LATEX Class for the Association for Computing Machinery*

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Abstract

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

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1 Introduction

The Association for Computing Machinery¹ 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 new consolidated template package replaces all previous independent class files and packages and provides a single up-to-date LaTeX package with optional calls. The package uses only free TeX packages and fonts included in TeXLive, MikTeX and other popular TeX distributions. The new ACM templates use a new font set (libertine) which will need to be installed on your machine before using the templates. Please download and install the libertine font set before writing your paper. Fonts used in the template cannot be substituted; margin adjustments are not allowed.

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., M Senthilkumar, 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.

¹http://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, acm-jdslogo.png, 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:

- amsart, https://ctan.org/pkg/amsart,
- babel, https://ctan.org/pkg/babel,
- balance, https://ctan.org/pkg/balance,
- booktabs, https://ctan.org/pkg/booktabs,
- caption, https://ctan.org/pkg/caption,
- cmap, https://ctan.org/pkg/cmap,
- comment, https://ctan.org/pkg/comment,
- draftwatermark, https://ctan.org/pkg/draftwatermark,
- environ, https://ctan.org/pkg/environ,
- etoolbox, https://ctan.org/pkg/etoolbox,
- fancyhdr, https://ctan.org/pkg/fancyhdr,
- float, https://ctan.org/pkg/float,
- fontenc, https://ctan.org/pkg/fontenc,
- framed, https://ctan.org/pkg/framed,
- geometry, https://ctan.org/pkg/geometry,
- graphicx, https://ctan.org/pkg/graphicx,
- *hyperref*, https://ctan.org/pkg/hyperref,

```
• hyperxmp, https://ctan.org/pkg/hyperxmp,
```

- iftex, https://ctan.org/pkg/iftex,
- libertine, https://ctan.org/pkg/libertine,
- manyfoot, https://ctan.org/pkg/manyfoot,
- microtype, https://ctan.org/pkg/microtype,
- *natbib*, https://ctan.org/pkg/natbib,
- newtxmath, https://ctan.org/pkg/newtxmath,
- pbalance, https://ctan.org/pkg/pbalance,
- refcount, https://ctan.org/pkg/refcount,
- setspace, https://ctan.org/pkg/setspace,
- totpages, https://ctan.org/pkg/totpages,
- unicode-math, https://ctan.org/pkg/unicode-math,
- xcolor, https://ctan.org/pkg/xcolor,
- xkeyval, https://ctan.org/pkg/xkeyval,
- xstring, https://ctan.org/pkg/xstring,
- zi4, https://ctan.org/pkg/zi4,
- zref-savepos, https://ctan.org/pkg/zref-savepos,
- zref-user, https://ctan.org/pkg/zref-user.

2.2 Invocation and options

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

```
\documentclass[\langle options \rangle] \{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}

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, ACMJDS, AILET,
	CIE, CSUR, FAC, GAMES, JACM, JATS, JDIQ, JDS, JEA, JERIC, JETC,
	JRC, PACMCGIT, PACMHCI, PACMMOD, PACMNET, PACMPL,
	PACMSE, POMACS, TAAS, TACCESS, TACO, TAIS, TAISAP, 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, TOPML, TOPS,
	TORS TOS, TOSEM, TOSN, TQC, TRETS, TSAS, TSC, TSLP, and
	TWEB, including special issues.
acmlarge	Large single-column format. Used for DLT, DTRAP, HEALTH,
	IMWUT, JOCCH, and TAP, including special issues.
acmtog	Large double-column format. Used for TOG, including annual confer-
	ence 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 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.

Sometimes conference proceedings are published as a special issue (or issues) of an ACM journal. In this case, you should use the journal format. The templates sample-acmsmall-conf.tex and sample-acmtog-conf.tex show how to enter conference information. Note that you need to comment out \acmJournal{...} line for such papers to get the conference information in the footers and headers.

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 $BibT_EX$ 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.

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. When there are many figures near the end of the document, the attempts to balance columns may lead to the loss of the figures. Set this option to false if you encounter problems. An alternative is the (experimental) option pbalance, which uses the new package pbalance. You may want to try pbalance=true to see if you get better results

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. 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 $\armanled{acmJournal}{\langle shortName \rangle}$ 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[$\langle short\ name \rangle$]{ $\langle name \rangle$ }{ $\langle date \rangle$ }{ $\langle venue \rangle$ } is used for conference proceedings published in the book form. The arguments are the following:

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 phalance package
urlbreakonhyphens	true	Whether to break urls on hyphens

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 $\ensuremath{\mbox{\mbox{\mbox{ommand}}}}$ 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:

