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Introduction

Mission statement

The IEEE Computer Society Style Guide Committee’s mission is to clarify the editorial styles and standards that the Society’s publications use. We maintain and periodically update a style guide to clarify those usages not adequately defined in accepted external sources. Our purpose is to promote coherence, consistency, and identity of style, making it easier for CS editors and our authors to produce quality submissions and publications that communicate clearly to all our readers.

General information

This revised (October 2016) edition of the IEEE Computer Society Style Guide complements these primary references:


The CS style guide defines and explains unique IEEE Computer Society usages, particularly where they differ from other usages. It also defines specialized terms to help editors determine proper usage and phraseology.

Entries in the alphabetical listing include commonly used acronyms, definitions, and brief remarks on points of style. Entries for terms are listed with their initial letter in lowercase, unless the term is a proper name or conventionally appears with an initial capital letter. A keyword given in italics denotes entries for remarks on style. Where topics can’t be covered by short explanations, they’re presented in the special sections listed in the Table of Contents.

An * denotes entries in the alphabetical listing that can be used as acronyms on first reference. An individual magazine’s editorial staff can make determinations about applying this designation to other acronyms on the list. Because some terms look like acronyms and some acronyms look like terms, the style guide provides overlapping entries to make it easier to use. Likewise, the listings include cross-references where necessary.

This style guide will be updated as required. An electronic version is available at www.computer.org/web/publications/styleguide.

The Style Guide Committee is a permanent body with a mandate to rule on questions of style and to provide guidelines where none exist. If you have a question to pose, or you find an entry that needs to be added or changed, please send your request by e-mail to style@computer.org. The committee will endeavor to reply within 30 days.
Resolving differences with authors

The Style Guide Committee’s goal is to direct editors to published works and offer guidelines that they should consider and follow, except when they have good reasons to do otherwise. We recognize that each CS publication has its own minor style variations. Moreover, a good editor knows when to bend a good rule in order to maintain clarity of meaning within a written passage.

Authors provide the technical content for Computer Society publications and, together with referees, bear the major responsibility for ensuring technical accuracy. The editor’s job is to present the material in the most effective manner possible, consistent with established CS publishing practices.

Computer Society style isn’t intended to alienate authors, universities, or corporations; its goal is to achieve professionalism and consistency while treating all firms, organizations, and individuals equally. This house style is generally supported by US trademark law.

Occasional author–editor disagreements can be expected, and compromises are often necessary. Each party should recognize that the other has a stake in the outcome. The author’s name appears on the book or article for all the world (and numerous colleagues) to see, and the editor must follow guidelines established by senior editors, managers, the publisher, and accepted CS editing practices.

Authors frequently feel that a particular usage is correct because it has appeared in a variety of printed communications. However, if these communications are conference proceedings, in-house technical reports, or unpublished papers that haven’t been professionally edited, no one has yet applied standard publishing rules. Once in a while, though, CS style might indeed be out of step, and questionable cases should be referred to the Style Guide Committee. Willingness to view a situation from another’s vantage point is a big step toward resolving differences.

Editors should be flexible enough to compromise when firm publishing and editing principles aren’t being violated. If an author’s preference violates strict grammar rules or firm CS guidelines, the editor should make clear what that violation is, explain why it’s not good practice, and suggest an alternative.

An editor’s decisions shouldn’t be, or appear to be, arbitrary. Explaining that the Style Guide Committee has given considerable thought to CS policies and has established guidelines intended to enhance the authority, effectiveness, and prestige of CS publications is usually the best way to enlist an author’s cooperation in the search for a solution. Unresolved disputes between an equally adamant author and editor should be referred to the department manager.

Acknowledgments

The participation of the following IEEE Computer Society staff members in revising this manual is gratefully acknowledged: Carrie Clark, Chris Nelson, Lisa O’Conner, Meghan O’Dell, Dennis Taylor, and Rebecca Torres.
Abbreviations

Styles differ on whether periods should be used with particular abbreviations. The Society discourages the use of periods in certain abbreviations, such as those for academic degrees, names of countries, and other abbreviations that are in all capitals. When periods are removed from abbreviations, the internal space should also be removed—for example, MIT, PhD, or US. The internal space is also removed from other abbreviations with internal periods, as with author initials. If an abbreviation also spells a word, removing the following period could cause confusion in some contexts—for example, in. and no.

Although many style manuals decry the use of abbreviations, some words are seldom spelled out. Among these are abbreviations for affiliations or scholarly degrees after a name (BA or PhD), and abbreviations such as AD, CPA, and Ltd. A symbol or figure beginning a sentence, on the other hand, is usually spelled out; if it can’t be, the sentence is rewritten—for example, “Two hundred miles,” not “200 miles.”

Style tips

The abbreviations Jr., Sr., II and so forth don’t require a comma because they’re part of the person’s name (John Smith Jr.).

Mr., Mrs., and Dr. are dropped if another title is also used (not Dr. John Smith Jr., PhD).

The preferred format avoids using a descriptor unless the company name might not be clear without it—for example, Data Co. However, if it’s necessary to use Limited, Incorporated, Corporation, or Company, they’re abbreviated to Ltd., Inc., Corp., or Co., respectively, and the abbreviation isn’t preceded by a comma.

The abbreviations Nat’l and Int’l (for national and international) don’t take a period.

The standard abbreviations for most degrees we encounter in our authors’ biographies are BS, MS, MSc, and PhD. For additional rules on abbreviating academic degrees, see the entry under academic degrees in the alphabetical section.

Centuries use the ordinal symbol—for example, 21st century.

Also see the References section; for a more complete discussion of abbreviations, see CMS, Chapter 10.

Abbreviations for units of measurement

The following abbreviations don’t need to be spelled out when used with numbers, except to avoid possible confusion.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ampere</td>
</tr>
<tr>
<td>°C</td>
<td>degree Celsius</td>
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<tr>
<td>cm</td>
<td>centimeter</td>
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<tr>
<td>d</td>
<td>day</td>
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<tr>
<td>dB</td>
<td>decibel</td>
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<tr>
<td>dpi</td>
<td>dots per inch</td>
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<tr>
<td>Symbol</td>
<td>Unit</td>
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<td>--------</td>
<td>--------------</td>
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<tr>
<td>°F</td>
<td>degree Fahrenheit</td>
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<td>ft</td>
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<td>Gbyte</td>
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<td>in</td>
<td>inch</td>
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<td>joule</td>
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<tr>
<td>K</td>
<td>kelvin</td>
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<tr>
<td>kHz</td>
<td>kilohertz</td>
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<td>kilometers per hour</td>
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<td>kilowatt</td>
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<tr>
<td>kWh</td>
<td>kilowatt hour</td>
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<td>liter</td>
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<td>lb</td>
<td>pound</td>
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<td>μs</td>
<td>microsecond</td>
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<td>m</td>
<td>meter</td>
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<tr>
<td>Mbyte</td>
<td>megabyte</td>
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<td>MHz</td>
<td>megahertz</td>
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<td>mi</td>
<td>mile</td>
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<tr>
<td>min</td>
<td>minute</td>
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<tr>
<td>mm</td>
<td>millimeter</td>
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<tr>
<td>mo., mos.</td>
<td>month, months</td>
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<tr>
<td>mph</td>
<td>miles per hour</td>
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<tr>
<td>ms</td>
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<td>mV</td>
<td>millivolt</td>
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<td>mW</td>
<td>milliwatt</td>
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<td>N</td>
<td>newton</td>
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<tr>
<td>ns</td>
<td>nanosecond</td>
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<td>Pa</td>
<td>pascal</td>
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<tr>
<td>s</td>
<td>second</td>
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<tr>
<td>sq ft</td>
<td>square foot</td>
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<tr>
<td>Tbyte</td>
<td>terabyte</td>
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<tr>
<td>V</td>
<td>volt</td>
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<tr>
<td>W</td>
<td>watt</td>
</tr>
<tr>
<td>y</td>
<td>year, years</td>
</tr>
</tbody>
</table>
Acronyms and Abbreviated Terms

A true acronym is formed by using the first letter from two or more separate words—for example, DEC for Digital Equipment Corporation. Articles or prepositions falling in between (for example, and, of, in, and the) generally aren’t part of the acronym. Use all capitals only for true acronyms.

Many acronyms or abbreviated terms used for measurements are traditionally all lowercase—for example, cpi (characters per inch) and dpi (dots per inch). A few are mixed, such as kHz (kilohertz). Capitalization also can differ depending on meaning—for example, MW (megawatt) and mW (milliwatt). See the alphabetical section when in doubt.

As a general rule, spell out all acronyms on first use, but don’t use initial capitals just because the letters form the acronym. There must be another reason for the caps; for example, the words constitute a proper noun. In other words, CAD is computer-aided design, not Computer-Aided Design.

Exceptions to the spell-out-on-first-use rule are acronyms so well known to a particular magazine’s readers that spelling them out would be insulting. In the alphabetical section, the Style Guide Committee has determined that acronyms marked with an asterisk are so familiar to all our readers that they don’t need to be spelled out on first use. Examples include RAM, ROM, and CD-ROM.

Put the acronym in parentheses immediately after the spelled-out term. In long articles with unfamiliar acronyms, it helps to spell out the words occasionally throughout to refresh readers’ memories and aid those who browse. If an article includes many unfamiliar acronyms, consider creating a glossary or sidebar.

Use judgment before allowing a short common term to be reduced to an acronym (for example, operating system to OS). Readers have difficulty with articles that read like alphabet soup.

Provided that an acronym isn’t visually distracting (use your judgment), capitalize it as the author submitted it, so long as the CS Style Guide doesn’t already prescribe a style for it and its formatting agrees with the official version. (For example, the www.flossproject.org provides the project’s preferred capitalization: FLOSS.) When deciding whether to revise acronym capitalization, first consider clarity, followed by author preference.

The Style Guide’s alphabetical section includes combinations of words and acronyms, such as MiniDIP, which generally follow both capitalization and acronym rules.

For a list of units of measurement that don’t need to be spelled out, see the “Abbreviations” section and the related entries in the Style Guide’s alphabetical section. For unfamiliar units of measurement, spell them out on first use.
Authors and Affiliations

On an article’s first page, list the authors in the order in which they appeared on the original accepted paper’s first page. (If no names appeared there, use the order of the author bios, if there are any. Otherwise, contact the authors.) If authors listed next to each other share an affiliation, group them together. If authors share an affiliation but aren’t listed next to each other, don’t group them together. For example, note the first and third lines of this list:

Khairi Reda and Alessandro Febretti, University of Illinois at Chicago

Aaron Knoll, University of Texas at Austin

Jillian Aurisano, Jason Leigh, and Andrew Johnson, University of Illinois at Chicago

Michael E. Papka and Mark Hereld, Argonne National Laboratory

The author order on the first page and in the bios should be the same. Also, an author’s name on the first page and in the bio should match exactly.

Normally, each author should have only one affiliation on the article’s first page—usually, the affiliation at which the research occurred. (You can list other affiliations in the bio. If an author must have more than one affiliation on the first page, inform Monette Velasco or Jennie Zhu-Mai before the issue ships.) If the affiliation is an institute or organization associated primarily with a university, use just the university name as the affiliation. However, in IEEE Software, you can list Software Engineering Institute as the affiliation without listing Carnegie Mellon University. If confusion about an affiliation name is possible (for example, school names that could apply to multiple institutions, such as Concordia University), add the location. Otherwise, the location isn’t necessary.

On the first page, an author’s name and affiliation both take the “AUTHOR” tag (we no longer use the “AUTHOR AFFILIATION” tag). In author bios, the author’s name takes the “vita name” tag, but the affiliation doesn’t get a special tag. After an affiliation first appears in a bio, you can abbreviate subsequent instances of that affiliation (in that or any following bio) to save space. In this case, the abbreviation should appear in parentheses after the first instance of the affiliation.
Best Practices

Here are a variety of guidelines for editing articles conforming to CS style. Some guidelines are specific to particular magazines.

Abstracts

Print abstracts (the short abstracts that appear at the article’s beginning) should have a maximum of 45 words for Computer (35 words for department articles), 35 to 40 words for IEEE Security & Privacy, and 40 words for IEEE Software.

Acknowledgments

We use the plural form for this section heading.

Article titles

Capitalize both parts of a hyphenated compound unless the first part is a prefix; in that case, capitalize only the prefix.

Compound adjectives

For compound adjectives with three or more words, normally use hyphens between each word if the words combine to make one concept—for example, “sparse-time-series tasks” and “near-real-time performance.” Note that in “near-real-time performance,” “near” modifies “real time,” not “performance.”

Figures

For figure callouts, use “(see Figure X)” if the sentence doesn’t already mention the figure. The callout normally shouldn’t give the page number.

For figure captions, the preferred style is to use a phrase to describe the figure and a sentence (or more) to describe the figure’s significance. For example, “Figure 1. Blue marshmallows. The campers mix blue dye with sugar and the mucilaginous root of the marshmallow, thus turning a pink-flowered European perennial herb into a tasty campfire treat.”

For abbreviations in captions, spell them out in the first caption in which they appear (with the abbreviation in parentheses immediately following the related term). Later captions can use just the abbreviation.

To acknowledge outside sources of figures, use this style: “(Source: NameOfSource; used with permission.)”

For program code examples that are part of a figure, input the code into the Word file (and tag it properly) if at all possible. Don’t send the code to the layout artist for input.
File and folder conventions

File names start with a letter specific to the related magazine: \( r = \text{Computer} \), \( j = \text{IEEE Security \\& Privacy} \), and \( s = \text{IEEE Software} \).

Here are examples of the optional magazines’ file name format, using the May/June IEEE Software Bellomo article as an example:

- s3bel.org.pdf (original file that the author sent)
- s3bel.tag.docx (original tagged but unedited file)
- s3bel.dt.docx (1st edit by Dennis Taylor)
- s3bel.dt-bb.docx (2nd read by Brian Brannon. This version usually replaces the previous one.)
- s3bel.gal.docx (version sent to author)
- s3bel.au.docx (version with author corrections)
- s3bel.fin.docx (version ready for layout)

Here are the guidelines for naming electronic folders, with examples.

- Theme article (only one theme in the issue): a-Bellomo
- First theme in a multitheme issue: a1-Bellomo
- Second theme: a2-Jones
- Third theme: a3-Smith
- Nontheme: q-Harris (Computer also inserts “r” at the beginning of folder names for queue articles—for example, rq-Harris.)
- Column: c-Opinions
- Department: d-Projects
- Track: t-Virtualization

The electronic folder should initially contain the current version of the article, figures, author photos (when necessary), copyright, and a Versions folder that holds all the other files. When the layout is ready, move all the files to the Versions folder except the copyright and figure files. You don’t need to clean out the folders before they’re archived.

Software uses “Focus” to indicate theme articles and “Feature” to indicate nontheme articles.

Main text

If an article begins with a quote, don’t insert a quotation mark before the initial drop cap.
Introductions should be three paragraphs, although a little longer is okay if necessary.

In the optional magazines, use title caps on first- and second-level headings. In *Computer*, first-level headings use all caps, and second-level headings use just an initial cap.

On multiline headings, try to make the lower lines the longer ones.

Don’t indent the paragraph immediately following a first- or second-level heading.

When first referring to a group of more than two authors, use this style: “Jane Doe and her colleagues.” For two authors, give their first and last names.

When referring to a specific table or figure in the text, use capitalization: Figure 3, Table 2, and so on.

Avoid having a line with a drop cap on the last line of a column.

Use the appropriate punctuation at the end of a display equation.

When referring to a numbered and displayed item in an article, use an initial capital letter (Figure 1, Table 2, Equation 3, Algorithm 4, …). Otherwise, for nouns accompanied by numbers or letters, don’t capitalize the noun (level 5, participant B, step 1, and so on) unless it’s a proper noun or it’s from a specification or standard.

For a quote that starts in the middle of a sentence, use an ellipsis at the beginning and an initial lowercase letter for the first word.

For names of software patterns, use an initial capital letter for each word and no special formatting.

Use a drop cap, not a heading, to start the conclusion.

**Professional-Society Titles**

Capitalize terms such as Fellow and Senior Member.

**Sidebars**

For sidebar titles, use normal title capitalization.

For titles of related-work sidebars, use “Related Work in …,” not “Related Work on ….”

**Tables**

Table titles use initial caps for only the first word.

Normally, each table column should have a heading. For guidelines on aligning column headings, see *CMS* 3.69.

Normally, text in columns is left aligned; numbers are right aligned or decimal aligned and then centered in the column.
If the table contains many abbreviations, you can insert an asterisk at the end of the table title and insert a footnote at the bottom of the table listing the abbreviations and their meanings. The list can be in the order in which the abbreviations appear in the table or in alphabetical order, whichever makes more sense in that context.

When referring to table columns or rows in the main text, normally use quotation marks and no capital letters ("In the ‘total characters’ column, …").

We no longer use the TABLE ROWz tag.

**URLs**

If you have to put a URL in parentheses after an acronym, use a semicolon to separate the two.

