LaTeX Class for the *Association for Computing Machinery**

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Abstract

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

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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

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 CIE, CSUR, DLT, FAC, GAMES, JACM, JDIQ, JDS, JEA, JERIC, JETC, JRC, PACMCGIT, PACMHCI, 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, 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.

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.

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. 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

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

\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.

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.*) 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 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 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 de-

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.

fault), 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}
```

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

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. 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`languagekeywords 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
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
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
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

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

Abbreviation	Publication
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
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
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}
[2022/08/27 v1.87 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]{%
  CIE,%
  CSUR,%
  DGOV,%
  DLT,%
  DTRAP,%
  FAC,%
  GAMES,%
  HEALTH,%
  IMWUT,%
  JACM,%
  JDIQ,%
  JDS,%
  JEA,%
  JERIC,%
```

```
  JETC,%
  JOCCH,%
  JRC,%
  PACMCGIT,%
  PACMHCI,%
  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,%
  TOS,%
  TOSEM,%
  TOSN,%
  TQC,%
  TRETS,%
  TSAS,%
  TSC,%
  TSLP,%
  TWEB,%
  FACMP%
}{%
\ifcase\@journalCode@nr
```

```
\relax % 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}%
\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 % 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 % 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{1539-9087}%
\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 % 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` The book title of the conference:

`\@acmBooktitle`

```
\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 rededine 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
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   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
```

```
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  honored. For all other uses, contact the
  owner\hspace*{.5pt}/author(s).
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```

```
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  (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
  \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
        \ACM@linecountR}%
    \else
      \fancyhead[LE]{\ACM@linecountL\@headfootfont
        \acmConference@shortname,
        \acmConference@date, \acmConference@venue}%
      \fancyhead[RO]{\@headfootfont
        \acmConference@shortname,
        \acmConference@date, \acmConference@venue\ACM@linecountR}%
     \fi
  \fi
\fi
\if@ACM@sigchiamode
   \fancyheadoffset[L]{\dimexpr(\marginparsep+\marginparwidth)}%
\fi
\if@ACM@timestamp
   \fancyfoot[LO,RE]{\ACM@timestamp}
\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
}%
\pagestyle{standardpagestyle}
}
```

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

```
\newdimen\@folio@wd
\@folio@wd=\z@
\newdimen\@folio@ht
\@folio@ht=\z@
\newdimen\@folio@voffset
\@folio@voffset=\z@
\def\@folio@max{1}
\ifcase\ACM@format@nr
\relax % manuscript
\or % acmsmall
  \@folio@wd=45.75pt\relax
  \@folio@ht=1.25in\relax
  \@folio@voffset=.2in\relax
  \def\@folio@max{8}
\or % acmlarge
  \@folio@wd=43.25pt\relax
  \@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` `\@subsecfont` `\@subsubsecfont` `\@parfont` Fonts for sections etc. are different for different formats.

```
\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.

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