```
\tilde{ShortTitle} \{ \langle ShortTitle \rangle \}
```

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.

 $\sl b$

Besides title, ACM classes allow a subtitle, set with the \subtitle\(\lambda\) 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 The basic commands are \author, \orcid (for the researchers registered with OR\orcid CID, http://www.orcid.org/), \affiliation and \email. In the simplest case, you \affiliation enter them in this order:

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

Do *not* use the Lack author commas, or \\ between the authors! Each author deserves his or her own \author command. An attempt to list several authors or their emails 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{...}
```

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

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

```
\author{...}
\operatorname{\colored}\{\ldots\}
\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 $\{\langle affiliation \rangle\}$ ". 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}
  \city{Hekla}
  \country{Iceland}}
\affiliation{%
 \institution{Institute for Clarity in Documentation}
  \city{Dublin}
  \state{Ohio}}
```

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

The \affiliation and \additionalaffiliation commands are further structured \institution to interact with the metadata extraction tools. Inside these commands you should use \department the \position, \institution, \department, \city, \state, and \country macros to \city indicate the corresponding parts of the affiliation. Note that in some cases (for example, \state journals) these parts are not printed in the resulting copy, but they are necessary since \country 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.

> Starting 2024, ACM no longer collects or print postal addresses of the authors. Thus the commands \streetaddress and \postcode, present in the previous versions of the class, now produce a warining.

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}
  \city{Sidney}
  \state{NSW}
  \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}}
```

\thanks

Like amsart (and unlike standard LTEX), 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 Later typesets them itself using the information you give it. However, you can override its choice using the command \authorsaddresses{\chicknowledge}, 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

While the command \thanks generates a note without a footnote mark, sometimes \subtitlenote the authors might need notes more tightly connected to the title, subtitle or author. The \authornote 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}
```

\authornotemark

Please never use a \footnote inside an \author or \title command since this confuses the metadata extraction software. (Actually these commands now produce errors.) Sometimes one may need to have the same footnote connected to several authors. The command \authornotemark[$\langle number \rangle$] 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.

\acmMonth

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

\acmArticleSeq

The articles in the same issue of a journal have a sequence number. By default it is

the same as the article number, but the command $\acmarticleSeg\{\langle n \rangle\}$ can be used to change it:

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

\acmSubmissionID

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

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

\acmTSBN

Book-like volumes have ISBN numbers attached to them. The macro $\acmission (ISBN \acmission ISBN \acmission (ISBN \acmission ISBN \acmission ISBN \acmission ISBN \acmission (ISBN \acmission ISBN \acmission ISBN \acmission ISBN \acmission ISBN \acmission (ISBN \acmission ISBN \acmission ISBN \acmission ISBN \acmission ISBN \acmission ISBN \acmission (ISBN \acmission ISBN \acmission ISBN \acmission ISBN \acmission ISBN \acmission ISBN \acmission (ISBN \acmission ISBN \acmission ISBN \acmission ISBN \acmission ISBN \acmission ISBN \acmission (ISBN \acmission ISBN \acmission ISBN \acmission ISBN \acmission ISBN \acmission ISBN \acmission (ISBN \acmission ISBN \acmission ISBN \acmission ISBN \acmission ISBN \acmission ISBN \acmission (ISBN \acmission ISBN \acmission ISBN \acmission ISBN \acmission ISBN \acmission ISBN \acmission (ISBN \acmission ISBN \a$ 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. \acmD0I The macro $\acmDOI{\langle DOI \rangle}$ 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.