When referring to URLs in a string of text, don’t apply extra formatting.

Omit “http://” or “https://” in all URLs,” and omit “/index.html” in homepage URLs.

Verify URLs by copying and pasting them into your browser. Some addresses don’t start with http://. Other protocols are also legitimate (for example, ftp:), and some addresses don’t need or even won’t work with www. Omit the http:// if the URL starts with www. Check URLs that start with https:// to see whether it’s required.

Be sure to include all punctuation exactly as supplied (hyphens and tildes, in particular, are very common in Web addresses).

If a URL must run across more than one line, follow these guidelines:

- Break after a colon or double slash. Don’t split the double slash.
- Break before a slash, a tilde, a period, a comma, a hyphen, an underline, a question mark, a number sign, or a percent symbol.
- Break before or after an equals sign or an ampersand.
- Don’t introduce hyphens to break words (be very careful about this because Word might try to hyphenate automatically).
- Separating the extension (for example, the html at the end) is discouraged.

Some URL examples using www.web-pac.com/mall/pacific/start.html:

**Acceptable:**

www.web-pac.com/mall/pacific/start.html

www.web-pac.com/mall/pacific/start.html

www.web-pac.com/mall/pacific/start.html

www.web-pac.com/mall/pacific/start.html

www.web-pac.com/mall/pacific/start.html

www.web-pac.com/mall/pacific/start.html
Unacceptable:

www.web-pac.com/mall/pacific/start.html

www.web-pac.com/mall/pacific/start.html

www.web-pac.com/mall/pacific/start.html

Webpages

When referring to various portions of a webpage in text, use an initial cap for the designated item. Don’t set it off with quotes, parentheses, or italics. Thus, a sample reference could be, “The proper way to search the page is to click on the Go button,” or “The text can be found in the Publications section of the company’s website.”

When referring to hypertext links found on a webpage (the highlighted underlined words), put the entire text of the link in quotes. For example, “Click on the ‘go here’ link to reach the table.”
Biographical Sketches

The preferred format for biographical sketches can vary depending on the publication. But full articles should generally follow this format:

//Author Name// is a //position// at //name of institution or company, with department name if applicable//. //His/Her// research interests include //list three or four topics//. //Last name// received a //highest academic degree [use an abbreviation if possible]// in //name of discipline [use lowercase]// from //name of degree-granting institution//. //He/She// has received //names of awards//. //He/She// is in on the editorial board of //name of publication// and has been //name of volunteer position// at //name of conference//. //He/She// is a member of //list up to three relevant professional organizations [okay to use an acronym or initialism for organizations]//. Contact //him/her// at //email address//.

Note: If there are space issues—for example, an unusually large number of authors—the professional organizations and research interests can be deleted (in that order).

For columns and departments, IEEE Security & Privacy uses the same format as for regular articles. Computer and IEEE Software follow this format:

//Author Name// is a //position// at //name of institution or company, with department name if applicable//. Contact //him/her// at //email//.

After an affiliation first appears in a bio, you can abbreviate subsequent instances of that affiliation (in that or any following bio) to save space. In this case, the abbreviation should appear in parentheses after the first instance of the affiliation.

If confusion about an affiliation name is possible (for example, school names that could apply to multiple institutions, such as Concordia University), add the location. Otherwise, the location isn’t necessary.
Capitalization

The Computer Society style is conservative in the use of capital letters. A company’s or public relations firm’s wishes about capitalization rarely carry any weight.

For company, product, system, and language names, use an initial capital only. Editors should determine whether the term is really a proper noun or merely descriptive or generic.

Internal capitals

For many years, Computer Society style prohibited the use of internal capitals in words, insisting on an initial capital only for product names, system names, and so forth. Words such as MiniDIP and AutoCAD were accepted as combinations of words and acronyms. This strict approach hasn’t been sustainable in the real world. We now permit one internal capital when it’s the first letter of another word, as in PostScript, MacDraw, or dBase. Only a few exceptions exist—for example, NeXT and LaTeX. If in doubt, see the alphabetical section of this style guide.

Titles

In the titles of articles, books, and so forth, capitalize nouns, pronouns, adjectives, verbs, adverbs, and first and last words. Function words (articles, coordinate conjunctions, and prepositions) aren’t capitalized, regardless of their length: “Better Health through Psychotherapy,” “Keeping the Peace without Creating Conflict.” The exception is following a colon—for example, “Along a Different Path: A Case Study.” For hyphenated words in titles, see CMS 8.159.

In references, use standard capitalization for titles but don’t lowercase internal capitals or improper acronyms that appear as part of a product or system name, even if it conflicts with the style guidelines.

Department names

Names of departments, divisions, laboratories, and so forth are capitalized when used as part of an organization’s proper name: the University of Pennsylvania Department of Computer Science; the university’s computer science department; the IBM Almaden Research Center; Hewlett Packard’s advertising department.
Copyrights

The IEEE owns the copyright for material published by the IEEE Computer Society. Authors must sign the IEEE copyright form, available online along with detailed information about IEEE intellectual property rights at www.ieee.org/copyright.

Authors shouldn’t include a copyright notice of their own in published articles or department submissions. Authors transfer copyright to the IEEE as part of the publication agreement. Staff members don’t need to complete a copyright agreement because its terms are part of the general conditions of their employment.

Each feature article carries a notice of IEEE ownership of copyright at the bottom of the first page. The two acceptable versions (with the symbol and with text) of the standard format are

- © 2013 IEEE
- Copyright 2013 by IEEE

Address questions regarding copyright issues to:
IEEE Intellectual Property Rights Office
IEEE Service Center
445 Hoes Lane, Piscataway, NJ 08854-1331
Phone: +1 732 562 3966; Fax: +1 732 981 8062
e-mail: copyrights@ieee.org

Trademarks

We don’t include the trademark symbol in articles published in IEEE Computer Society periodicals and proceedings. Trademark law doesn’t apply to the press because using a product name in the headline or text of an article doesn’t constitute an attempt to capitalize on the reputation of the company or the product.

US Government Work

When an author is (or all authors are) employed by the US government, the following wording is used instead of the IEEE copyright line: “US Government Work Not Protected by US Copyright.” The CCC code must not appear with that notice. Other useful information is at the IEEE Intellectual Property Rights website, www.ieee.org/copyright.

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### File Extensions and Their Meanings

<table>
<thead>
<tr>
<th>Extension</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>.arj</td>
<td>relatively uncommon archive file</td>
</tr>
<tr>
<td>.bak</td>
<td>backup file</td>
</tr>
<tr>
<td>.bin</td>
<td>binhex file—Macintosh</td>
</tr>
<tr>
<td>.bmp</td>
<td>bitmap file</td>
</tr>
<tr>
<td>.cca</td>
<td>cc:Mail archive file</td>
</tr>
<tr>
<td>.cdr</td>
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</tr>
<tr>
<td>.cfg</td>
<td>configuration file</td>
</tr>
<tr>
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</tr>
<tr>
<td>.com</td>
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</tr>
<tr>
<td>.cpl</td>
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</tr>
<tr>
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<tr>
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<td>database file</td>
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<td>.dir</td>
<td>directory</td>
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<tr>
<td>.dll</td>
<td>dynamic link library—Windows file system</td>
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<tr>
<td>.doc</td>
<td>MS Word document</td>
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<td>.dot</td>
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<td>.drv</td>
<td>printer driver file</td>
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<tr>
<td>.eps</td>
<td>encapsulated PostScript file</td>
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<tr>
<td>.exe</td>
<td>executable file—a program</td>
</tr>
<tr>
<td>.fon</td>
<td>font file</td>
</tr>
<tr>
<td>.gif</td>
<td>graphics interchange format—an art file</td>
</tr>
<tr>
<td>.gz</td>
<td>G-zipped file—Unix-based compressed file</td>
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<tr>
<td>.hgx</td>
<td>Harvard Graphics file</td>
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<td>.hlp</td>
<td>help file</td>
</tr>
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<td>BinHex compressed file</td>
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<td>.html</td>
<td>hypertext file—WWW page file</td>
</tr>
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<td>icon file</td>
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<td>.inf</td>
<td>information file</td>
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<td>initialization file—Windows file</td>
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<td>.kbd</td>
<td>keyboard layout file</td>
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<tr>
<td>.lan</td>
<td>local area network file—a Novell system file</td>
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<td>.lzh</td>
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<td>.mim</td>
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<td>message file</td>
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<td>PICT graphic</td>
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<tr>
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<td>portable document format file—Adobe Acrobat</td>
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</tr>
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<td>Adobe printer font—metric</td>
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<td>MS Publisher document</td>
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<td>.qxp</td>
<td>QuarkXPress document</td>
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<td>.reg</td>
<td>registry file—Windows file systems</td>
</tr>
<tr>
<td>.rfc</td>
<td>rich text format—a form of text formatting</td>
</tr>
<tr>
<td>.rul</td>
<td>cc:Mail rule file</td>
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<tr>
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<tr>
<td>.smi</td>
<td>system management interrupt—Intel</td>
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<tr>
<td>.sty</td>
<td>LaTeX style file</td>
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<td>.swp</td>
<td>Windows swap file</td>
</tr>
<tr>
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<td>DOS/Windows system file</td>
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<td>tape archive file—Unix-based compressed file</td>
</tr>
<tr>
<td>.taz</td>
<td>tar file that has been .z compressed</td>
</tr>
<tr>
<td>.tbl</td>
<td>Adobe table editor file</td>
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<tr>
<td>.tex</td>
<td>LaTeX file—a form of text formatting</td>
</tr>
<tr>
<td>.tif</td>
<td>tagged information format file—an image file</td>
</tr>
<tr>
<td>.tlb</td>
<td>MS Office executable file</td>
</tr>
<tr>
<td>.tmp</td>
<td>temporary file—Windows applications</td>
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<tr>
<td>.tf</td>
<td>TrueType font file</td>
</tr>
<tr>
<td>.txt</td>
<td>text file, usually plain ASCII</td>
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<tr>
<td>.vbx</td>
<td>Visual Basic file</td>
</tr>
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<td>.vxd</td>
<td>virtual driver file—Windows</td>
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<tr>
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<td>wave sound file</td>
</tr>
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<td>.wk1</td>
<td>Lotus 123 spreadsheet file</td>
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<td>.xls</td>
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<td>Windows metafile—a graphics file</td>
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<td>MS Write document</td>
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<td>.ws2</td>
<td>WordStart 2 document</td>
</tr>
<tr>
<td>.xls</td>
<td>Excel spreadsheet file</td>
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<tr>
<td>.xtg</td>
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<tr>
<td>.z</td>
<td>compressed file from a Unix-based system</td>
</tr>
<tr>
<td>.zip</td>
<td>compressed file from WinZip</td>
</tr>
<tr>
<td>.zoo</td>
<td>relatively uncommon archive file</td>
</tr>
</tbody>
</table>
Lists

How to use punctuation in a list depends on whether the introductory phrase is a dependent clause (it’s not a complete sentence) or an independent clause (it’s a complete sentence).

*If the introductory phrase is a dependent clause, there is no colon.*

In the past few months, I’ve been

- dressing more casually;
- finding unusual combinations of styles, colors, and textures; and
- looking for bargains.

*If the introductory phrase is an independent clause, there is a colon.*

People describe my wardrobe in many ways:

- sporty,
- colorful, and
- distinctive.

Here’s what I think:

- My wardrobe is distinctive.
- I can decide what to wear depending on my mood.
- I need some new clothes.

My wardrobe has many distinct characteristics:

- *Unusual.* Most people wouldn’t be comfortable making the same choices.
- *Versatile.* I can dress comfortably for a business meeting or casual Friday.
- *Color-coordinated.* I can mix and match garments to achieve a new look.

The following are examples of formatting alternatives for more complicated lists.

The major architectural components include

- a thin client terminal hosting a Web browser—the client terminals periodically send location updates to the network;
- an application server that delivers Web content prioritized according to user preferences—the application server formats the generated information content and adapts it for display on the client terminal; and
- a context and profile manager (CPM) that tracks the user’s dynamic context—the CPM also queries Web services and filters Web content data according to user profile context.

The architecture has three major components:

- A thin client terminal hosts a Web browser. The client terminals periodically send location updates to the network.
- An application server delivers Web content prioritized according to user preferences. The application server formats the generated information content and adapts it for display on the client terminal.
- A context and profile manager (CPM) tracks the user’s dynamic context. The CPM also queries Web services and filters Web content data according to user profile context.
The architecture has three major components:

- a thin client terminal,
- an application server, and
- a context and profile manager (CPM).

The client terminal hosts a Web browser and periodically sends location updates to the network. The application server delivers Web content prioritized according to user preferences; it formats the generated information content and adapts it for display on the client terminal. The CPM tracks the user’s dynamic context and queries Web services and filters Web content data according to user profile context.
Note: With the exception of running text—where the state name is spelled out—use of the postal abbreviation is preferred (CMS 10.28).

## Locations

### United States

<table>
<thead>
<tr>
<th>State</th>
<th>Standard abbreviation</th>
<th>Postal abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama</td>
<td>Ala.</td>
<td>AL</td>
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<tr>
<td>Alaska</td>
<td>Alaska</td>
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<td>Guam</td>
<td>Guam</td>
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<td>Hawaii</td>
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<td>Idaho</td>
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<td>New Jersey</td>
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<td>New York</td>
<td>N.Y.</td>
<td>NY</td>
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<td>State Name</td>
<td>Abbreviation</td>
<td>Postal Code</td>
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<td>North Dakota</td>
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</tr>
<tr>
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<td>OK</td>
</tr>
<tr>
<td>Oregon</td>
<td>Ore.</td>
<td>OR</td>
</tr>
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<td>Pennsylvania</td>
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</tr>
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<td>Puerto Rico</td>
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</tr>
<tr>
<td>Rhode Island</td>
<td>R.I.</td>
<td>RI</td>
</tr>
<tr>
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<td>S.C.</td>
<td>SC</td>
</tr>
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<td>Trust Territories</td>
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<td>Virgin Islands</td>
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<tr>
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<tr>
<td>West Virginia</td>
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<td>Wisconsin</td>
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</tr>
<tr>
<td>Wyoming</td>
<td>Wyo.</td>
<td>WY</td>
</tr>
</tbody>
</table>

Note: State names with five letters or fewer are never abbreviated. The names of states and territories outside the 48 contiguous US states are abbreviated only when used with a postal code.

Postal code placement: ZIP (Zone Improvement Program) codes follow the state code and are separated by a space: Los Alamitos, CA 90720. The Postal Service has expanded the original five-digit code to nine digits, known as ZIP+4. The added digits follow a hyphen appended to the original code: Los Alamitos, CA 90720-1314.
### Canada

<table>
<thead>
<tr>
<th>Province</th>
<th>Standard abbreviation</th>
<th>Postal abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alberta</td>
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<td>Man.</td>
<td>MB</td>
</tr>
<tr>
<td>New Brunswick</td>
<td>N.B.</td>
<td>NB</td>
</tr>
<tr>
<td>Newfoundland and Labrador</td>
<td>N.L.</td>
<td>NL</td>
</tr>
<tr>
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<td>N.W.T.</td>
<td>NT</td>
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<td>Nova Scotia</td>
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<td>Nunavut</td>
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<td>Ont.</td>
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<tr>
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<tr>
<td>Yukon Territory</td>
<td>Yukon</td>
<td>YT</td>
</tr>
</tbody>
</table>

Note: Quebec used to be abbreviated P.Q. for Province du Québec, but this is now obsolete. Francophones in Québec often use the postal abbreviation Qc.

Postal code placement: Canada’s postal code system is similar to the US ZIP code system. Postal codes are placed after the province code. The six-character codes are broken into two groups of three characters separated by a space. The format is letter, number, letter, space, number, letter, number—for example, Kingston, ON K1A 0S2.

### United Kingdom

UK postal codes are placed after the country (England, Scotland, Northern Ireland, and Wales) and are separated by a space. Add the nation (UK) after the postal code. The six-character codes are usually broken into two groups of three characters separated by a space. The usual format is letter, letter, number, space, number, letter, letter—for example, Stirling, Scotland FK9 4LA, UK. However, some cities use variations on this format.

### Europe

Postal codes are placed before the city name: D-4054 Nettetal, Germany. The number of digits varies among countries. The European postal union includes country prefixes with the postal codes. These prefixes, which are separated from the postal code by a hyphen, include:

<table>
<thead>
<tr>
<th>Country</th>
<th>Prefix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>B</td>
</tr>
<tr>
<td>Switzerland</td>
<td>CH</td>
</tr>
<tr>
<td>Germany</td>
<td>D</td>
</tr>
<tr>
<td>Denmark</td>
<td>DK</td>
</tr>
<tr>
<td>Spain</td>
<td>E</td>
</tr>
<tr>
<td>France</td>
<td>F</td>
</tr>
<tr>
<td>Italy</td>
<td>I</td>
</tr>
<tr>
<td>Norway</td>
<td>N</td>
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<tr>
<td>Netherlands</td>
<td>NL</td>
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<td>Sweden</td>
<td>S</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>UK</td>
</tr>
</tbody>
</table>
Include the state for all US cities except Atlanta, Baltimore, Boston, Chicago, Dallas, Denver, Detroit, Honolulu, Indianapolis, Los Angeles, Miami, Minneapolis, New Orleans, New York, Philadelphia, Phoenix, Pittsburgh, St. Louis, Salt Lake City, San Diego, San Francisco, and Seattle.

