, 66, 74, 83, 91, 103, 107, 111, 119, 127, 135, 145

\expandafter 329, 331, 643, 792, 1486, 1487, 1493, 1494, 1548, 1551, 1754, 1755, 1757, 1758, 1764, 1766, 3178, 3201

F

\familydefault 864

\fancyfoot 2955, 2963, 2973, 2984, 2988, 3012, 3039, 3050, 3051, 3108, 3110, 3114, 3124, 3134, 3143, 3148, 3152, 3157, 3169, 3170

\fancyhead . 2950, 2951, 2952, 2953, 2958, 2959, 2960, 2961, 2967, 2969, 2970, 2977, 2979, 2980, 2981, 2989, 2990, 2992, 2993, 2996, 2998, 3002, 3005, 3013, 3014, 3016, 3017, 3020, 3022, 3026, 3029, 3044, 3049, 3107, 3118, 3119, 3120, 3128, 3129, 3130, 3138, 3139, 3141, 3142, 3146, 3147, 3163, 3168

\fancyheadoffset 3036, 3043, 3121, 3131, 3162

\fancyhf 2937, 3101

\fancypagestyle 2936, 3100

\fi 56, 64, 72, 81, 89, 101, 117, 125, 133, 143, 156, 175, 181, 194, 199, 228, 233, 258, 259, 271, 275, 286, 288, 290, 292, 294, 296,

298, 300, 302, 304, 306, 308, 310, 312, 314, 316, 318, 320, 322, 324, 326, 328, 333, 335, 337, 339, 341, 343, 344, 353, 355, 369, 374, 377, 386, 390, 397, 405, 413, 416, 429, 444, 448, 454, 459, 464, 470, 481, 485, 494, 498, 500, 523, 524, 537, 548, 567, 607, 611, 620, 638, 640, 644, 647, 674, 675, 676, 754, 770, 788, 814, 826, 857, 858, 859, 865, 872, 881, 884, 938, 939, 955, 969, 973, 1000, 1422, 1441, 1447, 1453, 1454, 1462, 1478, 1483, 1490, 1497, 1498, 1503, 1504, 1512, 1518, 1519, 1520, 1525, 1545, 1568, 1578, 1585, 1591, 1607, 1643, 1647, 1656, 1662, 1670, 1676, 1690, 1691, 1700, 1706, 1707, 1711, 1725, 1736, 1742, 1762, 1770, 1771, 1777, 1798, 1801, 1805, 1811, 1814, 1817, 1820, 1823, 1826, 1829, 1833, 1837, 1841, 1886, 1902, 1903, 2044, 2056, 2062, 2065, 2076, 2077, 2086, 2088, 2100, 2107, 2108, 2109, 2110, 2114, 2122, 2125, 2126, 2133, 2134, 2135, 2140, 2152, 2157, 2162, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2175, 2179, 2184, 2185, 2190, 2193, 2194, 2213, 2224, 2237, 2240, 2241, 2270, 2279, 2291, 2319, 2323, 2324, 2329, 2355, 2381, 2406, 2410, 2415, 2419, 2425, 2428, 2434, 2439, 2451, 2453, 2458, 2466, 2467, 2475, 2483, 2496, 2497, 2499, 2501, 2503, 2504, 2507, 2509, 2535, 2570, 2577, 2593, 2596, 2600, 2611, 2627, 2628, 2632, 2643, 2666, 2667, 2675, 2683, 2694, 2713, 2714, 2722, 2728, 2739, 2748, 2750, 2770, 2783, 2785, 2793, 2795, 2801, 2806, 2813, 2817, 2831, 2834, 2835, 2836, 2874, 2881, 2907, 2911, 2923, 2928, 2932, 2933, 2942, 2944, 2945, 2950, 2951, 2956, 2965, 2975, 2986, 2988, 2997, 2999, 3008, 3009, 3010, 3012, 3021, 3023, 3032, 3033, 3034, 3037, 3040, 3053, 3054, 3055, 3078, 3097, 3108, 3111, 3117, 3127, 3137, 3143, 3144, 3148, 3149, 3155, 3158, 3159, 3172, 3173, 3174, 3192, 3203, 3205, 3273, 3278, 3300, 3332, 3370, 3389, 3420, 3421, 3446, 3447, 3453, 3464, 3472, 3478, 3481, 3491, 3492, 3493, 3515