\acmBadge

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 command to add these badges: $\armanneg [\langle url \rangle] \{\langle graphics \rangle\}$. The arguments have the following meaning: $[\langle url \rangle]$, if provided, sets the link to the badge authority in the screen version, while $\{\langle graphics \rangle\}$ 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

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

The command can be repeated, if a paper has several badges.

\startPage

The macro $\mathsf{startPage}\{\langle page \rangle\}$ sets the first page of the article in a journal or book. It is used by the typesetter.

The command $\ensuremath{\mbox{keyword}} \ensuremath{\mbox{keyword}}, \ensuremath{\mbox{keyword}}...\rangle$ } sets keywords for the article. \terms \keywords They must be separated by commas, for example,

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

CCSXML (env.)

ACM publications are classified according to the ACM Computing Classification \ccsdesc 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 T_FX 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>
 <concent>
  <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 license the paper to the ACM, some or all authors might be employees of the US or Canadian governments, etc. Accordingly the 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[$\langle version \rangle$]{ $\langle type \rangle$ }, where [$\langle version \rangle$] can be either 3.0 or 4.0 (4.0 by default), and { $\langle type \rangle$ } 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.

Table 3: Parameters for the $\backslash setcopyright$ command

Parameter	Meaning
none	The copyright and permission information is not typeset. (This is the option for some ACM conferences.)
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.
СС	Creative Commons license. If this key is set, doclicense im-
	ages are used to typeset the license. See also \setcctype command.
acmcopyright	The authors transfer the copyright to the ACM. This choice is no longer available for the non-commissioned authors and will trigger a warning.

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 FT_EX. 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 $\operatorname{settopmatter}\{\langle settings \rangle\}$. 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 $\ensuremath{\mbox{\sc command}} \ensuremath{\mbox{\sc command}} \ensuremath{\mbo$

Table 4: Settings for the \settopmatter command

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

The $[\langle stage \rangle]$ 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 $\{\langle name \rangle\}\{\langle value \rangle\}$, 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{ $\langle type \rangle$ } sets the article type, for example

```
\acmArticleType{Review}
```

\acmCodeLink The commands \acmCodeDataLink{ $\langle link \rangle$ } and \acmDataLink{ $\langle link \rangle$ } set the links \acmDataLink 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.

 \acmContributions The command $\acmContributions{\langle contributions \rangle}$ sets the contributions of the authors, for example,

```
\acmContributions{AW designed the study, CD performed it, all authors contributed to the writing.}
```

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}
```

The design of the cover page may require additional runs of latex to make the elements of the page align.

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 with 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

The commands $\translatedtitle{\langle language \rangle}$ title, $\translatedsubtitle{\langle language \rangle}$ subtitle \translatedsubtitle and \translatedkeywordslanguagekeywords are used to set title, subtitle and key-\translatedkeywords words 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.

Algorithms 2.7

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\\
                & Many-to-Many/Gossip CBR Streams\\
 Application
 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 $\Description[\slashed]{\label{long description}}$ 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:

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}}
```

If you use *cleveref* and share counters between the theorem-like constructs, you need to explicitly tell *cleveref* the kind of the construct you use, for example,

```
\newtheorem{theorem}{Theorem}[section]
\newtheorem{lemma}[theorem]{Lemma}
% Theorems and lemmas share counters
...
\begin{theorem}\label{thm:test} % This is a theorem
...
\begin{lemma}\label[lemma]{test-lemma} % This is a lemma
```

2.11 Online-only and offline-only material

printonly (env.) Some supplementary material in ACM publications is put online but not in the printed screenonly (env.) 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 an anonymous 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 $\anon[\langle substitute \rangle] \{\langle suppressed-text \rangle\}$. By default $[\langle substitute \rangle]$ 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 or comments.