Don’t list the state name or province for cities outside the US and Canada. For most cities outside the US, list the nation after the city. However, don’t include the nation for these locations:

<table>
<thead>
<tr>
<th>City</th>
<th>City</th>
<th>City</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amsterdam</td>
<td>Jerusalem</td>
<td>Taiwan</td>
</tr>
<tr>
<td>Athens</td>
<td>Rome</td>
<td>Munich</td>
</tr>
<tr>
<td>Bangkok</td>
<td>Kyoto</td>
<td>Tokyo</td>
</tr>
<tr>
<td>Barcelona</td>
<td>Seoul</td>
<td>Oslo</td>
</tr>
<tr>
<td>Beijing</td>
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<td>Edinburgh</td>
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<tr>
<td>Geneva</td>
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<td>Reykjavik</td>
</tr>
<tr>
<td>Helsinki</td>
<td>Montreal</td>
<td>Rio de Janeiro</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>Taipei</td>
<td></td>
</tr>
<tr>
<td>Istanbul</td>
<td>Moscow</td>
<td></td>
</tr>
</tbody>
</table>
Mathematical Expressions

Most style manuals don’t cover mathematical style well. CMS has some good suggestions in Chapter 12 but is insufficient. Another reference source is N.J. Higham, *The Handbook of Writing for the Mathematical Sciences*, Society for Industrial and Applied Mathematics, 1998. Although this book is largely about how to write mathematics clearly, it also has some suggestions about math typography and other stylistic matters.

Miscellaneous math style issues

If authors use punctuation after mathematical expressions, including displayed equations, leave it in (or revise as necessary).

- Include a space on either side of multiplication signs, equals signs, and other operators when they’re at full size—for example, $100 \times 100$ matrix, and $a + b = c$. MathType automatically inserts thin spaces around these symbols. In subscripts and superscripts, omit these thin spaces unless the formula becomes confusing without them. Also, when < or > precedes a number in text (that isn’t a formula), there should be no space after the symbol.
- If line breaks are needed in equations that appear in a paragraph, they should come after a plus sign, equals sign, or similar character.
- Characters with overbars must be set in MathType. If an article has many symbols with overbars or other symbols that make typesetting difficult, consider asking the author if there is an easier alternative.
- Equation numbers are put in parentheses to the right of displayed formulas. They shouldn’t be boldface. Generally, only formulas called out in the text need to be numbered.
- Use italic type for lowercase Greek variables; don’t use italic type for uppercase Greek variables.
- Variables denoting vectors are set in boldface, not italic. Don’t use the small arrows above the variable to denote vectors.
- Set the label that denotes a matrix in italic—for example, $A$.
- If the vectors are simply mathematical and don’t represent physical quantities and direction (that is, they don’t need to be clearly differentiated from scalars), boldface is less important, and you can use lightface italic type if the author has styled them that way.

If the author consistently uses another scheme, consider going along with it.
Equation formatting guidelines

Display equations can be broken down a number of ways to fit in a column. First, each line of an equation must be aligned to either a relation symbol or a binary operator in the first line of the equation (if one exists). These symbols work in a hierarchy. Relation symbols are aligned with other relation symbols, binary operators are aligned with other binary operators, and binary operators are indented from relation symbols. For example:

\[ l(s, w) = \sum_{h} s(x, y) \log(\tau_i) - N_t \theta_i \]

\[ p(w_1, z_i) = p(w_1, v_1) + p(v_1, z_i) = p(w_2, v_2) + p(v_2, z_2) = p(w_2, z_2) \]

\[ -\sum_{h} \log(s(x, y)!)
+ \sum_{h} s(x, y) \log(\theta_b) - N_b \theta_b
- \tau_i(x, y) \log(\phi_i) \]

\[ \phi^{(3)}(s) + r(s), \]

\[ \phi^{(4)}(s) + \Delta r(s) = \frac{dr(s)}{ds}, \]

\[ \phi^{(5)}(s) + \Delta^2 r(s) = \frac{d^2 r(s)}{ds^2} \]

If an equation has only one relation symbol or binary operator, break the equation after the relation symbol or binary operator and indent the second line slightly:

\[ \frac{d \lambda^{(a)}}{dt} = \]

\[ E_{\rho [\Gamma, M, \Lambda, \Phi]} \left[ H^{(\alpha, l)} (\Gamma^{(2)}) \right] \frac{\mu^{(\alpha)}(\Gamma^{(2)}) K (B - A) p(\Gamma; \Phi, \Lambda)}{K (A - B) p(\Gamma; \Phi, \Lambda)} \]

If there’s room, align the equation like this:

\[ x_{i+1} \leq \left[ M_{i+1} \right] + d_z z (2 + x - y)
+ (m - 2)(k - 3) \]

If a display equation can’t be centered, the first line can be made flush left to the column to allow more room for the following lines of the equation. If an equation number won’t fit to the right of an equation, it’s acceptable to have the equation number fall one line below the equation and to keep it right-justified to the column.
Math guidelines

When should you italicize, when should you use bold, and when should you do neither? If you edit Computer Society articles, you need to have a good handle on the answers to these questions. The detailed answers below are meant to help you see the logic behind these answers, so that you’ll be able to consistently make the right decisions when confronted with a math-heavy article.

Constants

A constant is a letter that represents one distinct value that never changes, no matter what. Don’t italicize constants. For example, k often represents Boltzmann’s constant, which is always equal to $1.380622 \times 10^{-23}$ Joules/Kelvin. We use k to avoid having to write out this long number in our equations, but it’s not a variable because its value can never change; it remains constant. In most cases, the author will identify the letter as a constant. If he or she doesn’t, you can probably assume it’s not a constant.

One exception is the speed of light ($2.997925 \times 10^8$ m/s), a constant typically represented by c. Authors probably wouldn’t explicitly refer to it as “a constant,” but it is, and you shouldn’t italicize it. By the way, this is the same c that appears in Einstein’s most famous equation, $E = mc^2$. Written properly, the E (energy) and m (mass) should be italicized (because they’re variables), but the c (the speed of light) shouldn’t.

Variables

A variable, unlike a constant, is a letter that can represent more than one possible value. Italicize all such letters (except uppercase Greek). For example, you could represent time by t, a variable. Time can be 3, 4, 5, … seconds. Even when the author is referring to one instance (for example, $t = 4$), or even if the author says something like “we’re keeping the time constant,” you should still italicize t because it’s possible in another situation that t wouldn’t be kept constant at 4 ms or whatever. Time isn’t a constant that’s universally always equal to 4.

Matrices

Matrices represent an array of numbers (columns and rows), like the desks in a classroom. Make them italic and uppercase. The individual matrix elements should be italic (not bold) because they’re actually variables.

For example, imagine classroom A, a matrix. The person in the 1st row, 1st column is element $a_{11}$. Second row, first column is $a_{21}$. If you sit in the 2nd row from the front, 3rd column from the left, you are $a_{23}$. Rows go across the classroom (side to side); columns go from front to back (even though, for some reason, in school what people call “rows” are actually columns). The person behind you (3rd row, 3rd column) is $a_{33}$. The person to your right (second row, fourth column) is $a_{24}$, and so on.

Vectors

Vectors are variables that have a direction associated with them. However, don’t italicize them. Make them bold and lowercase—for example, the vector $\mathbf{v}$.

Units

Units are letters that stand for words, not numbers. Don’t italicize them. For example, when s means second, don’t italicize it. The same goes for Greek letters. Italicize lowercase Greek variables, but don’t italicize lowercase Greek units, such as the $\mu$ in $\mu$s (microseconds).
Acronyms disguised as variables

Beware of acronyms disguised as variables. Don’t italicize them. Editors sometimes mistakenly italicize a subscript or superscript that looks like a variable but actually isn’t.

For example, in $V_{DD}$, $V$ is a variable and should be italicized, but the letters DD are neither variables nor constants. They’re more akin to acronyms. They don’t stand for numbers; they stand for words. That’s the test. If you can’t put a number in for a letter, don’t italicize it because it’s not a variable. In this case, DD stands for a transistor’s drain voltage.

Now, consider $V_T$. This T probably refers to temperature and thus isn’t a variable. You’ll have to consider its context. However, usually these subscripts aren’t variables. A common exception is $n$ or $i$ (or even $t$) when it indicates a series of numbers such as $V_1, V_2, \ldots, V_n$. In this case, a number could be inserted in place of $n$, so you should italicize it.

Here’s another example of an acronym in disguise, but one that isn’t a subscript: “The NMOS transistor’s source (n+), bulk (p–), and drain (n+) terminals form an npn bipolar transistor.” In this case, the n and p are neither variables nor constants. They are, once again, more akin to acronyms but typically appear in lowercase. You can’t substitute a number for either of these.

Using MathType

If you can easily insert equations into text without using MathType, do so. Otherwise, use MathType.
Non-English Words and Phrases

The IEEE Computer Society is a worldwide organization, but its publications are produced in the US in English. The way Society publications deal with non-English terms and phrases depends on several factors—namely,

- the true “foreignness” of the expression—many non-English expressions have entered mainstream English,
- the availability of appropriate accented fonts,
- the staff’s familiarity with languages other than English, and
- the extent of the non-English readership of a publication and the degree to which the Society desires to appeal to that audience.

Here are some guidelines for using non-English terms:

- Use accents in anglicized foreign terms when they affect pronunciation or will prevent confusion between English words that are spelled the same.
- Italicize terms not commonly accepted in English, but generally use such terms in text only when there’s no suitable English equivalent. The way to determine whether a term is commonly accepted in English is to see whether it’s in the main body of Webster’s—if it is, don’t italicize.
- Transliterate non-Roman languages into the Roman alphabet. Use the transliterated phrase, an English translation, or both.
- For non-English institutional names, use the original name for spellings using the Roman alphabet, providing a translation if the reader might not understand. This approach works well with organizations whose acronyms are well known, such as CCITT (Comité Consultatif International de Télégraphique et Téléphonique), because using a translation (International Consultative Committee for Telegraphy and Telephony) followed by the acronym could confuse some readers. This same guideline applies to university names in bylines and references. In some cases, the non-English acronym is well known and always associated with the English translation. An example is the European Center for Nuclear Research, which is widely known by its French acronym, CERN.
- For non-English references, provide the original title first, but follow it with the English translation in brackets so that English-only readers can understand it. Follow English capitalization rules in the translated title. If you don’t have a translation or can’t translate the title, query the article’s author (who presumably has read the work and can translate the title). If the author can’t provide a translation, propose deleting the reference.
- For author names, always follow the author’s preference. However, if the accents required aren’t readily available in the Society font list, ask the author for English equivalents.
Numbers and Symbols

Dates

The *IEEE Policies and Procedures* (Jan. 2000) specify the following formats for dates:

- **Email and formal correspondence**: day, month, year—for example, 6 January 2004.
- **Software applications**: four-digit year, two-digit month, two-digit day—for example, 2004-01-06.
- **Centuries**: Use the symbol for ordinal numbers—for example, 20th century. Note: *CMS* spells out the century—for example, twentieth century.
- **Decades**: The abbreviation is ’90s, not ‘90s.

Numerals

Spell out the integers one through nine and use numerals for 10 on, except in these cases:

Generally, use numerals even for one through nine when the integer is coupled with a symbol or unit of measurement (2°, 3 V). Use numerals with percentages even for one through nine (a 5 percent drop; 3 percent responded; 3 to 6 percent). However, in nontechnical passages, numbers less than 10 used with common units, especially time units, might look better spelled out, as do numbers used with approximate measurements:

- the program ran in 8 minutes [exact measurement]
- but a report from eight years ago said [nontechnical]
- he lives eight miles down the road [nontechnical]
- about eight or nine centimeters [approximate]

Spell out a number at the beginning of a sentence, or recast the sentence.

For a list of units of measurement that don’t need to be spelled out, see the “Abbreviations” section and the related entries in the Style Guide’s alphabetical section. For unfamiliar units of measurement, spell them out on first use and abbreviate them thereafter. However, use abbreviations in figures or tables, but explain any unusual or nonstandard abbreviations.

When a sentence includes both an integer less than nine and an integer greater than nine to describe something in the same category, use numerals for consistency—for example, “The network can have 4, 8, or 16 nodes.”

Hyphenate a compound adjective consisting of a number and an abbreviation—for example, 24-Kbyte memory.

Numbers with four digits or more have commas: 1,000, 10,000. Exceptions include page numbers and dates (*CMS* 9.55). Precede decimal fractions with values of less than one with a zero to prevent the reader from overlooking the decimal point: 0.1 (however, observe the exceptions in *CMS* 3.70 and 9.19). And remember, they’re singular: 0.1 inch, not 0.1 inches.

Use an *s* to create plurals of numerals:

- the early 1920s
- in twos, threes, and zeros
• he had a collection of 386s and 486s

Fonts and computers are inconsistent in the treatment and availability of fraction symbols. So, for in-text fractions, full-size numerals with a slash are usually preferred: 1/2, not ½. In more complicated mathematical expressions set in MathType, built-up fractions are generally used: numerator over denominator, separated by a horizontal line. In mixed numerals, put a hyphen between the integer and the fraction:

• 8-1/2 inches wide
• 24-5/8-mile track

For further reference, see CMS Chapter 9, especially the parts on scientific and technical usage.

Symbols and signs

Use symbols in text only when you’re certain that readers are familiar with them.

Multiplication symbol: Use the multiplication sign “×” instead of “by” when numerals refer to dimensions: 3 × 5 cm box; 3 in. × 5 ft. board. When indicating the use of “times” with a number, use a multiplication sign instead of x—for example, 2× speedup. However, you may use “times” when it seems appropriate—for example, “The new version has 10 times the memory.”

Spacing of characters for units of measurement and symbols: Abbreviations for units of measurement, even if one letter, are separated from the numeral by a space (3 V, 5 m, 14 mm). Actual symbols, as opposed to abbreviations for units, can be closed up—for example, 42°30' for 42 degrees, 30 minutes latitude.

Use “sq ft,” not “ft².”

Don’t use abbreviations when the reference is indefinite or casual—say “several gigahertz,” not “several GHz.” However, where brevity is a key factor—for example, in new product write-ups and tables—use symbols liberally.

When defining variables in run-in text, use “is” rather than “=”—for example, “where t is the temperature,” not “where t = the temperature.”

Use the word “percent” in text; use the % symbol only in figures and tables.

Don’t insert “US” in front of the dollar sign except to avoid confusion.

Telephone and fax numbers

The IEEE Policies and Procedures specify the following format for phone and fax numbers:

In North America: +1 area code xxx xxxx—for example, +1 714 821 8380

Outside North America: +country code city code xxx xxxx—for example, in Belgium, +32 3 770 2242
Program Code

Use the “program code” tag for program code that appears inline; use the “PROGRAM SEGMENT” tag for code that’s set off from the main text.

If the lines of code are longer than a column width and can’t be easily broken, consider turning the code into a figure.

If a program line doesn’t fit on a single printed line, break and indent it to indicate the continuation. Never add extra punctuation. Authors will often request continuation lines to be right-justified or will otherwise express strong preferences on this issue.

In general, try to duplicate the spacing, indentation, punctuation, and capitalization in the author’s manuscript. Programming languages don’t normally recognize boldface or italics, but the author might use them for emphasis.

Spacing is very important because omitting a space will often prevent a computer from recognizing a command or variable.

Indentations often indicate subsets of the program. Although they aren’t necessary to the computer, they make a program easier to understand.

Punctuation

- Don’t substitute two single typesetting quotation marks (‘ ’) or normal double typesetting quotation marks (“ ”) for typewriter quotation marks (”).
- Don’t substitute a hyphen (-) for a minus sign (–).
- Don’t substitute a raised asterisk (*) for a multiplication asterisk (\^{}).
- Don’t substitute an em dash (—) for two hyphens (--), which is a comment symbol in some languages.

Capitalization

Words or letters in programming languages generally represent commands (tokens) or variables. In Fortran and Basic, the general convention is to capitalize commands (such as IF, PRINT, FORMAT, GOTO) and variables (often I, N, X(n.)). In C, Algol, and PostScript, these words and letters are lowercase.