\firstpagestyle 3099

\floatname 941

\flushbottom 800, 802, 804, 806, 808, 811, 813

\footnote 2809

\footnotemark 590, 1562, 1571, 2772, 2773, 2807

\footnoterule 779

\footnotesep . . . 565, 578

\footnotesize 571, 2920, 2934, 2955, 2963, 2973, 2984, 2988, 2996, 3002, 3012, 3051, 3110, 3114, 3124, 3134, 3143, 3148, 3154, 3170, 3500

\footnotetext . . 1565, 1567, 1574, 1577, 1584

\footnotetextauthorsaddresses 2098, 2105

\footnotetextcopyrightpermission 2113, 2117

\footrulewidth 2939, 3042, 3103, 3161

\foreignlanguage 432, 435

\format 32

\FrameCommand 1731

\FrameRestore 1733

\frenchspacing 3516

\fulltextwidth 961, 965, 981

G

\g@addto@macro . 157, 432, 435, 438, 446, 1461, 1493, 1496, 1511, 1517, 1524, 1544, 1562, 1564, 1567, 1571, 1573, 1576, 1582, 1583, 1588, 1590, 1699, 1705, 1741, 1759, 1766, 2049, 2053, 2055, 2066, 2069, 2610, 2623, 2674, 2681, 2690, 2721, 2727, 2735, 2772, 2773

\gdef 156, 1435, 1436, 1437, 1438, 1440, 1448, 1458, 1460, 1481, 1484, 1486, 1489, 1501, 1509, 1515, 1548, 1551, 1648, 1680, 1697, 1703, 1739, 1755, 1757, 1758, 1764, 2276, 2608, 2612, 2617, 2647, 2648, 2669, 2670, 2672, 2676, 2678, 2685, 2716, 2717,

2719, 2723, 2725, 2730, 2755, 2756, 2761
\geometry . . . 680, 683, 690, 697, 704, 711, 718, 725, 732, 741, 748
\getrefnumber 1640, 1664, 1774, 2806
\global 510, 513, 549, 569, 870, 880, 883, 953, 980, 1428, 1442, 1474, 1476, 1477, 1522, 2209, 2210, 2214, 2216, 2230, 2489, 2491, 2496, 2500, 2505, 2508, 2586, 2587, 2588, 2605, 2629, 2633, 2643, 2695, 2698, 2740, 2778, 2781, 2869, 2873, 3401, 3425, 3427, 3429, 3441, 3445
\grantnum *24*, 3463
\grantsponsor . . *24*, 3462

H

\hbox . 580, 2085, 2090, 2481
\headrulewidth 2938, 3102
\hfill 2471, 2872
\href 1550, 1553, 2031, 2032, 2316, 2321, 2422, 2437, 2449, 2464, 2484, 2488
\hrule 773, 780, 2471
\hsize 572, 1733, 2084, 2229, 2407, 2409, 2411, 2441, 2443, 2469, 2511, 2631, 2641, 2697, 2742
\hskip 475, 489, 519, 532, 536, 2318, 2424, 2436, 2452, 2461, 2482, 3394
\hspace . . . 1731, 1915, 1926, 1935, 1960, 1972, 1993, 2646, 2700
\ht 2280, 2288
\Huge . 2366, 2368, 2370, 2372, 2374, 2376, 2378
\hypersetup 613, 619, 621, 2198
\hyphenpenalty 3499