\grantsponsor

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

```
\proonup \
```

Here $\{\langle sponsorID \rangle\}$ is the unique ID used to match grants to sponsors, $\{\langle name \rangle\}$ is the name of the sponsor, $\{\langle url \rangle\}$ is its URL, and $\{\langle number \rangle\}$ is the grant number. The $\{\langle sponsorID \rangle\}\$ of the \grantnum command must correspond to the $\{\langle sponsorID \rangle\}\$ 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 $\{\langle sponsorID \rangle\}$ 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{my-grant-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}
```

Bibliography 2.14

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

2.14.1 Processing using BibT_FX

This uses the natbib package for formatting references and the BibTFX style file ACM-Reference-Format.bst for BibTFX 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. You can find many examples on the Web page https://www.acm.org/publications/authors/bibtex-formatting.

2.14.2 URL, DOI, eprint

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 dynamic nature of Internet makes URLs not permanent: sometimes they disappear or change. The problem of "stale links" exists from the early days of WWW. That is why ACM prefers DOIs to URLs: unlike the latter, the former are supposed to work forever. However, if you really need to use URLs, there are two facilities that help to mitigate some problems with the URLs. The field lastaccessed gives the date when the given URL was visited and had the information you saw. Presumably, some service like Internet Wayback Machine (https://web.archive.org/) allows the reader to retrieve this link at the given date. Moreover, sometimes a page is explicitly archived by this or other service. In this case the field archived will give the reference of the archival version. Examples:

```
lastaccessed = {March 2, 2005},
```

```
archived = {https://web.archive.org/web/20240505055615}
```

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

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

2.14.3 Special entry types

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

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},
          = 2013,
 vear
   {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 and archived field to add the archival link.

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 supplemental material attached 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",
                "2003",
 year =
                "ACM Press"
 publisher =
                "New York, NY",
 address =
                "4",
 pages =
                "March 21, 2008",
 month =
                "10.9999/woot07-S422",
doi =
howpublished = "Video".
}
```

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

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

Sometimes a work is presented at meeting, but is not (yet) published in the proceedings. The entry type presentation is used for this purpose. The field venue is used for the place of the meeting:

The URL, if present, may be accompanied by lastaccessed and archived links. A preprint can be cited using the entry preprint, for example,

```
@preprint{AnzarootPBM14,
  author
            = {Sam Anzaroot and
               Alexandre Passos and
               David Belanger and
               Andrew McCallum},
  title
            = {Learning Soft Linear Constraints with Application to
                  Citation Field Extraction},
            = \{2014\},
 year
 archivePrefix = {arXiv},
 eprint
           = \{1403.1349\},
  doi =
           {10.48550/arXiv.1403.1349}
}
```

Sometimes you need to cite an article under review. ACM prefers the authors to use preprints for this purpose, but sometimes it is not feasible. In this case you can use the entry underreview, for example,

2.14.4 Dates and sorting

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,

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.

2.14.5 Processing using BibLATEX

You will find in this package two sets of style files for BibLATEX, acmnumeric and acmauthoryear, that mimic the behavior of the ACM-Reference-Format.bst BibTEX style. They provide you access to all the power of BibLATEX and already include support for advanced citation of software artifacts 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 LTEX sources are set up when using BibLTEX instead of BibTEX, that we summarize briefly here (please refer to the official BibLTEX documentation for more details).

First of all, you need to pass the natbib=false option to the document class, and remove the \citestyle{acmauthoryear} command from the sources (if present).

Then, in the preamble of your document you need to load the BibLitz 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 \addbibresource command (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 BibLTeX 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:

- ColourBrewer: http://colorbrewer2.org/
- 2. ACE: The Accessible Colour Evaluator: http://daprlab.com/ace/ for designing WCAG 2.0 compliant palettes.