Tokens in text

Use the “program code” tag for program commands to distinguish them in text. Resist using boldface, italics, underlining, superscript, or subscript. If the language is case-sensitive (where a compiler doesn’t see “do,” “Do,” “dO,” and “DO” as equivalent), follow the language’s rules. Most popular languages aren’t case-sensitive.
Case-insensitive

Ada, Algol, Anna, APL, assembly, Basic, Clu, Cobol, Fortran, job-control languages, Lisp (including Common Lisp), Logo, MS-DOS and other operating-system-level command interpreters (micro and mainframe), Occam, Pascal, PL/I, Prolog, SISAL, Snobol, and SQL.

Case-sensitive

ABC, C, C++, Eiffel, Interlisp, Loops (including the Common Loops and Concurrent Loops dialects), Modula-2, Prolog, and Smalltalk. Most case-sensitive languages are object oriented, although some (for example, ABC) aren’t. Some newer dialects of these languages might not be case-sensitive; check with the author.
Punctuation

In general, punctuation is such a complex topic that referring to the appropriate CMS sections is the preferred option. However, here we present some specific guidelines.

Colons

When a colon introduces text within a sentence, the following word starts with a lowercase letter. Otherwise, the following word has an initial cap.

Ellipses

Because the correct use of an ellipsis is sometimes mysterious, we provide these guidelines:

- For omissions within a sentence when using Word, insert a space, the ellipsis symbol, and a space.

- For omissions between sentences, use closing punctuation before an ellipsis if the preceding sentence is grammatically complete. If the preceding sentence isn’t grammatically complete, don’t use closing punctuation. Place a space directly before and after the ellipsis.

For more complete information about using an ellipsis, see CMS 13.48–13.56.

En dashes

Use en dashes for page ranges and other cases where the CMS calls for them; see CMS 6.78–681.

Quotation marks

Use double quotation marks for quoted text inside block quotations, decks, headings, and interviews. Don’t put quotation marks around the entire quotation, deck, and so on.

Slashes (virgules)

Use your judgment regarding the use of slashes. Normally, there should be no space on either side of the slash. For an exception, see CMS 6.104.
References

This special section consists of two subsections: sample formats and general style. The first presents examples of most of the reference types that arise in Computer Society publications. The second delineates the policies and style principles underlying the formats.

To save time, ask the authors for any missing reference information. If they don’t provide it, then search for it if possible.

Sample formats

Article in a collection


Article in a conference proceedings

In general, delete prepositions in conference titles where the meaning is clear without them (see the “Abbreviations” section). Use the ordinal symbol (2nd, 14th, 23rd) for annual conferences. If available, include the conference initialism in parentheses—for example, (ICDE 98)—following the abbreviated name of the conference. Include the sponsor’s name if it’s part of the official proceedings title. The publisher’s name is unnecessary. Use the page numbers, article number, or DOI.


Article in a journal or magazine

Use lowercase for vol. and no. The default is to use the volume and issue number, but for popular publications, you can use the publication date instead. Page numbers through 9999 don’t require a comma.


Blog

To cite the blog itself:

*The Official Google Blog*, Google; http://googleblog.blogspot.com. (Google is listed as the publisher here.)


*Artificial Intelligence and Robots*, blog; http://smart-machines.blogspot.com. (no named author or publisher)
Entries in a blog:


Book


Book series


Note: According to CMS 14.128, if the book can be located without the series title, it can be omitted to save space.

Dissertation or thesis


Electronic publication

DOIs

Note: If the volume and issue number, date, and page numbers are available, it isn’t necessary to include the DOI. If they aren’t available, use the DOI, if possible.

Article in a journal

Article in a conference proceedings


Online-only publication


Website


Executive order


Government report


Legal citations

Note: In text, italicize the names of court cases.

US Supreme Court decisions


Lower-court decisions


US laws

Newsletter


Non-English source

Including original title


Original title unprintable


Patent

With patentee information


Without patentee information


Pending publication

For an article or paper, include the name of the publication and date if known:


For a book, include the publisher and year of publication:

R. Lee, Writing New Programs, McMillan, to be published in 2012.

Personal communication and unpublished materials

These usually aren’t referenced because they aren’t available to the reader. Authors who insist on attributing material obtained through personal communication should identify the source of the information in the main text (for example, “As Maria Youngblood stated during a conference panel, ...”).

Preprint

Special issue


Standard


IETF working draft


Note: Per IETF guidelines, references to working drafts shouldn’t include URLs because they expire after six months; use “work in progress” instead.

Industry specification


MPEG specification


RFC


W3C note

D. Box et al., *Simple Object Access Protocol (SOAP) 1.1*, W3C note, May 2000; www.w3.org/TR/soap.

W3C recommendation

N. Mitra, *SOAP v.1.2, Part 0: Primer*, W3C recommendation, June 2003; www.w3.org/TR/soap12-part0.

Supplemental material

Technical memo, technical report, technical or user manual

Include the department name for technical memos, technical reports, and other material that might not be indexed in a company-wide or university-wide library or by an abstracting service.

Technical memo


Technical report with report number


Technical report without report number


Technical or user manual


White paper


Wikipedia

Avoid citing as a reference if a more standardized source is available.
General style

Author names

Use each author’s initials and last name. Leave no space between initials, but leave a space between the period following the last initial and the first letter of the last name (for example, E.F. Codd). For hyphenated first names, use a period for each initial (for example, J.-L. Picard).

If an entry has more than three authors, use the first author’s name and follow it with “et al.”—for example, T.G. Lewis et al.

Dates

Include just the year of publication for books. For periodicals, normally include the volume number, issue number, and year. However, for popular periodicals, include the month and year. If a periodical appears more frequently than monthly, include the date with the month—for example, 15 Mar. 2000. If a periodical appears quarterly, use the season or issue number, depending on the periodical’s usage. For periodicals that appear irregularly, don’t use the month—for example, vol. 16, no. 5, 1997.


Electronic references

References to electronic repositories are acceptable in IEEE Computer Society publications, but they aren’t the references of choice for formal archival use. Whenever possible, use references to printed material. However, when this isn’t possible, cite the electronic address along with as much additional information as possible. If the address itself becomes invalid in the future, the other information might help researchers find the same document elsewhere on the Internet. At the very least, a reference to an electronic source must include the URL.

When citing an electronic reference simply to give the reader a place to go for more information, instead of including it in a formal reference list, noting it in parentheses in the running text is acceptable. Because such references break the flow of the text, use them sparingly and don’t set them off in italic, boldface, or typewriter font. If an article includes many electronic references, consider placing them in a sidebar or a broken-out list.

Page numbers

If a reference’s page numbers start with page 1 (for example, “pp. 1–10”), verify that those are the actual page numbers and not just the number of pages. If that information refers to the number of pages, use the DOI instead, if possible.

Publications

Italicize names of books (including collections), magazines, journals, newsletters, technical reports, white papers, and manuals. Use quotation marks to enclose names of articles, papers, theses, dissertations, technical notes, and technical memos.
When listing conference abbreviations in a reference, use the conference abbreviation and the last two digits of the year: AAAI 07.

After the name of a book, thesis, proceedings, or other book-like material, list the publisher, year of publication, and inclusive page numbers if applicable. Delete terms such as Co., & Co., Ltd., S.A., Publisher, and Publishing Co.; retain Press. Where the publisher is a university, add its location if needed for clarity—for example, Miami Univ., Ohio.

Don’t include the editor’s name for a conference proceedings unless it’s an edited volume published as a book.

References for proceedings should tell where an interested reader can find the source, not where the conference took place. If a proceedings didn’t use a traditional publisher, provide the sponsoring organization.

Use an en dash to indicate multiple issue numbers—for example, vol. 5, nos. 1–4. If the name of a column is cited in the reference, use initial caps without quotation marks—for example, Embedded Computing.

If a reference’s page numbers start with page 1 (for example, pp. 1–10), verify that those are the actual page numbers and not just the number of pages. If that information refers to the number of pages, use the DOI instead, if possible.

**Titles**

Capitalize the first and last words, and all nouns, pronouns, adjectives, verbs, adverbs, and subordinating conjunctions. Lowercase articles, coordinating conjunctions, and prepositions, regardless of length. Example: “Toward Better Real-Time Programming through Dataflow.”

To make a source easy for researchers to find, use the title as it originally appears. Don’t add or remove hyphens, change words to preferred spellings, or lowercase internal capitals.

For foreign-language references, provide the original title first, followed by its English translation (if available) in brackets: *Zur experimentalen Aesthetic* [Toward an Experimental Aesthetic].

For a complete treatment of titles, see *CMS* 8.154-8.195.
Abbreviations in references

Use the following abbreviations in the titles of periodicals and proceedings and when naming publishing institutions:

Am. American
Ann. Annual
Assoc. Association
Bull. Bulletin
Comm. Communications (of)
Conf. Conference (on)
CS Computer Society
Dept. Department (of)
ed. edition, editor
Eng. Engineering
Fed. Federal
Govt. Government
Inst. Institute
Int’l International
J. Journal (of)
Lab(s) Laboratory (Laboratories)
Math. Mathematics, Mathematical
Nat’l National
no. Number
Org. Organization
Proc. Proceedings (of)
Q. Quarterly
Rev. Review
Soc. Society
Symp. Symposium (of or on)
Trans. Transactions (on)
Univ. University
vol. Volume

Use “Comm.” (for Communications) when the term refers to the type of periodical (and is part of the periodical’s name), not when it refers to the topic of communications.

Use “Eng.” (for Engineering) in the titles of periodicals and conference proceedings and in the names of professional organizations, not in article or book titles.

Drop the “on” from “Workshop on” constructions. When abbreviating institution names, drop “of” except in “University of” constructions—for example, Inst. Systems Research, Univ. of Wisconsin.

* Denotes entries for which it’s okay to use the acronym or abbreviated term on first use

* A: ampere—for example, 25 A (n.); 25-A current (adj.)
AAAII: American Association for Artificial Intelligence
AAAS: American Association for the Advancement of Science
AACP: American Association of Computing Professionals
ABET: Accreditation Board for Engineering and Technology
* AC: alternating current
academic degrees: BS, MS, and PhD are the standard abbreviations for the bachelor’s, master’s, and doctoral degrees that we encounter in most of our authors’ biographies. However, if an author insists, using BSME or BSEE instead of “BS in mechanical engineering” or MSc instead of MS is acceptable. These and other variants have the sanction of being included in the Webster’s list of abbreviations. In general, reproduce non-US degrees as authors submit them (except for periods)—for example, BEng, BTech, and DPhil. See also bachelor’s, master’s, doctorate.
accents: Use accents in anglicized non-English terms when important for pronunciation, to avoid confusion with another word, or where context makes it unclear. Use accents in non-English names, especially names of individuals. In general, lean toward the author’s preference. See also the “Non-English Words and Phrases” section.
ACE: Advanced Computing Environment
ACID: atomicity, consistency, isolation, and durability (a test)
ACK: acknowledgment
Acknowledgments: not Acknowledgements. Use the plural form for the section of the same name at the end of an article.
ACL: Association for Computational Linguistics
ACM: Association for Computing Machinery; includes several special-interest groups (SIGs). With the exception of Siggraph and Sigmod, use the ACM style for each SIG in text or references. See www.acm.org/sigs for a current listing. Use “is a Member of ACM” in bios. In references, use ACM instead of ACM Press (old format). Don’t insert “the” before ACM.
acronyms: See the “Acronyms and Abbreviated Terms” section for general style guidelines.
ACS: Australian Computer Society
ActiveX: software technology from Microsoft
A/D: analog/digital
Ada: a programming language (named for Augusta Ada Lovelace) developed by the US Defense Department
ADAPSO: Association of Data Processing Service Organizations; renamed as Information Technology Association of America (ITAA) in 1991
ADC: analog-to-digital converter

add-in board

Addison-Wesley or Addison Wesley Longman; Addison-Wesley Professional

add-on (adj.)

address mode (n.): the way the processor is addressed. It includes sequential, forward, and backward addressing, among other modes; hyphenate it when it’s used as an adjective.

ADSL: asymmetric digital subscriber line (for fast Internet access)

admin: okay to use instead of “administration” in appropriate cases

AEA: American Electronics Association

AEC (adj.): architecture-engineering-construction; no hyphens in the acronym

AES: Advanced Encryption Standard; NIST standard for symmetric key encryption

AFCET: Association Française pour la Cybernétique Économique et Technique

AFIPS: American Federation of Information Processing Societies (no longer exists)

agile: not capitalized when it refers to programming techniques

* AI: artificial intelligence

AIAA: American Institute of Aeronautics and Astronautics

AIChE: American Institute of Chemical Engineers

AIIM: Association for Information and Image Management

AIM: advanced instruction module

AIP: American Institute of Physics

Ajax: Asynchronous JavaScript and XML

A K Peters: Publisher (no periods after initials)

Algo: stands for algorithmic language

ALPG: algorithmic pattern generator (hardware and software)

Al Qaeda

ALU: arithmetic logic unit

* a.m.: ante meridiem “before noon” (also includes 12:00 midnight). See also p.m.

ampersand: Retain the symbol in proper names when the name owner uses it that way; otherwise avoid it.

Amazon.com

Amazon Mechanical Turk (MTurk)

AMS: American Mathematical Society

AMU: Association of Minicomputer Users

analog: not analogue

and/or: Avoid this construction.

ANOVA: analysis of variance; a statistical test

* ANSI: American National Standards Institute

Ansys: finite-element analysis software by Swanson Analysis Systems

anti-: not hyphenated as a compound modifier unless the root word is a proper noun or begins with “i”—for example, antialiasing, anti-intellectual

apa: all points addressable
APDA: Apple Programmers and Developers Association
* API: application programming interface
* APL: A Programming Language
appendices: not appendixes
Apple IIe, IIgs; Macintosh IIc, IIcx, IIfx, and so on
apps: acceptable abbreviation for applications
AR: augmented reality
Arcnet: Attached Resource Computer Network; developed by Datapoint Corp.
ARO: after receipt of order; Army Research Office (preceded by US if spelled out)
ARPA: Advanced Research Projects Agency, a part of the US Defense Department;
DARPA is the preferred usage.
Arpanet: the oldest of the networks on the Internet; initial capital only
artificial intelligence: AI is acceptable on first reference if the context makes it clear. The
term loosely includes expert systems, knowledge bases, natural-language interfaces,
pattern recognition (voice, image, and signal), and neural networks.
ASC: American Society for Cybernetics
ASCI: Accelerated Strategic Computing Initiative
* ASCII: American Standard Code for Information Interchange
ASIC: application-specific integrated circuit.
ASIS: American Society for Information Science and Technology
ASME: American Society of Mechanical Engineers
ASP: application service provider; application-specific processor; Active Server Pages
ASPLOS: Architectural Support for Programming Languages and Operating Systems; the
name of a conference
assembly language (lowercase; not “assembler”): a computer language that assembles the
assembly-language code, as a compiler compiles high-level code
ASTI: Association for Science, Technology, and Innovation
ATE: automatic test equipment
ATM: asynchronous transfer mode
ATPG: automatic test-pattern generation
AutoCAD: software from Autodesk Inc.; exception to normal style because of common
usage
Autoprobe
avatar: a graphical image that represents a person
Awk: a language based on the authors’ names—Aho, Weinberger, and Kernighan
B2B: business-to-business
B2C: business-to-consumer

bachelor’s degree

back door (n.), backdoor (adj.)

back end (n.), back-end (adj.)

backplane (n.): an electronic circuit board containing circuitry and sockets into which additional electronic devices on other circuit boards or cards can be plugged; generally synonymous with or part of a computer motherboard

backup (n., adj.): for example, “the system served as a backup;” “a backup copy”

back up (v.): as in, “you can back up the database”

bandwidth

bar code

Basic: a programming language; allegedly stands for “beginner’s all-purpose symbolic instruction code,” but this is etymologically suspect

BasicA: Microsoft advanced Basic; known as “GW-Basic” on non-IBM, MS-DOS computers

baud (sing. or pl.): transmission speed in units per second, originally used to measure telegraph transmission. In computing, the units are usually bits, hence the common practice of using baud and bps interchangeably. However, this is technically inaccurate because the unit in a baud can be any discrete element.

BCS: British Computer Society

BDI: beliefs, desires, intentions—a model of human reasoning

BEEP: Blocks Extensible Exchange Protocol

Beijing: the Pinyin form used instead of “Peking”

benchmark: a standardized problem, test, or suite of tests that serves as a basis for the repeatable, objective comparison of hardware or software. Examples include Dhrystone, Mflops, Sim, and Whetstone.

beta site: the secondary (hence beta) site

Beta-spline (n., adj.): not the same as a B-spline

beta test (n., v.)