I

\if 330
\if@ACM@acmcp 168, 273, 1734, 2101, 2116, 2186, 2220, 2408, 2426, 2630, 3041, 3160, 3276
\if@ACM@acmthm . 67, 3346
\if@ACM@affiliation@obeypunctuation 1526, 2480, 2497, 2499, 2501, 2502, 2504, 2507
\if@ACM@anonymous 120, 1480, 1492, 1499, 1523, 1543, 1563, 1572, 1581, 2052, 2058, 2074, 2103, 2930, 3473
\if@ACM@authordraft 136, 658, 2118
\if@ACM@authorversion 84, 2124, 2144
\if@ACM@badge 1616, 2313, 2444, 2460
\if@ACM@balance 104, 3422, 3450
\if@ACM@citypresent 2581, 2594
\if@ACM@countrypresent 2583, 2597
\if@ACM@engage . 166, 375, 388, 1893, 2129, 2175, 2995, 3019
\if@ACM@instpresent 2579, 2591
\if@ACM@journal 163, 229, 370, 382, 393, 401, 409, 908, 1444, 1686, 2487, 2766, 2789, 2797
\if@ACM@journal@bibstrip 164, 2104, 2128, 2148, 2160, 2823, 2947, 3104
\if@ACM@maketitle@typeset 442, 1049, 1645
\if@ACM@manuscript 162, 268, 1683, 2127, 2141
\if@ACM@natbib 112, 276, 367, 623
\if@ACM@natbib@override 112
\if@ACM@newfonts 827, 838
\if@ACM@nonacm 92, 667, 1639, 1663, 1773, 1889, 2111, 2159, 2766, 2818, 2954, 2962, 2972, 2983, 2991, 3015, 3109, 3113, 3123, 3133, 3153
\if@ACM@pbalance 108, 3400
\if@ACM@printacmref 1657, 2211
\if@ACM@printccs 1651, 2180
\if@ACM@printfolios 1671, 2942, 2944, 2950, 2951, 2988, 3012, 3108, 3143, 3148
\if@ACM@review 75, 2859, 2876, 2883
\if@ACM@screen 51, 612, 3466
\if@ACM@sigchiamode 165, 556, 666, 863, 963, 970, 2086, 2088, 2643, 3035
\if@ACM@timestamp . . 128, 2912, 3038, 3150
\if@ACM@urlbreakonhyphens 59, 609
\if@acmowned 1783
\if@Description@present 866, 879, 882, 952, 2780
\if@filesw 545, 645
\if@insideauthorgroup 1469, 1475
\if@nobreak 455
\if@noskipsec . . 448, 512
\if@printcopyright 1779, 2136
\if@printpermission 1781, 2125
\if@twocolumn . 3451, 3493
\if@undescribed@images 868, 871
\IfBeginWith 1547
\ifcase . 201, 235, 593, 678, 757, 795, 915, 984, 1123, 1604, 1714, 1849, 1905, 2247, 2294, 2332, 2358, 2383, 2512, 2540, 2655, 2708, 2884, 2948, 3066, 3105, 3240, 3284, 3316, 3375, 3402, 3423
\ifcsname 349

\ifdim . . 452, 472, 504, 529, 2282, 2290, 2871
\IfEq 2028, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041
\IfFileExists 829, 832, 835
\IfInteger 1678
\ifluatex 849
\ifNAT@numbers 640
\ifnum 170, 176, 182, 195, 464, 465, 479, 483, 492, 496, 1640, 1664, 1768, 1769, 1770, 1774, 1794, 1799, 1802, 1806, 1812, 1815, 1818, 1821, 1824, 1827, 1830, 1834, 1838, 2076, 2112, 2652, 2705, 2747, 2749, 2806, 3080, 3082, 3151
\ifPDFTeX 815
\IfSubStr 1472, 1541
\ifvmode 2479
\ifvoid 784
\ifx 155, 234, 285, 287, 289, 291, 293, 295, 297, 299, 301, 303, 305, 307, 309, 311, 313, 315, 317, 319, 321, 323, 325, 327, 332, 334, 336, 338, 340, 342, 378, 418, 642, 1439, 1450, 1452, 1457, 1479, 1482, 1500, 1502, 1507, 1508, 1514, 1587, 1639, 1695, 1696, 1702, 1709, 1738, 1754, 1763, 1773, 2063, 2097, 2102, 2153, 2162, 2165, 2166, 2167, 2178, 2181, 2187, 2191, 2235, 2238, 2241, 2275, 2315, 2320, 2412, 2416, 2421, 2432, 2435, 2448, 2456, 2463, 2473, 2495, 2574, 2607, 2615, 2616, 2671, 2677, 2684, 2718, 2724, 2729, 2767, 2775, 2787, 2812, 2817, 2829, 2836, 2921, 2932, 2941, 2997, 2999, 3021, 3023, 3053, 3054, 3172, 3173, 3178, 3201, 3205, 3464, 3481, 3483, 3487, 3512
\ifxetex 844
\ignorespaces 525, 565, 578, 870, 1530, 1531, 1533, 1546, 2485, 2486, 2488, 2490, 2491, 2492, 2493, 2497, 2754, 2794, 2802, 2808, 2816, 3395
\immediate 547, 646
\includecomment 3467, 3471, 3477
\includegraphics . . . 2031, 2317, 2322, 2423, 2438, 2450, 2465
\indent 3374
\input 816
\InputIfFileExists . . 25
\institution *11*, 1531, 2485, 2756
\interfootnotelinepenalty 559
\interlinepenalty 476, 533, 559
\item 3394, 3496
\itshape 2130, 2132, 3237, 3238, 3259, 3260, 3280, 3292, 3314, 3383