2.15.1 Manual bibliography

Some people create bibliographies manually, writing down \bibitem commands explicitly. This approach is *not* recommended for ACM styles. The reason is, ACM submissions, besides being typeset, are also processed by special programs that extract metadata and references. Bibliographies created automatically with ACM styles contain customized macros for these programs, for example,

Manual bibliographies without these macros may slow down the publication process, and thus are not recommended for ACM submissions.

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 $\left\{ \text{math} \right\}$... $\left\{ \text{math} \right\}$ 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 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 type-setting of ACM papers.

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

2.19 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.

2.20 Currently supported publications

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

Abbreviation	Publication
ACMJCSS	ACM Journal on Computing and Sustainable Societies
ACMJDS	ACM Journal of Data Science
AILET	ACM AI Letters

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

Abbreviation	Publication
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 Tech-
	niques
PACMHCI	PACM on Human-Computer Interaction
PACMOD	PACM on Management of Data
PACMNET	PACM on Networking
PACMPL	PACM on Programming Languages
PACMSE	PACM on Software Engineering
POMACS	PACM on Measurement and Analysis of Computing Systems
TAAS	ACM Transactions on Autonomous and Adaptive Systems
TACCESS	ACM Transactions on Accessible Computing
TAC0	ACM Transactions on Architecture and Code Optimization
TAIS	ACM Transactions on AI for Science
TAISAP	ACM Transactions on AI Security and Privacy
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 and Optimization
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 Com-
	puting Systems
TOMS	ACM Transactions on Mathematical Software
TOPC	ACM Transactions on Parallel Computing
TOPLAS	ACM Transactions on Programming Languages and Systems
TOPML	ransactions on Probabilistic Machine Learning
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.

2.21 Samples

There are several samples of acmart documents, that can serve as templates for the authors. Among them sample-sig... are templates for conference papers, while sample-acm... are templates for journal articles and special materials.

Here is the list of the samples:

sample-manuscript: A proceedings paper in the manuscript format.

 ${\bf sample-acmsmall:}\ \ {\bf A\ journal\ paper\ in\ the\ acmsmall\ format.}$

sample-acmsmall-biblatex: A journal paper using experimental biblatex bibliography processing.

sample-acmlarge: A journal paper in the acmlarge format.

sample-acmtog: A journal paper in the acmtog format.

sample-sigconf: A proceedings paper in the standard sigconf format.

sample-sigconf-biblatex: A proceedings paper in the sigconf format using experimental biblatex bibliography processing.

sample-sigconf-authordraft: A proceedings paper in the sigconf format with the authordraft option selected.

sample-sigconf-i13n: A proceedings paper in the sigconf format with multilanguage titles and abstract.

sample-sigconf-xelatex: A proceedings paper in the sigconf format, XelfTpX ver-

sample-sigconf-lualatex: A proceedings paper in the sigconf format, Lual/TEX version.

sample-sigplan: A proceedings paper in the sigplan format.

sample-acmsmall-conf: A proceedings paper in the acmsmall format for the publication in a journal using this option.

sample-acmtog-conf: A proceedings paper in the acmtog format for the publication in a journal using this option.

sample-acmcp: A sample of ACM Cover Page used by JDS.

sample-acmengage: A sample of ACM Engage publication.

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.) margintable (env.)

This format has large margin uses for special figures and tables. This package promarginfigure (env.) vides 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:

figure: \columnwidth,

marginfigure: \marginparwidth,

3. figure*: \fulltextwidth.

2.23 Experiments with tagging

ACM is firmly committed to produce fully tagged PDFs compliant with the accessibility standards. We use the developmental version of tagging code by LTEX3 team, see the details at https://www.latex-project.org/publications/indexbytopic/pdf/ and https://tug.org/twg/accessibility/overview.html.

At present this work is highly experimental. You may try the experiments by (1) using the class acmart-tagged in the document class line, and (2) adding the command \DocumentMetadata[\langle options \rangle] in the preamble, see the file sample-acmsmall-tagged. tex. If you do this, please do not ask ACM for support. On the other hand, bug reports at https://github.com/borisveytsman/acmart/issues will be appreciated.

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