Bezier: no accent mark on the first syllable

BFL: buffered field-effect transistor logic

BIFS: binary format for scenes

BGP: Border Gateway Protocol

“Big Blue”: informal name for IBM

big data (n., adj.): not capitalized

BIOS: basic input/output system; operating system software that handles communications with devices, including monitors, keyboards, disk drives, processors, and ports

Birkhäuser Boston: North American branch of the Swiss publisher, Birkhäuser Publishing
BIST: built-in self-test
bit: a binary digit, 0 or 1; the basic element making up digital data
-bit (suffix): Adjectives formed with numbers and bit are hyphenated—for example, “64-bit processor.”
bitblt: Previous CS Style Guide versions defined this term as “bit block-level transfer,” but some authors insist on “bit block transfer.”
bitline
bitmap: a digital representation of an image in which bits are mapped into pixels; in color graphics, a different bitmap is used for each red, green, and blue value
bitted graphics
Bitnet: a communications network between universities and research centers. Although it’s reputed to stand for “Because It’s Time Network,” the term isn’t a true acronym.
bit rate
bit-slice processor
bit-sliced (adj.)
bitstream (n., adj.)
bitwise (n.): dealing with bits rather than a larger structure such as a byte. Bitwise operators are programming commands or statements that work with individual bits.
black-and-white (adj.)
BlackBerry
black box: a complicated electronic device whose internal mechanism is usually hidden from or mysterious to the user
BLAS: basic linear algebra subroutines
blog: a shared online journal
Bluetooth
Blu-ray
BNF: Backus-Naur Form, a metalanguage
boldface: Strictly limit its use as an emphasis technique; italic type is preferred and should be used whenever possible.
Boolean: from George Boole; spelling with a capital B is preferred
bootup (n.), boot up (v.): more commonly just boot
botnet: jargon term for a collection of software robots, or bots, that run autonomously
bottom-up design: design that starts at the system level as opposed to top-down design, which starts at the logic level and works down. In middle-out design, design starts at the middle level and proceeds up or down.
boundary scan: a self-test technique; not synonymous with scan
BPEL4WS: Business Process Execution Language for Web Services
bpi: bits per inch—for example, 1,600-bpi magnetic tape unit; 1,600 bpi
BPML: Business Process Modeling Language
BPMN: Business Process Model and Notation
bps: bits per second, as in 1,200 bps; see also baud
BPSS: Business Process Specification Schema
BRDF: bidirectional reflectance distribution function
**B-rep**: boundary representation

**broadband** (n.): a technique for high-speed data transmission

**broadcast bus**: sends a single data item to all bus destinations in a unit of time

**brute-force attack**

**BSA**: Business Software Alliance

**Bsafe**: encryption software

**BSD**: Berkeley Software Distribution, an extended and modified version of AT&T Unix from the University of California, Berkeley

**B-spline** (n., adj.): not the same as a Beta-spline

**Bsquare**

**b-trieve**: random-access search technique used in databases

**burn-in** (n., adj.), **burn in** (v.)

**bus, bused, busing, buses**: The *s* isn’t doubled.

**byte**: an eight-bit string that a processor reads as a group. Generally, one byte equals one alphanumeric character.

**bytecode**: one word
°C: degree Celsius

C: a programming language

C++: a programming language based on C and extended to include object-oriented features (++ is not super- or subscripted)

C³: command, control, and communications

C³I: command, control, communications, and intelligence

Cᵋ: (x is an integer or an algebraic representation of an integer); a mathematical notation referring to the continuity of a function and therefore its differentiability (in calculus) because derivatives are undefined where functions are discontinuous. Less formally, continuity refers to the “smoothness” of a function or curve. \( C^0 \) means the function is continuous but its derivatives aren’t. \( C^1 \) means both the function and its first derivative are continuous, but the second derivative might not be. More complicated forms, such as \( C^{0,1} \), also occur. Some authors make the C calligraphic, but this isn’t necessary.

* CAD: computer-aided design

CADAM: computer graphics augmented design and manufacturing system

* CAD/CAM: computer-aided design and computer-aided manufacturing

CADD: computer-aided design and drafting

CAE: computer-aided engineering

CAGD: computer-aided geometric design

CAI: computer-assisted instruction or computer-aided instruction

CalArts: California Institute of the Arts; abbreviated term acceptable only on second reference

Calcomp, Calcomp IGS-500, Calcomp 960 plotter

CALM: Common Assembly Language for Microprocessors

Caltech: California Institute of Technology

CAM: contact addressable memory

CAM-I: Computer-Aided Manufacturing International


Cartesian: initial capital

CASE: computer-aided software engineering

CASA/SME: Computer and Automated Systems Association of the Society of Mechanical Engineers

CAT: computer-aided testing (not computerized axial tomography); see CT catalog (not catalogue)

CAVE: Cave Automatic Virtual Environment

CavernSoft: note internal cap

CBEMA: Computer Business Equipment Manufacturers Association

CCALI: Center for Computer-Assisted Legal Instruction
CCD: charge-coupled device
CCIA: Computer and Communications Industry Association
CDA: DEC’s compound document architecture
CD-I: compact disc-interactive
CDMA: code division multiple access—a wireless communications technology
*CD-ROM: compact-disc read-only memory. The preferred spelling is with the hyphen.
Cedar: a Xerox programming language
Cedex: a French postal pickup station, used in addresses
cel: a clear acetate sheet onto which animators’ drawings are traced and painted for photographing

cell phone
century: Use the symbol for ordinal numbers—for example, 20th century. Note: CMS spells out the century (twentieth century).
CerDIP: trademark name for a ceramic dual in-line package
*CERN: Centre Européen des Recherches Nucléaires (European Center for Nuclear Research)
CERT Coordination Center: CERT/CC, a center of Internet security expertise, located at the Software Engineering Institute, Carnegie Mellon University
CGA: color graphics adapter (or array); an IBM color-display standard allowing eight colors
CGI: common gateway interface
CGS: Computer Graphics Society
child: one of several family words used to describe relationships among nodes in databases. The terms are legitimate—don’t edit them out.
chipmaker, chipset
CHMOS: Intel’s CMOS
*CIA: US Central Intelligence Agency
CIDR: classless interdomain routing
CIE: International Commission on Illumination (Commission Internationale de l’Eclairage)
CIELUV: perceptually based color space
CIM: computer-integrated manufacturing
ciphertext: no hyphen; i not y
CIPS: Canadian Information Processing Society
CISC: complex-instruction-set computing
CLB: configurable logic block
cleanroom: a software development approach aimed at producing software with the minimum number of errors
cleanup (n., adj.), clean up (v.)
cleartext (n.)
client-server: Use a hyphen, not a slash.
clk: clock
clock cycle: the time it takes the CPU to fetch and execute an instruction. Don’t substitute “clock.”
closed-loop (adj.)
(the) cloud, cloud computing
CLUT: color lookup table
* cm: centimeter
CMM: Capability Maturity Model, Levels 1–5. Don’t spell this out in IEEE Software.
* CMOS: complementary metal-oxide semiconductor
co-: Compounds formed with this prefix generally aren’t hyphenated. Exceptions are compounds that result in a double o (co-op, co-official) and a compound such as co-edition that could be confusing or suggests infelicitious reading. However, this doesn’t apply to words such as coincidence or cooperate where the first two letters, through long-standing use, are viewed more as an integral part of the word than as prefixes. See Webster’s and CMS 7.85, Table 4, for other examples.
Co.: abbreviated when used in text as part of a company name. Avoid using it unless a company’s name might not be clear without it—for example, Data Co.
CO2e: equivalent carbon dioxide
Cobol: Common Business-Oriented Language; Cobol on all references
CoCom: an informal abbreviation for Coordinating Committee for Multilateral Expert Controls
* Cocomo: Cost Constructive Model, a project-estimation system developed by Barry Boehm
Codasyl: Conference on Data Systems Languages, an obsolete organization devoted to developing a universal data system language for business; active from 1959 to about 1971
code base
codesign; hardware-software codesign
Codiac: centralized operation deterministic interface access control
colocate: locate together, as in putting two things close together to share common facilities
COM: Component Object Model
compiler: a program that translates code in a high-level language into instructions a machine can execute
complex-instruction-set computing: also CISC
compute: Resist the tendency to use this as an adjective or adverb. Use “computationally intensive” instead of “compute-intensive” and “computation server” instead of “compute server.”
Computer (magazine): not IEEE Computer
computer games: Italicize the names of computer games but not the names of other types of games.
Computer Science Press: an imprint of W.H. Freeman. Spell out the name to avoid confusion with CS Press.
**Computer Society**: Use “the IEEE Computer Society” on first reference; “Computer Society” without “IEEE” is acceptable on second reference. The executive staff often uses IEEE-CS in its official communications.

**Computer Society publications**: Use IEEE CS in references.

**cooltown**: a ubiquitous-computing initiative sponsored by Hewlett Packard. Don’t call it “CoolTown.”

**copyleft**: a general method for making a software program free and requiring all modified and extended versions of the program to be free software as well

**copyright, ©**: See the “Copyrights, Trademarks, and Image Permissions” section.

**Corba**: common object request broker architecture. Don’t spell this out in IEEE Software.

**Corp.**: abbreviated when used in text as part of a company name; spelled out when used in a byline or biography. Generally used only if a company’s name might not be clear without it—for example, Logic Corp.

**Cosmic Cube**: a supercomputer at the University of Illinois

**cost-effective**: always hyphenated

* **COTS**: commercial off-the-shelf

**counter**: prefix, not hyphenated

**Courant Institute of Mathematical Sciences**: an institute at New York University

**CPA**: Computer Press Association

**CP/M, CP/M-86**: two of many early operating systems

**epi**: characters per inch

**epl**: characters per line; spell it out

**CPS**: a single cyber-physical system or the domain or concept of cyber-physical systems. The plural form is CPSs.

**cps**: characters per second, as in 125-cps printer

* **CPU**: central processing unit; plural is CPUs

**Cray-1, Cray-2, Cray X-MP/24, Cray X-MP/48, Cray-MP**: parallel processors from Cray Research (now Cray Inc.)

**CRM**: customer relationship management

**cross-assembler, cross-compiler**: an assembler or compiler that assembles or compiles code on one machine for use on another, normally incompatible, machine

**crossbar (adj.)**

**cross-hair cursor**

**cross section (n.), cross-section (adj.)**

**Crossstalk**: communications software

**cross validation (n.), cross-validation (adj.)**

**crowdfunding**

**crowdsourcing**

* **CRT**: cathode-ray tube; acceptable on first reference; use VDT when talking about video displays in general

**CS**: informal acronym for IEEE Computer Society; rarely used alone in publications

**CSCW**: computer-supported cooperative work

**CSE**: computational science and engineering; also, “computer science and engineering”
CSG: constructive solid geometry
CSI: Computer Security Institute
CSIC: customer-specific integrated circuit; pronounced “seasick”
CSMA/CA: carrier sense multiple access with collision avoidance
CSnet: Computer Science Network. It was established to connect institutions that have Arpanet to each other and to those that don’t. Merged with Bitnet in 1989.
CS Press: no longer used except for books as of 2011.
CSS: Cascading Style Sheets; a style sheet language

CT: computerized tomography; a 3D-scanning technique (not CAT)
CUDA: (Compute Unified Device Architecture) Not commonly spelled out.
CURE: an algorithm
CUT: circuit under test
cyber: (adj.) relating to computers or computer networks
cyber- (prefix): cyberattack, cyberinfrastructure, cybersecurity, cyberwarfare, cyberworld
cyber-physical systems
d: day (unit of measurement)
DA: design automation
D/A: digital/analog
DAC: digital–analog converter; Design Automation Conference
DAG: directed acyclic graph; a data structure for representing computer graphics
daisy chain (n.), daisy-chained (adj.)
daisywheel
DAML: DARPA Agent Markup Language
DAML+OIL: DARPA Agent Markup Language + ontology inference layer. Spell this out on first use.
* DARPA: US Defense Advanced Research Projects Agency
DASD: direct-access storage device
DASH: Design Aid Schematic Helpmate
data: Follow the author’s preference for use as singular or plural, but maintain consistency within an article (unless the context clearly demands inconsistency).
database, datacenter, datapath, dataset, datastream, datatype
data-entry (adj.): as in “data-entry switch”
dataflow (n., adj.)
data mining
Data General: The Westboro, Mass.-based company’s products include the Eclipse MV/8000, Eclipse MV/1000 superminicomputer, Eclipse S130, and GW/4000 graphics workstation.
daughter: one of several family words used in computer-based relationships. Although the preferred usage is the gender-neutral “child,” the term is legitimate; don’t edit it out.
Davic: Digital Audio Video Interactive Council
* dB: decibel (40 dB)
dBase II, dBase III, dBase III+: database products produced by Ashton-Tate
DBMS: database management system. The plural form is DBMSs.
* DC: direct current
DCE: Distributed Computing Environment
DCFL: direct coupled field-effect transistor logic
DCOM: Distributed Component Object Model
DCT: discrete cosine transform
DDL: document-description language
DDN: Defense Data Network
DDN PMO: Defense Data Network Program Management Office
DEC: Use Digital Equipment Corp. on first reference in text; DEC or Digital is acceptable for subsequent references.
DEC 10: The DEC 10 is the same computer as the PDP-10. Digital Equipment Corp.
changed the name to DEC 10 around 1973.

decimals: See the “Numbers and Symbols” section.
decision maker (n.), decision making (n.), decision-making (adj.)
DECnet: A Digital Equipment Corp. facilities’ network

DECsystem-10

DECUS: Digital Equipment Corp. Users Society; absorbed into Encompass, an HP users group
deep-submicron (adj.)
degrees: Spell this out in text when it’s used as a unit of measure. For educational degrees, see academic degrees. Use the degree symbol for temperatures.
Denelcor: a defunct company famous for making the HEP, a parallel processor no longer in production
denial-of-service (adj.): The abbreviation is DoS.
depth buffer: see z-buffer
DES: Data Encryption Standard
design by contract (n.)
desktop
device-independent (adj.): capable of making I/O requests without regard for the characteristics of I/O equipment

* DevOps: a portmanteau of “development” and “operations”
DFM: design for manufacturability
DFT: discrete Fourier transform; design for testability
DHCP: dynamic host configuration protocol
Dhrystone: a benchmark
DHTML: Dynamic HTML
dialog: as in “dialog box”
dialogue: a conversation. Be consistent regarding spelling if dialogue and dialog appear in proximity.
dial-up (adj.)
Diffserv: differentiated services
Digital Equipment Corp.: Spell this out on first reference in text; use DEC or Digital for subsequent references.
dimensions: Whether you spell out the term or use abbreviations, be consistent: 8 ft. × 5 ft. or eight feet by five feet. See the “Numbers and Symbols” section.
DIMM: dual inline memory module
DIP: dual in-line package; also, MiniDIP with no hyphen
disk: preferred, as in “floppy disk.” However, “disc” is the standard in optics, farming, and medical applications.
display-list (adj.)
Disspla: initial cap only; product of Computer Associates Int’l
distributed computing system: a system in which storage and processing facilities are dispersed and loosely coupled by transmission media; also a system in which many processors perform a computation in parallel
**DIVE**: Distributed Interactive Virtual Environment

**DLL**: dynamic linked library

**DMA**: direct memory access

* **DNS**: Domain Name System

  **doctorate**: preferred over “doctor’s degree”

**DoD**: Use Department of Defense on first reference; consider using Defense Department instead. Add US if the context isn’t clear.

**DoD-Std**: Department of Defense standard; not the same as Mil-Std

**DoE**: Use Department of Energy on first reference; consider using Energy Department instead. Add US if the context isn’t clear.

**DOF**: degrees of freedom

* **DOI**: digital object identifier

**DoJ**: Use Department of Justice on first reference; consider using Justice Department instead. Add US if the context isn’t clear.

  **dollar sign**: Don’t place “US” in front of the dollar sign except to avoid confusion.

**DOM**: document object model

* **DOS**: disk operating system

**DoS**: see **denial-of-service**

**dot-com**: Internet-based business

**dot matrix printer**: no hyphen

**double-buffer** (adj.): as in “a double-buffer scheme”

**double buffering**

**download** (v.)

**downtime** (n.)

**DPA attack**: differential power analysis

* **dpi**: dots per inch

**DPMA**: Data Processing Management Association

**DPMI**: DOS protected-mode interface

* **DRAM**: dynamic RAM (pronounced “dee-ram”)

**DRAM module**: a group of dynamic RAM chips packaged together

**DRM**: digital rights management

* **DSL**: digital subscriber line

**DSL**: domain-specific language

**DSP**: digital signal processor (chips); digital signal processing (applications, systems).

**DSS**: decision support system

**DSSS**: direct sequence spread spectrum

**DTD**: document type definition; an SGML term

**DTF**: dielectric thin film (filters)

**DTR**: data terminal ready

**DUT**: device under test

* **DVD**: digital video disc or digital versatile disc
**DXF:** data exchange file (format)
E.: “east” in addresses

e-: prefix denoting “electronic,” as in e-commerce, e-health, e-learning, e-publishing, e-science, but not in email. When using in an article title or headings, capitalize both the “e” and the word following the hyphen, as in “E-Commerce in Asia.”

on Earth (planet), of the earth (soil)

EasyLiving: a ubiquitous-computing project of the Vision Group at Microsoft Research. Don’t call it “easy living.”

eBay

EBCDIC: extended binary-coded decimal-interchange code; compare with ASCII

ebook

ECC: error-correcting code

ECL: emitter-coupled logic

E/D: enhancement/depletion mode

EDI: electronic data interchange

editor in chief (n.), editor-in-chief (adj.): Editor in Chief Bill Smith; Bill Smith, the magazine’s editor in chief; editor-in-chief position

EDSAC: Electronic Delay Storage Automatic Calculator

EDVAC: Electronic Discrete Variable Automatic Computer

Eeprom: electrically erasable programmable read-only memory

e.g.: exempli gratia; substitute “such as” or “for example”

EGA: extended graphics adapter or array; an IBM color-display standard allowing 16 colors

EIA: Electronic Industries Alliance

EIAJ: Electronic Industries Association of Japan

eigen-: prefix meaning “characteristic”

EISA: extended international standard architecture

Eispack: benchmark

EJB: Enterprise JavaBeans

E-JFET: n-channel enhancement mode junction field-effect transistor

electron beam (n.), electron-beam (adj.)

ellipsis: See the “Punctuation” section or CMS 13.48-13.56.

email: electronic mail. Use curly brackets to list multiple persons at the same email address—for example, {jsmith, pjones, abrown}@computer.org.