J

\jobname 544, 547

K

\kern 772, 773, 779, 780, 2471
\keywords *16*, 1637
\keywordsname 371, 373, 383, 385, 394, 396, 402, 404, 410, 412, 1558, 2188

L

\l@section 552
\l@subsection . . 552, 553
\l@subsubsection . . . 554
\labelenumi 992
\labelenumii 993
\labelenumiii 994
\labelenumiv 995
\labelsep 1003, 1011, 1016, 1026, 1031, 1034, 1036, 1038, 1040, 3394
\labelwidth 1026, 1031, 1034, 1036, 1038, 1040, 1043
\LARGE 2360, 2362, 2364, 2380, 2391, 2393, 2395, 2397, 2399, 2403, 2547, 2550, 2565, 3096
\Large 2232, 2538, 2556, 3250, 3251, 3253, 3254, 3256, 3270, 3271
\large 2119, 2543, 2548, 2551, 2566, 2568, 3244, 3245, 3247, 3248
\lastbox . . 514, 2790, 2798
\leaders 2471
\leavevmode 448, 2471, 2699
\leftmargin 1025, 1030, 1033, 1035, 1037, 1039
\leftmargini 1009, 1010, 1011, 1012, 1025, 1026
\leftmarginii 1015, 1016, 1017, 1018, 1030, 1031
\leftmarginiii 1018, 1019, 1033, 1034
\leftmarginiv 1019, 1020, 1035, 1036
\leftmarginv 1020, 1021, 1037, 1038
\leftmarginvi 1021, 1039, 1040
\leftskip . 2470, 2743, 3233
\let . 306, 308, 320, 322, 324, 350, 466, 582, 583, 624, 625, 626, 627, 628, 629, 632, 636, 794, 860, 874, 875, 877, 878, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 943, 944, 948, 949, 958, 959, 964, 965, 966, 1029, 1044, 1048,

1534, 1535, 1536, 1537, 1538, 1638, 1744, 1747, 2064, 2079, 2080, 2081, 2082, 2094, 2095, 2096, 2099, 2106, 2195, 2209, 2210, 2245, 2246, 2271, 2272, 2506, 2605, 2629, 2695, 2701, 2740, 2745, 2804, 2805, 2839, 2840, 2842, 2843, 2851, 2852, 2853, 2855, 2856, 2857, 3183, 3185, 3187, 3188, 3190, 3196, 3199, 3202, 3496, 3501, 3502, 3509, 3510, 3511
\libertineLF 862
\lineskip 2700, 2744
\linespacing . . . 542, 543
\liningnums 860
\list 1042
\listisep . 1023, 1024, 1028
\listparindent 1027
\LoadClass 261
\long 442, 557, 568, 943, 947, 958, 1645, 1648, 1650, 2049, 2845
\loop 2283, 2868, 3081
\LTX@adddotafter 3202, 3205

M

\makeatletter 539
\makebox . . 2119, 3044, 3049, 3090, 3163, 3168
\MakeFramed 1733
\makelabel 1044
\MakeTextUppercase . 2608, 2610, 3235, 3244, 3247, 3250, 3253, 3263, 3267, 3270
\maketitle 19, 2072
\MakeUppercase 3189
\marginfigure 946
marginfigure (env.) . . . 33
\marginpar 557, 945, 951, 960, 2314
\marginparsep . . 962, 3036
\marginparwidth . 962, 3036
\margintable 957
margintable (env.) 33
\mathchardef . . 2679, 2682
\mbox 328
\mdseries . . 2385, 2387, 2389, 2393, 2395, 2397, 2399, 2401, 2403, 2405, 2560, 2563
\medskip . . 2249, 2251, 2253, 2255, 2633, 2635, 2699, 2784, 2814
\MessageBreak 172, 178, 184, 185, 186, 187, 188, 189, 190, 191, 192, 420, 421, 422, 423, 425, 427, 1666, 1667, 1668, 1727, 1898, 1899
\metadata@authors 2195, 2196, 2199
\mktitle@bx 2071, 2280, 2281, 2284, 2288, 2289, 2296, 2298, 2300, 2302, 2304, 2306, 2308, 2310, 2312, 2326, 2328, 2420, 2442, 2470, 2633, 2698, 2699, 2778
\month 1603, 2924
\moveleft 980
\multiply 3087

N

\NAT@@setcites 346
\NAT@aysep 337
\NAT@citetp 632
\NAT@close 286, 288, 290, 292, 335
\NAT@cmprs . . 314, 316, 318
\NAT@cmt 341
\NAT@ctype 632
\NAT@find@eq 329
\NAT@fullfalse 632
\NAT@longnamestrue . 326
\NAT@merge . . 320, 322, 324
\NAT@nmfmt 328
\NAT@numbersfalse . . 300
\NAT@numberstrue 302, 304
\NAT@open 286, 288, 290, 292, 333, 632
\NAT@partrue 632
\NAT@rem@eq 331
\NAT@sep 294, 296, 298, 343
\NAT@sort . . . 310, 312, 318
\NAT@superfalse 302
\NAT@supertrue 304
\NAT@swafalse 631
\NAT@up 328
\NAT@yrsep 339
\NeedsTeXFormat 1
\newblock 633
\newbox 2071, 2226, 2477, 2637
\newcommand . 356, 362, 417, 431, 434, 437, 639, 870, 1434, 1521, 1556, 1586, 1623, 1628, 1694, 1749, 1844, 2057, 2493, 2502, 2919, 3222, 3454, 3463, 3479
\newcount . 1465, 1467, 2862
\newcounter 1748, 2915, 2917
\newdimen . . 961, 1001, 2638, 3059, 3061, 3063
\newenvironment . 440, 946, 957, 1730, 2048
\newfloat 940
\newif 162, 163, 164, 165, 166, 168, 827, 866, 868, 1049, 1469, 1616, 1779, 1781, 1783, 2579, 2581, 2583
\newlength 1618, 1620, 1621, 2861
\newsavebox 2860
\newskip 1023, 2639
\newtheorem 3349, 3352, 3355, 3358, 3361, 3365, 3368
\newtheoremstyle 3301, 3333
\newwrite 546
\next 3180, 3182, 3192
\nobreak 505, 2814
\noindent 555, 1559, 1710, 2096, 2183, 2189, 2249, 2251, 2253, 2255, 2286, 2293, 2314, 2420, 2427, 2430, 2433, 2457, 2471, 2472, 2474, 2572, 2633, 2634, 2698, 2744, 2778, 2779, 2814, 2815, 2848, 3384
\noindentparagraph 2261, 3222
\nolinkurl 2679, 2682, 2725, 2727, 2763

\normalbaselines . . . 2642
\normalcolor 786
\normalfont 580, 1710, 2090, 2539, 2544, 2553, 2554, 2556, 2557, 2569, 2865, 3295, 3312, 3324, 3327, 3392, 3516
\normalparindent . . . 771
\normalsize 2382, 2539, 2553, 2554, 2557, 2866, 3516
\num@authorgroups 1465, 1476, 2076, 2655, 2659, 2661, 2708, 2749
\num@authors 1467, 1474, 1488, 1495, 1549, 1552, 2747
\number 464
\numberline 484, 497
\numexpr . 2914, 2916, 2918
\nxandlist 2196

O

\onehalfspacing 270
\openout 547
\or 204, 206, 208, 210, 212, 214, 216, 218, 221, 224, 238, 240, 242, 244, 246, 248, 250, 252, 254, 256, 595, 596, 597, 598, 599, 600, 602, 603, 605, 606, 682, 689, 696, 703, 710, 717, 724, 731, 740, 747, 759, 760, 761, 763, 764, 765, 766, 767, 768, 769, 797, 798, 799, 801, 803, 805, 807, 809, 810, 812, 917, 918, 919, 920, 921, 923, 926, 931, 936, 937, 986, 987, 988, 989, 990, 991, 996, 997, 998, 999, 1128, 1132, 1136, 1140, 1144, 1148, 1153, 1157, 1161, 1168, 1172, 1176, 1180, 1185, 1189, 1193, 1197, 1202, 1206, 1212, 1218, 1222, 1228, 1234, 1238, 1242, 1247, 1251, 1255, 1259, 1263, 1267, 1271, 1275, 1279, 1283, 1287, 1291, 1295, 1299, 1303, 1307, 1311, 1315, 1319, 1323, 1327, 1331, 1335, 1339, 1343, 1347, 1352, 1357, 1361, 1365, 1370, 1374, 1378, 1382, 1386, 1390, 1394, 1398, 1402, 1406, 1410, 1414, 1604, 1605, 1606, 1717, 1719, 1721, 1723, 1850, 1852, 1855, 1857, 1858, 1860, 1862, 1864, 1867, 1870, 1873, 1875, 1878, 1881, 1884, 1906, 1917, 1928, 1936, 1942, 1948, 1962, 1974, 1981, 1995, 2002, 2008, 2015, 2020, 2026, 2250, 2252, 2254, 2256, 2258, 2260, 2262, 2264, 2266, 2268, 2297, 2299, 2301, 2303, 2305, 2307, 2309, 2311, 2325, 2327, 2335, 2337, 2339, 2341, 2343, 2345, 2347, 2349, 2351, 2353, 2361, 2363, 2365, 2367, 2369, 2371, 2373, 2375, 2377, 2379, 2386, 2388, 2390, 2392, 2394, 2396, 2398, 2400, 2402, 2404, 2515, 2517, 2519, 2521, 2523, 2525, 2527, 2529, 2531, 2533, 2542, 2545, 2546, 2549, 2552, 2555, 2558, 2561, 2564, 2567, 2657, 2658, 2660, 2662, 2710, 2887, 2889, 2891, 2893, 2895, 2897, 2899, 2901, 2903, 2905, 2957, 2966, 2976, 3068, 3073, 3112, 3122, 3132, 3242, 3243, 3246, 3249, 3252, 3255, 3261, 3265, 3269, 3272, 3286, 3287, 3288, 3289, 3290, 3291, 3296, 3297, 3298, 3299, 3318, 3319, 3320, 3321, 3322, 3323, 3328, 3329, 3330, 3331, 3377, 3378, 3379, 3380, 3381, 3382, 3385, 3386, 3387, 3388, 3404, 3405, 3406, 3408, 3410, 3412, 3414, 3416, 3417, 3419, 3426, 3428, 3430, 3432, 3434, 3436, 3438, 3440, 3442, 3444
\orcid *10*, 1546
\outer@nobreak 977