EMS: Expanded Memory Specification; a standard developed by Lotus Development, Intel, Microsoft, and AST Research for configuring and addressing memory above the MS-DOS direct-address 640-Kbyte limit. Also known as LIM EMS, from the companies’ names. AST became a development partner after the acronym was coined.

end-fire coupling

endpoint (n.): Use this in a geometric context and when referring to networks; otherwise,
use two words: end point.

end user (n.), end-user (adj.): the ultimate user or customer. Use just “user” unless distinguishing different types of users, such as a testing user or support user. Consider substituting “customer.”

* ENIAC: Electronic Numerical Integrator and Computer; an early-generation computer
* EPFL: Ecole polytechnique fédérale de Lausanne
* Eprom: erasable programmable read-only memory
* EPS: encapsulated PostScript
* ERP: enterprise resource planning
* Esprit: European Strategic Programme for Research and Development; retain the spelling of Programme
et al.: et alia. Use this for more than three authors in a bibliography, including a period after al.; it’s okay to substitute “and colleagues” or “and coauthors” in text.
etc.: et cetera. Substitute “and so forth” or “and so on.”
* Ethernet: LAN technology; also, Fast Ethernet and Gigabit Ethernet
* EU: European Union, formerly the European Community
euclidean: lowercase in most uses except when referring to the Euclidean algorithm
* Euler: an adjective describing a mathematical concept. It’s pronounced “oiler” and takes “an” as its article.
* Euler–Poincaré formula: a graphics algorithm
euro: European monetary unit
* EuroASIC: European Conference on Application Specific Integrated Circuits
* EuroDAC: European Design Automation Conference
* European Federation of National Engineering Associations
* EuroVHDL: European Conference on VHSIC Hardware Description Language
* EUUG: European Unix Users Group; now known as EurOpen
* Extensible Markup Language: XML; okay to use acronym on first use
* Extreme Programming (XP): not eXtreme Programming
* °F: degree Fahrenheit

fail-soft-features

fan-in, fan-out (n., adj.): types of logic networks
fan in, fan out (v.)

* FAQ

farad: unit of capacitance
Fastbus: an IEEE standard

Fast Ethernet

fast Fourier transform (FFT): (not hyphenated) decoding algorithm

father: one of several family words used to describe relationships among nodes in databases. Although the preferred usage is the gender-neutral “parent,” both terms are legitimate; don’t edit them out.
fault tolerance (n.), fault-tolerant (adj.): a system’s capability to keep executing in the presence of a limited number of faults

* fax: document facsimile, document facsimile telecommunications equipment

* FBI: US Federal Bureau of Investigation

FDDI: Fiber Distributed Data Interface

FDM: frequency-division multiplexing

FEA: finite-element analysis; also the acronym for Fast Ethernet Alliance

Fellow: always uppercase in “IEEE Fellow” and other similar titles—for example, “she’s a Fellow of IEEE”

FEM: finite-element method

femtosecond: one quadrillionth of a second

FET: field-effect transistor; also occurs in combinations, such as MESFET

ff: femtofarad
FF: flip-flop. Spell this out in text.
FFT: fast Fourier transform

Fhourstone: a benchmark

FHSS: frequency hopping spread spectrum

Fibre Channel: a computer communications protocol for high-performance information transfer

fiber optic (n.), fiber-optic (adj.)

field testing (n.), field-testing (adj., v.), field-test (v.)

FIFO (adj.): first-in, first-out—for example, “first-in, first-out accounting”

filename: can be used as two words when not relevant to computers

file system

finite-element analysis

FIPA: Foundation for Intelligent Physical Agents
FIPS: federal information-processing standard
FIR: finite-length impulse response
FireWire: trademarked name for IEEE 1394, an external bus standard
fixed-bubble memory
fixed-length field
fixed point (n.): notation in which the position of the point is fixed in relation to the numerals, according to some convention
fixed-point (adj.): as in “fixed-point arithmetic”
FJ: femtojoule
Flash: a proprietary Adobe software platform
flash memory
flat-panel display
Flex/32: a system from Flexible Computer Corp.
flip-flop (n.): a circuit or device capable of assuming one of two states at a given time; abbreviated FF
flits: flow-control digits
floating point (n.); floating-point (adj.): notation in which a point’s location isn’t fixed but is regularly recalculated. The location is usually expressed as a power of the base.
floorplan
flops: floating-point operations per second; never “flop,” except when quoting the use of this incorrect form. For example, the 1993 Branscomb Report is titled “From Desktop to Teraflop ...” Don’t change the title, but the report talks about building a teraflops, not teraflop, computer.
flowchart
flow control (n.), flow-control (adj.): the sequence of operations performed in the execution of an algorithm
flowgraph
flowtime
FOAF: Friend-of-a-Friend Protocol
focused, focusing
follow-up (n., adj.), follow up (v.)
footprint: loosely defined as the amount of space a machine takes on a surface (usually a floor or desktop) or as the system resources an application uses in a computer
foreign: Because the IEEE is an international society, “foreign” isn’t truly applicable in our publications when referring to nationalities; use “non-US” or “international” instead. Italicize terms that aren’t commonly accepted in English, but use such terms only when there’s no suitable English equivalent. See the “Non-English Words and Phrases” section and CMS 7.49-7.53.
formulas: not formulae
Forth: a programming language
Fortran: for formula translator, a programming language. Dialects include Fortran 77.
FOTS: fiber-optics transmission system
FPGA: field-programmable gate array.
fps: frames per second.

fractions: Use slash notation (1/1,000) for a general, rounded-off measurement; use decimals (0.001) for a specific, precise measurement. See the “Numbers and Symbols” section and appropriate sections in CMS.

frame buffer (n.)
Free Software Foundation: supports GNU Linux

front end (n.): usually refers to a small computer that serves as an interface between the host system and its peripherals

front-end (adj.): as in “front-end processing”

FSM: finite-state machine

* ft: foot

FTAM: file transfer and management

F-test

* FTP: File Transfer Protocol

full-scale (adj.)

full-screen (adj.)

Futurebus (n.): IEEE Standard 896 bus

fuzzy set (n.), fuzzy-set (adj.)
G: giga; standard prefix meaning one billion

* g: gram

g: gravity (“6-g acceleration”; “passengers in a BMW are exposed to 2 g”). The gravitational notation, g, is often italicized to differentiate it from “g” for “gram” or “grams”

GaAs: gallium arsenide; a semiconducting material, like silicon, used for integrated circuits. Spell this out on first use.

**Game Boy; Game Boy Advance; GameCube** gameplay

GB: gigabyte. Use Gbyte (instead of GB) or spell it out.

Gbit: gigabit. Use Gbit or spell it out.

Gbps: gigabits per second.

GBps: gigabytes per second.

* Gbyte: gigabyte—for example, 25 Gbytes and 25-Gbyte memory

GEM: Digital Research’s Graphics Environment Manager, an operating environment for MS-DOS PCs

**general-purpose processors**

genlock: to superimpose computer-generated graphics over videotaped images (from a camera, VCR, or VTR)

**Georgia Tech**

Gflops: gigaflops

* GHz: gigahertz

* GIF: graphic interchange format—an electronic file format

giga-: standard prefix meaning one billion

**Gigabit Ethernet**

GIGI: DEC’s General Imaging Generator and Interpreter

GIGO: garbage in, garbage out

GIPS: billion instructions per second

GIS: geographic information system

GKS: Graphical Kernel System, an international graphics standard

**GlobeCom**: an IEEE conference

* GNP: gross national product

GNU: supports GNU Linux; GNU’s not Unix

**googling**

GOPS: giga operations per second

GPL: GNU General Public License

GPRS: general packet radio service

* GPS: Global Positioning System; a constellation of 24 satellites used for navigation and precise geodetic position measurements
* **GPU**: graphics processing (or processor) unit

**graftal**: an image constructed using parallel graph grammars to define complex objects

**grandparent, grandmother, grandfather**: a group of family words used to describe relationships among nodes in databases. The terms are legitimate—don’t edit them out. Use the gender-neutral “grandparent” when possible.

**grand challenge**: a difficult problem at the leading edge of a computing field

**Grappa**: a Java graph-drawing package from AT&T

**gray**: not “grey,” except in quoted material

**Gray code**: a binary sequence in which two contiguous numbers differ in only one bit. Capitalize Gray because it’s the inventor’s name.

**gray scale** (n.), **gray-scale** (adj.): for example, “displayed in gray scale,” “a gray-scale display”

**grid, grid computing**

**GSM**: Global System for Mobile Communications.

* **GUI**: graphical user interface

**GW-Basic**: the Microsoft version of Basic for MS-DOS computers; BasicA is the IBM version
**h:** hour (unit of measurement)

**hacker:** an expert who explores the details of programmable systems to stretch their capabilities

**halfword:** half a computer word

**halftone:** an image reproduced from a photo or similar original medium, comprising a series of lines arrayed in a screen, to facilitate sharp, clear printing of images when producing books. Also the preferred format for images in electronic text for camera-ready and other forms. A 100- to 110-line screen is best; lines per inch is the US unit of measure.

**handheld** (adj., n.)

**handshaking:** identification protocol for modems

**hard copy** (n.), **hard-copy** (adj.)

**hardwired:** describes circuits with only wire and terminal connections, with no intervening switching (no resistors, inductors, or capacitors)

**HarperBusiness, HarperCollins**

**hashtag**

**HCI:** human-computer interaction.

**HD** (adj.): high-definition

**HDL:** hardware description language—any language from a class of computer languages

**HDTV:** high-definition TV

**head-mounted display**

**healthcare**

**help desk**

**hertz:** see **Hz**

**Hewlett Packard Labs**

**hexadecimal:** A numbering system with a base of 16. “A” through “F” represent the decimal numbers 10 through 15.

**HID:** human interface device

**hidden-line removal**

**hidden Markov model**

**hidden-surface algorithm**

**hidden-surface removal:** in computer graphics, removing from the display the surfaces that ordinarily would be obscured by the rest of the object.

**high level** (n.), **high-level** (adj.)

**high-performance computing**

**high-speed** (adj.): for example, “high-speed computing” and “high-speed switch,” but “very high speed switch”; also, **International Journal of High Speed Computing**.

**HiperLan2**

**Hippi:** high-performance parallel interface; also written as HiPPI and HIPPI—be prepared to negotiate
hither, yon: in computer graphics, the near and far clipping planes.

HMM: hidden Markov model

homepage

The Hong Kong University of Science and Technology (HKUST): “the Hong Kong University of Science and Technology” in text

hostname

HPC: high-performance computing

HPCwire: an online weekly publication about high-performance computing. Paper copy doesn’t exist. Italicize it as with the name of any periodical.

HPGL: Hewlett-Packard Graphics Language

* HTML: Hypertext Markup Language

* HTTP: Hypertext Transfer Protocol. In Web addresses, use lowercase—http://.

HVAC: heating, ventilation, and air conditioning. Always spell this out on first occurrence.

hyper- (prefix): not hyphenated when used to form a compound

hypercube: a parallel computer architecture

hyphenation: If you can’t resolve a hyphenation question by consulting Webster’s, review CMS 7.77-7.85. If you feel a word that technically doesn’t require hyphenation (for example, reallocate) might be confusing, consider hyphenating it.

* Hz: hertz; the standard term for cycles per second
IAB: Internet Architecture Board
IAMA: Internet Assigned Members Authority
IANA: Internet Assigned Numbers Authority
IAP: Internet access provider
IBE: identity-based encryption

* IBM: International Business Machines Corporation; sometimes informally called “Big Blue”
IBM 3740-formatted disk, IBM 370-type controllers (note the hyphenation)
IBM PC, IBM PC AT, IBM PC XT, IBM RT PC, IBM PS/2 (Models 25, 30, 50, 60, and 80): no hyphens. IBM PC AT-compatible (adj.).
IBM System/360, IBM System/370: IBM mainframes
IBM T.J. Watson Research Center

IC: integrated circuit; acceptable on first reference if context warrants

* ICANN: Internet Corporation for Assigned Names and Numbers
ICASE: Institute for Computer Applications in Science and Engineering, at NASA’s Langley Research Center
ICOT: Japan’s Institute of New Generation Computer Technology, the so-called Fifth Generation project. The initials refer to the Japanese transliteration of the program, not the English translation.

* ICQ: an instant-messaging program
ICT: information and communications technology

* ID: identification
IDC: formerly International Data Corp.

* IDE
IDE: integrated drive electronics; also, integrated development environment. Don’t spell this out in IEEE Software when it means the latter.
IDL: Interface Definition Language
i.e.: that is—spell it out

IEC: International Electrotechnical Commission—an international standards organization
IET: Institution of Electrical Engineers, UK; as of May 2006, renamed as Institution of Engineering and Technology (IET)—merged with Institution of Incorporated Engineers
IEEE 488 bus

* IEEE: Institute of Electrical and Electronics Engineers. When it’s used to refer to a document’s publisher, it’s no longer IEEE Press—just IEEE. Also, don’t insert “the” in front of it.
IEEE Computer Society: Insert “the” in front of this in text.
IESG: Internet Engineering Steering Group
IETF: Internet Engineering Task Force
**IFIP:** International Federation for Information Processing

**IGES:** International Graphics Exchange Standard

**iff:** if and only if. Spell this out.

**if-then**

**III:** integrated interconnection logic

-**ility, -ilities:** This is an *IEEE Software*-related term. On its first appearance in an article, use quotes (“-ilities”) but no italics. On subsequent appearances, drop the quotes but keep the hyphen.

**Illiac IV:** An early computer, retired from NASA use at Ames Research Center, Moffett Field, Calif., in 1985

**IMACS:** International Association for Mathematics and Computers in Simulation

**i-mode:** a wireless service

**IMP:** interface-message processor

**implementer**

* **in:** inch

**Inc.:** Abbreviate this when it’s used in text as part of a company name, but avoid using it unless a company’s name might not be clear without it (for example, Lisp Inc.). Don’t set it off with a comma.

**inches:** Whether you use symbols or spell them out, be consistent when describing dimensions—for example, “three inches by five inches” or “3” × 5”.” See also the “Numbers and Symbols” section.

**indexes:** use “indices” in mathematical contexts

**informatics:** a term often used to refer to computer science

**Information Age**

**INFORMS:** the Institute for Operations Research and the Management Sciences; formed in 1995 when the Operations Research Society of America (ORSA) merged with the Institute of Management Sciences (IMS)

**infoserver**

**in-house (adj.)**

**ink-jet printers**

**inline (adj.)**

**in queue:** Hyphenate this when using it as an adjective—for example, “an in-queue directory.”

* **INRIA:** Institut National de Recherche en Informatique et en Automatique (French National Institute for Research in Computer Science and Control)

**in-service (adj.)**

**INSPEC:** Information Services for Physics, Electronics, and Computing; an IET database of English-language research papers. Not a true acronym, but handle as one.

**integrated circuit:** IC is acceptable on first reference.

**Intel’s XScale processor**

**interconnect or interconnection** (n., adj.): Either is acceptable, but follow the author’s usage and be consistent throughout an article.