P

\p@ 550, 755, 762, 772, 773, 779, 780, 2427, 3042, 3161, 3207, 3211, 3215, 3216, 3219, 3220, 3223, 3224, 3228, 3229, 3392, 3494, 3497
\PackageError 56, 64, 72, 81, 89, 101, 105, 109, 117, 125, 133, 143
\PackageInfo 53, 55, 61, 63, 69, 71, 77, 80, 86, 88, 94, 100, 114, 116, 122, 124, 130, 132, 138, 142, 1167, 1211, 1217, 1227, 1233
\PageIndex 15
\pageref 2926
\pagestyle 3057
\par 432, 435, 449, 505, 541, 782, 975, 1559, 1710, 2099, 2106, 2125, 2130, 2132,

2183, 2189, 2232, 2236, 2239, 2249, 2251, 2253, 2255, 2296, 2298, 2300, 2312, 2328, 2427, 2433, 2440, 2457, 2468, 2471, 2474, 2476, 2499, 2501, 2503, 2504, 2572, 2576, 2633, 2635, 2642, 2644, 2672, 2674, 2681, 2690, 2699, 2701, 2719, 2721, 2727, 2735, 2743, 2745, 2776, 2777, 2778, 2780, 2794, 2814, 2837, 2841, 2845, 2848, 3390
\paragraph 3218
\parbox 662, 671, 2429, 2447, 2454, 2462, 2865, 3094
\parindent . . 755, 771, 1010, 2099, 2106, 2123, 2231, 3218, 3234, 3281, 3313, 3497
\parskip . . 755, 2123, 3497
\part 3227
\PassOptionsToClass 158, 159
\pdfgentounicode . . . 824
\pdfglyphtounicode 817, 818, 819, 820, 821, 822, 823
\pdfstringdefDisableCommands 585
\phantomsection 280, 2788, 3458
\popQED 3397
\position . . . *11*, 1530, 1534, 1535, 1536, 1537, 1538, 2485, 2754
\postcode *11*, 1537, 2485, 2753
printonly (env.) *23*
\ProcessOptionsX . . . 160
\proof 3390
\proofname 3390
\protect 484, 497
\protected@edef 469, 560, 574
\providecommand 633, 637, 3279
\ProvidesClass 5
\ProvidesFile 3
\ps@headings . . 2853, 2857
\ps@myheadings 2852, 2856
\ps@plain 2851, 2855
\pushQED 3391
\put 2879, 2909

Q

\qed 3391
\quad 526, 2968, 2971, 2978, 2982, 3152

R

\raggedright 2429, 2470, 2743, 3498
\raisebox . . 2119, 2422, 2437, 2449, 2464, 3045, 3090, 3092, 3164
\real@adddotafter 3187, 3190
\realSectionformat . . . 3183, 3195, 3196
\received *18*, 1694
\RecordChanges 17
\ref 2826, 2833
\refname 279, 280
\refstepcounter 468
\relax 170, 176, 182, 195, 202, 236, 329, 330, 418, 450, 469, 471, 475, 489, 503, 518, 528, 536, 547, 594, 679, 758, 794, 796, 916, 985, 1124, 1466, 1468, 1474, 1476, 1586, 1587, 1640, 1664, 1715, 1733, 1754, 1763, 1773, 1774, 1794, 1799, 1802, 1806, 1812, 1815, 1818, 1821, 1824, 1827, 1830, 1834, 1838, 1849, 1905, 2094, 2095, 2112, 2248, 2295, 2333, 2359, 2384, 2513, 2541, 2640, 2650, 2651, 2652, 2653, 2656, 2659, 2661, 2663, 2665, 2668, 2700, 2703, 2704, 2705, 2706, 2709, 2712, 2715, 2747, 2749, 2772, 2806, 2863, 2885, 2886, 2888, 2890, 2906, 2916, 2918, 2921, 2949, 3067, 3069, 3070, 3071, 3074, 3075, 3076, 3079, 3080, 3082, 3085, 3086, 3087, 3088, 3106, 3151, 3178, 3201, 3205, 3241, 3285, 3317, 3376, 3392, 3403, 3424, 3483, 3487, 3497
\removelastskip 541
\renewcommand 278, 282, 283, 286, 288, 290, 292, 294, 296, 298, 348, 371, 373, 376, 383, 385, 387, 389, 394, 396, 398, 402, 404, 406, 410, 412, 414, 864, 1041, 1471, 1540, 2050, 2083, 2759, 2938, 2939, 3042, 3102, 3103, 3161, 3206, 3210, 3214, 3218, 3227
\renewenvironment . . 942, 1042, 1644, 3390
\repeat . . 2290, 2871, 3084
\RequirePackage 29, 30, 31, 262, 263, 264, 265, 266, 267, 269, 272, 274, 277, 380, 581, 584, 648, 649, 659, 668, 677, 774, 825, 839, 845, 846, 850, 851, 854, 855, 856, 906, 1745, 2850, 3407, 3409, 3411, 3413, 3415, 3418, 3431, 3433, 3435, 3437, 3439, 3443
\reset@font 558, 571
\reversemarginpar . . 739
\rightarrow 1751
\rightskip 3232
\rlap 3091
\rotatebox 3046, 3165
\rule 565, 578, 3093

S

\savebox 2865

screenonly (env.) *23*
\scriptsize 2233, 2868, 2872
\scshape 3282, 3373
\section 279, 2257, 2259, 2263, 2265, 2267, 2269, 2792, 2800, 3206, 3457
\section@raggedright 3231, 3235, 3236, 3244, 3245, 3247, 3248, 3250, 3251, 3253, 3254, 3256, 3257, 3258, 3263, 3264, 3267, 3268, 3270, 3271
\Sectionformat 3179, 3183, 3185, 3196
\SelectFootnoteRule 775, 777
\selectlanguage 1557, 2796
\set@ACM@acmcpbox 2221, 2226
\setbox 514, 569, 980, 2230, 2284, 2420, 2442, 2470, 2481, 2633, 2643, 2698, 2778, 2790, 2798
\setcctype *17*, 1844
\setcitestyle *25*, 283, 357, 363
\setcopyright . . *16*, 1842
\setcounter 2089, 2176, 2278, 2916, 2918, 3239, 3262, 3266, 3277
\setengagemetadata *19*, 2068
\setkeys . 38, 174, 180, 1427, 1681, 1729, 1842, 2618, 2619, 2624, 2625, 2686, 2687, 2691, 2692, 2731, 2732, 2736, 2737
\setlength 755, 756, 762, 771, 1003, 1004, 1009, 1015, 1018, 1019, 1020, 1021, 1619, 1622, 2231, 2867
\setmonofont . . . 847, 852
\settopmatter *18*, 98, 1669, 1681, 1682, 1684, 1687, 1689, 1692, 2822
\setTrue 540
\SetWatermarkColor 661, 670
\SetWatermarkFontSize 660, 669
\SetWatermarkText 662, 671
\sfdefault 864
\sffamily 2360, 2362, 2364, 2366, 2368, 2370, 2374, 2378, 2380, 2538, 2543, 2547, 2568, 2934, 3096, 3235, 3236, 3237, 3244, 3245, 3247, 3248, 3253, 3254, 3263, 3264, 3267, 3268
\shortauthors *19*, 1500, 1501, 1508, 1509, 1511, 1514, 1515, 1517, 2208, 2210, 2933
\shortcite 636, 639
\shorttitle 2953, 2961, 2971, 2982, 2989, 3013
\showeprint 3479
\sidebar 940
sidebar (env.) *33*
\skip 785
\small 558, 945, 952, 960, 1710, 2249, 2251, 2253, 2255, 2544, 2569, 2790, 2798, 2814, 3108
\smallskipamount . . . 1024
\space 493, 1473, 1542, 1669, 2204, 2507, 3053, 3172, 3464, 3503, 3506, 3514
\specialcomment 3455
\standardpagestyle . 2935
\startPage *16*, 1633
\state . *11*, 1536, 2485, 2758
\stepcounter 1565, 1567, 1574, 1577, 1584, 1753
\StrDel 2494
\streetaddress *11*, 1534, 2485, 2752
\string 420, 421, 424, 426, 646, 1473, 1542, 1635, 1669, 2810, 2811, 3503, 3506, 3514
\strut 2447, 2462, 3047, 3166
\strutbox 565, 578
\subsection 3210
\subsubsection 3214
\subtitle *10*, 1463
\subtitlenote . . *14*, 1570