**International standard:** use “ISO standard”
Internet: normally “the Internet”; Internet 2
Internet Stream Protocol: ST
intranet: internal network
* I/O (n., adj.): input/output
IOP: Internetworking Operating System
IoT: Internet of Things
IP: Internet Protocol; intellectual property
iPhone: acceptable at the beginning of a sentence.
iPSC: a parallel processor from Intel
IPsec: Internet Protocol security
IPv6: Internet Protocol version 6
IPX: internetwork packet exchange
IR: infrared.
IrDA: Infrared Data Association.
IRDS: information-resource dictionary system, a de facto CASE standard
IRQ: interrupt request
ISAM: indexed sequential access method
iSBX bus: an Intel product
ISDN: Integrated Services Digital Network, a telecommunications service
ISM band: Industry, Science, Medicine band
ISMM: International Society of Mini- and Microcomputers
ISO: International Organization for Standardization (ISO). Use ISO when referring to standards (for example, ISO 9000 or “an ISO standard”), but use the entire name with the letters in parentheses when referring to the organization. ISO was originally a true acronym for the International Standards Organization, but the name has been changed and the letters are now only an identifier. Don’t spell this out in IEEE Software.
* ISP: Internet service provider
italics: Use sparingly for emphasis or to introduce new terms; use also for foreign expressions not commonly accepted in English (that is, not found in the main body of Webster’s), single-letter variables, longer variables that might be confused with text if not in italics, book titles (including manuals), movie titles, and TV-series titles.
* IT: information technology
ITC: International Test Conference
item set; some publications use itemset
iterator (n.): a programmed action that sets up a counter to control the number of times the action is performed
ith: Note: no space, no hyphen, no superscript.
ITU-T: International Telecommunication Union-Telecommunication Standardization Sector; formerly, CCITT
* J: Joule


**Jabber**: streaming XML protocol

**Java**: cross-platform programming language from Sun Microsystems

**JavaOne, JavaBeans, JavaScript, JavaServer Pages (JSP)**

**Java RMI**: Java remote method invocation

**JDK**: Java development kit

**JEDEC**: the JEDEC Solid State Technology Assoc., once known as the Joint Electron Device Engineering Council

**JEIDA**: Japan Electronic Industry Development Association

**JFIF**: J-PEG file interchange format

**jif**: an electronic file format

**Jini**: Java wireless technology

**JMS**: Java Message Service

**John Wiley & Sons**

**Josephson junction** (n.): an electronic switching device

**Jossey-Bass**: a subsidiary of John Wiley & Sons

**joystick**

* **JPEG**: Joint Photographic Experts Group; also an electronic-file format

* **JPL**: Jet Propulsion Laboratory

**Jr.**: doesn’t require a preceding comma

**JSON**: JavaScript Object Notation

**JTAG**: Joint Test Action Group; founders of the boundary scan standard

**jth**

**just-in-time (jit)**: an inventory management method; no capitals needed. It’s almost always used as a modifier.

**JVM**: Java virtual machine

**JXTA**: a platform-independent peer-to-peer distributed networking protocol developed by Sun

**Jython**
**K**

* **K:** (degree) Kelvin

**K:** 1,024, the binary thousand (25 Kbytes, 25-Kbyte memory); also used as temperature designator for Kelvin scale, as in 273 K. However, when used as $10K$ (with no space), “K” means 1,000. The use of “K” when referring to monetary quantities is discouraged.

**k:** 1,000, the decimal thousand (164 km); used in metric designations; see *CMS* 10.57

**KAoS:** knowledgeable agent-oriented system (nonstandard, but accepted acronym)

**KB:** kilobyte; use Kbyte (25 Kbytes, 25-Kbyte memory)

**Kb:** kilobit; use Kbit or spell out, but use Kbps for kilobits per second

**KBES:** knowledge-based expert system (as opposed to rule-based)

**Kbit:** kilobit; use Kbit or spell out

**Kbps:** kilobits per second, preferred over Kb/s; spell out on first use

**Kbyte:** kilobyte (25 Kbytes, 25-Kbyte memory). Don’t use KB.

**KEE:** Knowledge Engineering Environment, an Intellicorp product

**keiretsu:** a group of companies

**kernel:** the central part of a program or operating system that does the bulk of the calculations; not to be confused with the mathematical meaning

**keyboard, keyframe, keyshare, keystream, keyword**

**Kflops:** thousand floating-point operations per second. Spell this out or convert it to Mflops notation.

**Khornerstone:** benchmark

* **kHz:** kilohertz (50 kHz)

**kiloWhetstone:** measure of floating-point capacity. See *benchmarks.*

**KIPS:** thousand instructions per second. Spell this out or convert it to MIPS notation.

* **KLOC:** thousands of lines of code

**kludge** (n.), **kludgy** (adj.): a quick fix on a computer or in code

**Kluwer Academic Publishers**

**KM:** knowledge management

* **km:** kilometer

**km²:** okay to use instead of “square kilometers”

**k-means:** a type of algorithm

* **kmph:** kilometers per hour

**knowledge base**

**KSR1:** no internal hyphen; a parallel supercomputer from Kendal Square Research

**kVA:** kilovoltampere

* **kW:** kilowatt

* **kWh:** kilowatt hour
* L: liter
LALR(1): left-to-right scan with one look-ahead token; compare to \textit{LL(1)}
* LAMP: an open source Web server software bundle
* LAN: local area network
Lapack: a benchmark. See also \textit{ScaLapack}.

large-scale integration: See \textit{LSI}.
laser disk: preferred spelling over “laser disc” (unless the word appears as a trademark)
LASSO: least absolute shrinkage and selection operator
LaTeX (\TeX, \texttt{PCTeX}, \texttt{PCLaTeX}): a formatting language for typesetting math-heavy articles; pronounced “lah-tech” or “lay-tech.” Don’t set this in small caps or shift any characters above or below the baseline. \LaTeX\ is a superset of \TeX, the original format devised by Donald Knuth.

* lb: pound
* LCD: liquid crystal display
LCCC: leadless ceramic-chip carriers; chip packaging
LDAP: Lightweight Directory Access Protocol
Lear Siegler: hardware manufacturer

least worst: an acceptable term in decision theory

* LED: light-emitting diode
LiDAR: light detection and ranging (scanning technology)
lifecycle (n., adj.): the software product-development process, usually divided into typical phases: requirements specification, design, validation, development, testing (verification), implementation, and maintenance
LIFO (adj.): last-in, first-out

light pen
LIM EMS: Lotus/Intel/Microsoft/AST Research expanded memory specification, a standard for configuring and addressing memory above the MS-DOS direct-address 640-Kbyte limit. AST became a development partner after the acronym was coined.
Linccages: Linkage Interactive Computer Analysis and Graphically Enhanced Synthesis package (not a true acronym, but handle as one); a synthesis program for mechanism design developed at the University of Minnesota
Linpack: See \textit{benchmark}.

Linux: an open operating system based on the Unix platform
LIPS: logical inferences per second

Lisp: from “list processing”; a programming language used mainly in artificial intelligence

liveness: the quality of making sure that something good happens (not just ensuring that nothing bad happens). Liveness ensures, for example, that a calculation’s results are returned for use, not just calculated. Don’t use this term without an explanation. Compare with \textit{safety}

\textit{LL(1)}: left-to-right scan with one look-ahead token producing a leftmost derivation; short
for “leftmost LALR(1)”; see LALR(1)

* LNAI: Lecture Notes in Artificial Intelligence
* LNCS: Lecture Notes in Computer Science. Use this abbreviation in reference lists.
* LOC: lines of code
  LOCS: lines of code in service
  LoD: learning on demand
  login, logon, logout, logoff (n., adj.), log in, log on, log out, log off (v.)
  look-ahead (adj.)
lookaside
lookup (n., adj.); look up (v.): the process of matching by computer the words of a text with material stored in memory
LOTOS: logic of temporal ordering system
low-cost (adj.)
low-end (adj.)
lowercase (n., adj.)
lpi: lines per inch (300-lpi resolution, 300 lpi)
lpm: lines per minute (145-lpm printer, 145 lpm)
LSI: large-scale integration, about 1,000 to 10,000 circuits per chip
LUT: lookup table. Avoid using this acronym.
μ: mu. See *mu* and *micro-.*

* μs: microsecond

M: SI prefix for million or mega (40-Mbyte hard disk, 12 Mbytes of memory)

* m: meter

m: one one-thousandth or milli- (18 mm)

mA: milliampere (20-mA current loop, 20 mA)

MAA: Mathematical Association of America

MAC: media access control

**MacDraw, MacPaint, MacWrite**

Macintosh: computer from Apple

**Macro II**: Digital Equipment Corp. assembly language

**macro-** (prefix): not hyphenated when used to form a compound (macroassembler). An exception is when a double “o” occurs—for example, macro-object.

Macsyma: a symbolic manipulation program developed at MIT

**mainframe**: a computer housed in a large frame or cabinet, usually used for multiuser applications, which usually requires a temperature-controlled environment and special power supply. Examples are the Digital Equipment Corporation VAX and IBM System 370 computers; saying “mainframe computer” is redundant.

**makefile**

MAN: metropolitan area network

manet: mobile ad hoc network

man-hour, man-month, man-year (n.): Try to use a non-gender-specific term, such as staff-hour.

**man-in-the-middle attack; MITM attack**


marked up: When it’s used as an adjective, hyphenate it when it comes before the word it modifies but not when it comes after.

**market research firm**

markup (adj., n.)

mashup (n.); **mash up** (v.)

**master’s degree**

**master slice** (n.): a nonmetalized wafer containing arrays of circuit elements interconnected to perform different functions

matrices: preferred over “matrixes” in a mathematical context. In other contexts such as structural composition, use “matrixes”—for example, “matrixes of materials.”

**Matlab**
matrix, -es: See matrices.

MB: megabyte. Use Mbyte—for example, 40-Mbyte hard disk, 12 Mbytes of memory.

Mb: megabit. Use Mbit or spell it out.

Mbit: megabit. Use Mbit or spell it out.

Mbps: megabits per second (spell out on first use); Mbps, not MBPS.

Mbone: multicast backbone; Internet broadcasting technology

Mbyte: megabyte (40-Mbyte hard disk, 12 Mbytes of memory)

MCAE: mechanical computer-aided engineering

MCM: multichip module

MDA: Model Driven Architecture

MEMS: microelectromechanical systems

MEPS: millions of events per second

meta- (prefix): not hyphenated when used to form a compound (for example, metarule) unless it looks weird, as when the second term starts with a vowel (for example, meta-analysis)

Mflops: megaflops; million floating-point operations per second

mHealth: mobile health

MHEG: Multimedia and Hypermedia Experts Group

MHz: megahertz (50-MHz channel, 50 MHz)

mi: mile

micro, micros: acceptable as nouns when referring to microcomputers

micro- (prefix): one-millionth part of a specified unit (for example, microgram); not hyphenated when used to form a compound (for example, microelectronics)

micro-BGA: micro-ball-grid array

microCAD, microCADD: computer-aided design and computer-aided design and drafting performed on a microcomputer—no longer relevant because most CAD or CADD is performed on microcomputers

microelectromechanical: one word, no hyphens or capitals; often seen as “microelectromechanical systems,” abbreviated as MEMS

micrometer (µm): SI abbreviation for one-millionth part of a meter. The accepted abbreviation is µ.

micron: millionth part of a meter. However, the SI term is “micrometer.” Usage varies; for example, “micron” is used in integrated circuit production. Can also be written as µ.

microphotograph: a small photograph normally magnified for viewing (such as microfilm). The field is called micrographics. Do not confuse with “photomicrograph,” a magnified picture of small things.

microsecond (µs): The letter “u” isn’t a replacement. If a Greek font isn’t available, spell the greek letter out as “mu.” In magazines, the spelled-out form is preferred, at least on first reference, except perhaps in tables and figures.

MicroVAX, MicroVAX II, MicroVMS

mid: Check Webster’s for the preferred format.

middle-out design

midframe: a computer housed in a small frame or cabinet, usually used for multiuser
applications, that doesn’t require a temperature-controlled environment or special power supply. Saying “midframe computer” is redundant.

* MIDI: musical instrument digital interface

millisecond: the abbreviation is ms

Milnet: along with Arpanet, the main constituent of the Defense Data Network (DDN). Minet is the European split-off from Milnet.

Mil-Std: military standard; not the same as DoD-Std

MIMD: multiple instruction, multiple data. Pronounced “mimdee” and takes “a” as its article. Spell it out on first use unless the context dictates otherwise; add hyphens when it’s used as a modifier.

* MIME: Multipurpose Internet Mail Extensions

MIMO: multiple input, multiple output

* min: minute

mini- (prefix): not hyphenated when used to form a compound (for example, minicartridges)

MiniDIP: trademark name for a dual in-line package

MINX: Multimedia Information Network Exchange

MIP mapping: multiple texture mapping technique

MIPS: million instructions per second; also, MIPS Technologies Inc., a subsidiary of SGI. Use the full name when the context requires it.

* MIT: Massachusetts Institute of Technology. Spell this out on first use if the context dictates it.

MITI: Japan’s Ministry of International Trade and Industry

MITRE: the preferred format for this company’s name

mL: millilambert

ml: milliliter (5-ml strip, 0.5 ml)

* mm: millimeter (35-mm film, 0.5 mm)

MMOG: massively multiplayer online game

MMU: memory management unit

* mo., mos.: month, months

MobiCom: For 1999 and before, the conference acronym format is MobiCom 99; for 2000 and afterwards, the format is MobiCom 2000. The full conference name is, for example, 6th Ann. Int’l Conf. Mobile Computing and Networking (MobiCom 2000), 2000.

mobile phone: not hyphenated, even when it’s an adjective

mockup: (n., adj.)

MODFET: modulation doped field-effect transistor

molecular dynamics: hyphenated when it’s an adjective

Moore’s law: a theory predicting that the number of transistors on a chip doubles as technology advances

MOPS: million operations per second

Morgan Kaufmann: publisher

MOS (adj.): metal-oxide-semiconductor
MOSFET: metal-oxide-semiconductor field-effect transistor
mother: one of several family words used to describe relationships among nodes in databases. The preferred usage is gender-neutral “parent”; however, don’t change this without checking with the author.
motherboard: a circuit board into which various processor boards are plugged
Motorola: Don’t follow this with “Inc.” because confusion exists in the company about whether “Inc.” or “Corp.” is appropriate, even though company stationery uses “Inc.” Use the prefix “MC” when referring to the specific microprocessor from Motorola—for example, MC68030. Use “M68000” when referring to the family of devices that share the M68000 architecture.
Moving Picture Experts Group (MPEG): a family of standards for coding audio-visual information
* MP3, MP4: audio file formats
* MPEG-1, MPEG-2, MPEG-3, MPEG-4
* mph: miles per hour
MPI: message passing interface
MPU: microprocessing unit
MPW: an Apple development environment for the Mac
* MRI: magnetic resonance imaging
* ms: millisecond
* MS-DOS: Microsoft’s version of DOS; see also DOS
MSI: medium-scale integration
MSPS: million searches per second
MTBF: mean time between failures
MTTR: mean time to repair, mean time to restore
MTU: maximum transmission unit
mu (μ): Greek letter used as a symbol for micron
multi- (prefix): Don’t hyphenate this when it’s used to form a compound, except with “double-i” combinations—for example, multimeter and multi-integral.
Multibus, Multibus II: Intel trademarks. IEEE 796 is the multibus standard.
multiplexer (n.)
multiplication symbol: Use the multiplication sign “×” instead of “by” when numerals refer to dimensions—for example, 3 × 5 cm box, 3 in × 5 ft board. When indicating the use of “times” with a number, use a multiplication sign instead of x—for example, 2× speedup. However, you may use “times” when it seems appropriate—for example, “The new version has 10 times the memory.”
MUT: module under test
mux: multiplexer; muxes (pl.): Spell this out on first reference.
* mV: millivolt
MVP: matrix-vector product, the primary operation around which supercomputers are designed
MVS: an IBM mainframe operating system
**MW**: megawatt (2 MW, 2-MW system)

* **mW**: milliwatt (200 mW, 200-mW system)

**Mycin**: an expert system that can be programmed with knowledge databases for different domains
**9/07 Xen:** open source virtualization software

**9/11; September 11, 2001**

* N: Newton (unit of measurement)
N.: “north” in addresses
n: SI prefix for one billionth or nano (100 ns)
n: variable designation for an integer; italicized

* N/A: not applicable or not available

**NAA:** formerly the National Association of Accountants; reincarnated as the Institute of Management Accountants (IMA)

**naive**

**namespace**

**nano-** (prefix): one billionth. Don’t use a hyphen—for example, nanoseconds, 100 ns.

**narrow band (n.), narrow-band (adj.):** However, according to the *IEEE Dictionary of Electrical and Electronic Terms*, **narrowband** or **narrow band** are used as adjectives in some contexts.

* **NASA:** National Aeronautics and Space Administration, Washington, D.C.

  - **Ames Research Center**, Moffett Field, Calif.
  - **Dryden Research Center**, Edwards AFB, Calif.
  - **Goddard Space Flight Center**, Greenbelt, Md.
  - **Jet Propulsion Lab (JPL)**, Pasadena, Calif.
  - **Johnson Space Flight Center**, Houston
  - **Kennedy Space Flight Center**, Cape Canaveral, Fla.
  - **Langley Research Center**, Hampton, Va.
  - **Lewis Research Center**, Cleveland, Ohio
  - **Marshall Space Flight Center**, Huntsville, Ala.

**NASA Massively Parallel Processor**

**NAT:** network address translator

**national laboratories:** The names of US national laboratories (for example, Los Alamos National Laboratory) don’t have a “the” before them in text.