T

\teaserfigure 2048
teaserfigure (env.) . . . *18*
\terms *16*, 1635
\textbf . . 1756, 1768, 2848
\textbullet 588, 1755, 2968, 2971, 2978, 2982
\textcolor 3096
\textheight 2230, 2282, 2284, 2290, 2871, 3045, 3164
\textit 1769, 2824, 2828, 2829, 2830
\textrightarrow 589, 1751, 1765
\textwidth 962, 981, 982, 2084, 2407, 2441, 2469, 2511, 2650, 2697
\thanks *13*, 2050, 2845
\thankses 2053, 2055, 2097, 2845
\the . . 1488, 1495, 1549, 1552, 1601, 1603, 2868, 2872, 2924, 3087
\theACM@time@hours 2918, 2925
\theACM@time@minutes 2925
\theenumi 992
\theenumii 993
\theenumiii 994
\theenumiv 995
\thefootnote 2083
\theindex 3493
\theoremstyle 3344, 3347, 3363, 3371
\thepage 2926, 2942, 2944, 2950, 2951, 2988, 3012, 3108, 3143, 3148
\thispagestyle 2285, 2292
\thmname 3311, 3343
\thmnote 3311, 3343
\thmnumber 3311, 3343
\thr@@ 324
\time 2913, 2916, 2918
\title *10*, 2810
\titlenote . . *14*, 1561, 2811
\topsep . . 1028, 1032, 3392
\translatedabstract 440

translatedabstract (env.) 21
\translatedkeywords 21, 437
\translatedsubtitle 21, 434
\translatedtitle . 21, 431
\trivlist 3393
\tw@ 322
\two@digits . . . 2924, 2925
\twocolumn . 2302, 2304, 2306, 2308, 2310, 2326

U

\unskip 517, 587, 783, 1533, 1539, 1546, 2482, 2485, 2486, 2488, 2490, 2491, 2492, 2493, 2507, 2576, 2752, 2753, 2754, 2756, 2757, 2758, 2759, 2760, 2761, 2763, 2808, 2816, 2833, 2846
\unvbox . 570, 787, 792, 2286, 2633, 2699, 2778
\upshape 1041
\url . 1739, 1741, 1887, 3464
\UrlBreakPenalty 2679, 2682
\urlstyle . . . 592, 601, 604
\usebox 2879, 2909
\usepackage 9, 10, 11, 12, 13, 14

V

\value 1770
\vbox 569, 980, 2420, 2442, 2470, 2633, 2698, 2778
\vfill 2234, 2236, 2239, 2241
\vskip 506, 541, 785, 793, 975
\vspace 2427, 3501
\vsplit 2284
\vtop 2230, 2643

W

\wd 982, 2482
\write 646

X

\xdef 333, 335, 337, 339, 341, 343

Y

\year 1601, 2924

Z

\z@ 312, 316, 452, 472, 504, 514, 529, 542, 565, 578, 756, 793, 910, 914, 925, 1009, 1015, 1027, 2099, 2106, 2119, 2123, 2214, 2216, 2231, 2422, 2437, 2449, 2464, 2743, 2790, 2798, 2938, 2939, 3044, 3049, 3060, 3062, 3064, 3090, 3092, 3102, 3103, 3163, 3168, 3206, 3210, 3214, 3222, 3227, 3234, 3293, 3325, 3494, 3497
\z@skip 541, 975, 1032, 3233