**NBS:** National Bureau of Standards, an agency of the US Commerce Dept.; obsolete, now called NIST

**NC:** numerical control

**NCCCD:** National Center for Computer Crime Data

**NCGA:** National Computer Graphics Association

**n-channel; n-channel device:** insulated-gate field-effect transistor where source and drain are regions of n-type conductivity

**NCSA:** National Center for Supercomputing Applications

**nCube:** in preference to nCUBE or nCUBE

**NCP:** Network-Control Protocol
near real time (n.), near-real-time (adj.)

Net: short name for the Internet

.NET

NetBIOS: a product that provides basic I/O services for a network. Don’t use this as a synonym for “network BIOS” or “LAN BIOS,” which are generic terms for a BIOS designed for a local area network

Netherlands: use “the” in front

netlist (n., adj.): a list of the pin connections (pin network) that appear on a printed circuit board

newsfeed

Newton-Raphson: a well-known algorithm for solving equations

NFS: Network File System (from Sun Microsystems’ application, SunSoft)

NGSCB: Microsoft’s next-generation secure computing base

*NIST: National Institute of Standards and Technology; formerly NBS

nm: nanometer

NMOS: n-channel metal-oxide semiconductor

no.: the abbreviation for number; nos. (pl.)

NOAA: National Oceanic and Atmospheric Administration, an agency in the US Dept. of Commerce. Although sometimes pronounced “noah,” it takes “an” as an article, as if each letter were pronounced (“an NOAA study”).

NoD: news on demand

node: Family words—mother, daughter, child—describe relationships among nodes in databases. The terms are legitimate; don’t try to edit them out.

non- (prefix): not usually hyphenated. Be flexible with words that are difficult to read—for example, non-negligible, non-real-time mode.

non–von Neumann: See von Neumann. In this case, an en dash is recommended over a hyphen.

NoSQL: not SQL; a generic term

NP-hard, NP-complete: classes of difficult problems

n-queen’s solver

* ns: nanosecond (3,000 ns)

* NSA: National Security Agency

NSERC: Natural Sciences and Engineering Research Council; a Canadian research agency similar to the US National Science Foundation

* NSF: US National Science Foundation. NSF is acceptable on second reference or on first reference in the acknowledgments section of a feature when used with a grant number.

NSFnet

NSPE: National Society of Professional Engineers

NuBus

numbers and symbols: See the related section and CMS Section 9.

NTSC: National TV Standards Committee. The committee and standard use the same acronym.

Nurbs: nonuniform rational B-spline
Nvidia
NW: northwest in addresses, no periods
NYU/IBS Ultracomputer
OASI: Office Automation Society International
OASIS: Organization for the Advancement of Structured Information Standards;
www.oasis-open.org
Object Management Group: OMG
Object Modeling Technique: OMT

object orientation

object-oriented (OO): An approach to programming that stresses the creation of functions (objects) that are linked in various relationships, usually in hierarchies, to provide the desired functionality. Compare this with traditional approaches such as imperative programming, which stresses actions to be taken rather than relationships between objects.

Objective-C: a computer language
Occam: the language used by Inmos for its transputer chip
OCR: optical character recognition. The machine is an OCR scanner.
octree: a tree structure that describes the division of a cubic region into smaller cubes
OCX: optical cross-connect
ODBC: open database connectivity

* OEM: original equipment manufacturer
OFDM: orthogonal frequency-division multiplexing
off-chip (adj.)
offline: all uses—for example, “the printer is offline” and “offline equipment”
offload, offscreen, onsite
The Ohio State University: “the Ohio State University” in text
ohm (n.): a unit of electrical resistance
OIL: ontology inference layer; see also DAML+OIL
okay

OLAP: online analytical processing
OLE: object linking and embedding; a Microsoft item
OLED: organic light-emitting diode
OLTP: online transaction processing
OMG: Object Management Group
Omnimax (n., adj.): a stereoscopic, eggshell-shaped theater
OMT: object modeling technique
ONA: Open Network Architecture
onboard: all uses—for example, “onboard regulation”
on-chip (adj.): as in on-chip logic
on-demand: (adj.)
online: all uses—for example, “the printer is online” and “online equipment”
ONR: US Office of Naval Research
onscreen, onsite
OO: object-oriented
op amp: operation amplifier. Spell this out in text on first use.
opcode (n.): operation code
OpenGL: a graphics programming language
open-loop (adj.): for example, “an open-loop program”
open loop (n.): A system in which there is no feedback mechanism for self-correction as there is in a closed loop
open source (n., adj.): Don’t use this as a verb (instead, consider wording such as “released X as open source”).
order-of-magnitude (adj.)
ORB: object request broker
ORSA: merged with the Institute of Management Sciences in 1995 to become the Institute for Operations Research and the Management Sciences (INFORMS)
orthogonal: In linear algebra, the term describes a set of vectors that are independent, in that no element is a linear combination of the others. In programming, the term is used more loosely to refer to independent—although possibly related—concepts.

* 
OS: operating system
OSI: open systems interconnection; a concept whereby different vendors’ products work together
OSPF: Open Shortest Path First Protocol
OS X
out queue (n.), out-queue (adj.)
OWL: Web Ontology Language
P2P: peer-to-peer
P3P: Platform for Privacy Preferences; a W3C standard
p: italicized; usually indicates probability
p: SI prefix for one trillionth or pico (3 ps)
p.: abbreviation for page when referred to in text; use pp. for multiple pages
* Pa: pascal (unit of measurement)
PABX: private automated branch exchange, a telephone system
packet: a packed block of data for data transmission
PAD: packet assembler/disassembler
PADL: Part and Assembly Description Language, developed at the University of Rochester
pairwise
PAL: phase alternating line—a European video standard; also the acronym for Paradox Application Language
Palm Pilot
PAN: personal area network
PAR: project authorization request
parameterization: not “parametrization.” To split this at the end of a line, note that “parameter” and like words are split after the m—for example: param-eter; but “parametric” is split before the m: para-metric. Automatic hyphenation programs tend to split “parameter” incorrectly.
PARC: Palo Alto Research Center
ParcTab: the first context-sensitive computer, developed at Xerox PARC. Note the capitalization.
parseable (alternate spelling: parsable)
PASC: Portable Applications Standards Committee
Pascal: a programming language (named for mathematician Blaise Pascal)
pascal: a unit of measurement. The abbreviation is Pa (no period).
parent: one of several family words used to describe relationships among nodes in databases. The terms are legitimate; don’t try to edit them out.
pass/fail
pathname
Pbps: petabits per second
p-channel (adj.)
* PC: personal computer; see also IBM PC
PC-DOS: IBM’s version of MS-DOS
PCB: printed circuit board. The plural form is PCBs.
* PCI: peripheral component interconnect
PCM: pulse-code modulation
PCMCIA: Personal Computer Memory Card International Assoc.
* **PDA**: personal digital assistant

* **PDF**: portable document format

  **PDL**: page-description language

  **PDP-11, PDP-11/03, PDP-11/70**: Digital Equipment Corporation computers

  **percent**: Spell it out; don’t use %. Don’t use it without a number as a replacement for “percentage.”

* **Perl**: Practical Extraction and Report Language

  **pervasive computing** (n.), **pervasive-computing** (adj.)

  **PET**: positron emission tomography

  **peta**: a thousand trillion (petaflops = a thousand teraflops)

  **petabit**

  **Petri net** (n.): a graphical model of information flow, showing static and dynamic properties of a system; named after Karl Petri, a German mathematician

  **pF**: picofarad; a unit of capacitance equal to one-trillionth of a farad

  **PhD**: no periods

  **PHIGS**: Programmer’s Hierarchical Interactive Graphics System, an ANSI and ISO standard

  **photo-**: no hyphen when used as a modifier—for example, “photomultiplier”

  **photomicrograph**: a magnified picture of small things. Don’t confuse it with “microphotograph.”

* **PHP**: recursive acronym for Hypertext Preprocessor, a scripting language

  **pico-** (prefix): one trillionth, no hyphen—for example, “pictogram” and “picosecond”

  **Pict**: an image-file format (generally produced by Apple Macintosh programs); not the same as a .PIC graphics file, which is produced primarily by MS-DOS spreadsheet programs

  **PID**: proportional, integral, derivative

  **PIM**: peripheral interface module; Protocol-Independent Multicast (SM = Sparse Mode; SSM = Single-Source Multicast)

* **PIN**: personal identification number. Don’t use “PIN number.”

  **pinout**

  **Pisces**: parallel implementation of scientific computing environments

  **Pittsburgh Supercomputing Center**: one of the four US national supercomputer centers funded by the National Science Foundation

  **pixel** (n.): Derived from “pix” (short for “picture”) and “element,” it’s the smallest resolvable dot in an image display.

  **PKI**: public-key infrastructure

  **PL/I**: a programming language developed by IBM (roman “I” per textbook by developer)

  **PLA**: programmable logic array

  **plaintext**: the intelligible form of an encrypted text—for example, “Plaintext contains routing information.” Use “plain text” when referring to unencrypted text—for example, “User entries are in italics; the computer’s response is in plain text.”

  **PlayStation**

  **plug-in** (n., adj.)
**plurals**: The general rule is to add an “s”—for example, 1980s (year), 40s (temperature), HP-1000s (name), and Apple IIs (name). See *CMS* 7.14 and 9.54.

* **p.m.**: post meridiem, meaning “after noon” (also includes 12:00 noon); see also *a.m.*

**PMU**: processor management unit

**PMOS**: p-channel metal-oxide semiconductor

**PNG**: portable network graphics

**PnP**: plug and play

**PO**: post office. In addresses, use no periods—for example, “PO Box 33.”

**PocketPC**: brand name; **pocket PC**: generic term

**podcast**

**policymaker**

* **POP3**: Post Office Protocol, version 3

**popup**

**Posix**: The IEEE standard for a portable operating systems interface. The initial standard deals with portability standards for C programs on computers running Unix.

**post-**: no hyphen unless the root is based on a proper noun—for example, “postprocessing” and “post-Victorian”)

**postmortem**

**PostScript**: a graphics- and font-description language from Adobe Systems, used primarily in desktop publishing

**power down** (v.)

**PowerPC**

**pp.**: the abbreviation for multiple pages. Single-page references are denoted by p.

**PPP**: Point-to-Point Protocol

**pre-**: no hyphen unless the root is based on a proper noun—for example, “preeminent” and “pre-Columbian”)

**prefixes**: see *CMS* 7.85, Table 4

**Prentice Hall**

**prepositions in titles**: See the “Capitalization” section.

**president**: Capitalize this only when it refers to the president of a country and comes before that person’s name—for example, “President George Washington” and “George Washington, first president of the United States.”

**prettyprinting**: the process of reformatting source code so that it has a consistent layout

**price/performance ratio**: written with a slash (“/”), not a hyphen

**printed circuit board**: the board on which most components are connected by printed circuitry. **PCB** or **PCBs** is acceptable on second reference.

**printout**

**Prism**: parallel reduced-instruction-set multiprocessing (Apollo architecture)

**programs and tokens**: See the “Program Code” section.

**Prolog**: a logic programming language

**PROM**: programmable read-only memory

**pronouns**: Instead of “he” or “she,” try to use a gender-neutral alternative—for example, a plural pronoun (and verb), “he or she,” or “the user.”
**ps**: picosecond

**PS/2**: Personal System/2, an IBM PC family based on Intel 80286/80386 processors. Unlike the IBM PC AT, it has a proprietary Micro Channel bus; it can run OS/2 or MS-DOS.

**PSB**: parallel system bus

**pseudo-** (prefix): no hyphen when used to form a compound—for example, “pseudorandom.” Word processors might hyphenate after “pseu,” but be careful to hyphenate after “pseudo.”

**PSN**: packet-switch node

**PSP**: Personal Software Process or PlayStation Portable

**PSTN**: public switched telephone network

**p test**

**pulsewidth**: not the same as pulse duration

**PUMA**: programmable universal mechanical assembly

**p value**

**PWB**: printed wiring board
**Q-bus**: from Digital Equipment Corp.

**QCD**: quantum chromodynamics

**QED**: quantum electrodynamics; also *quod erat demonstrandum*, “which was to be demonstrated,” commonly used at the end of mathematical proofs.

**QoS**: (n.) quality of service; (adj.) quality-of-service

* **QR code** (n.) quick response code

**quadword**: a 48-bit or 32-bit piece of data

**quasi, quasi-**: This is hyphenated for adjectives—for example, “quasi-parenthetical.” It’s open for nouns, except for some established closed compounds—for example, “quasi system” and “quasiparticle.”

**Quel**: a relational calculus language

**quicksort routine**: memory sorting

**QuickTime**: the Macintosh movie/animation application

**quotation marks**: Use them around direct quotations, chapter titles, episode titles, words when referred to as words, and letters when referred to as letters. In an article that begins with a quotation, don’t use an opening quotation mark with the initial drop cap (an oversized, boldface capital at the beginning of a paragraph), but close the quotation with a quotation mark. Block quotations don’t take quotation marks. For more information, see *CMS* 13.20-13.22 and 13.37-13.41.

**QVGA**: quarter VGA

**qwerty**: the standard typewriter or computer keyboard, with the letters *q, w, e, r, t,* and *y* at the upper left; no initial capital
**R8000**: a 64-bit RISC microprocessor introduced in 1994 by MIPS Technologies Inc. It was formerly code-named TFP. Other processors made by MIPS include the R4400 and R4600.

**rackmount** (adj.): computer equipment that’s standardized to 19 inches in width

* **RAID**: redundant array of independent disks (originally “inexpensive” disks)
* **RAM**: random-access memory

**RAND Corp.**: the official format for the name of the nonprofit research corporation. In *IEEE Security & Privacy*, use “Rand Corporation” in affiliations and bios.

* **R&D**: research and development

**raster** (n.): the scan lines that form the graphic output on a computer display; also referred to as bitmap

**raster-op**: raster operation

**ray tracer** (n.): an algorithm for drawing computer-generated shaded or highlighted images (also, a ray-tracing algorithm)

**RC**: resistance-capacitance

**RCS**: radar cross-section

**RDBMS, RDBMSs** (pl.): relational database management system

**RDF**: Resource Description Framework

**RDFS**: RDF Schema

**re-**: no hyphenation in most cases. See *Webster’s* for individual examples; watch the context for words such as resign (to quit a job) or re-sign (to sign again).

**readback**: a way to ensure the accuracy of output by comparing the transmitted data with the original data

**readout** (n.): a visual display of data stored electronically; **read out** (v.)

**read/write**

**RealNetworks**

**real time** (n.), **real-time** (adj.): the actual time during which something takes place

**reengineer**: to examine and alter a subject system to reconstitute it into a new form and to subsequently implement the new form; contrast with “reverse engineering”

**registered trademark** (®): See *trademark*.

**register-transfer** (adj.): for example, “register-transfer level”

**relational database**: a database with data organized into tables

**REST**: Representational State Transfer, an XML protocol

**reverse engineering** (n.), **reverse-engineering** (adj.), **reverse-engineer** (v.): to deduce the plans of something already built as opposed to reengineering an entity

**Rexx**: IBM’s Restructured Extended Executor

* **RF**: radio frequency

* **RFC**: request for comments

* **RFID**: radio frequency identification
RFP: request for proposal. Spell this out on first use.
RGB: red, green, blue; an additive color model used in TV and raster displays
RISC: reduced-instruction-set computing or computer
RMI: remote method invocation. See Java RMI.
road map
ROI: return on investment
rollout (n.), roll out (v.)
* ROM: read-only memory (nonerasable)
roman: a type style that isn’t italic or boldface; no initial capital when referring to the type style
round-off error
royalty-free images
* RPC: Remote Procedure Call; a protocol
RPF: reverse path forwarding
rpm: revolutions per minute
RS-232, RS-232C: hardware interface protocols
RS/6000: RISC System/6000, a workstation from IBM. It comes in a variety of models, such as the IBM RS/6000 Model 350.
RSCS: Remote Spooling and Communications Subsystem, the spooling protocol used in Vnet and Bitnet
* RSS: Really Simple Syndication, Rich Site Summary, or RDF Site Summary—a method of describing Web content that’s available for distribution or syndication from an online publisher to Web users
RSVP: Resource Reservation Protocol
RT: register transfer
RT-11: the operating system for Digital Equipment Corp. PDP-11 computers
RTCP: Real-Time Control Protocol
RTL: register transfer level or Register Transfer Language
RTP: Real-Time Transfer Protocol
RTSP: Real-Time Streaming Protocol
RTTP: Real-Time Transport Protocol; also seen as RTP
rubberbanding: a computer graphics technique that lets lines in an image be stretched and moved as if elastic
rule set
runtime (n., adj.)
s: SI abbreviation for second—for example, 30 s and 30 ns. See sec.
S.: “south” in addresses
SaaS: software as a service. It takes “a” when used as an adjective.
SAE: Society of Automotive Engineers
safety: In some computing contexts, this is a technical term meaning the quality of making sure that nothing bad happens. Safety, for example, ensures that a calculation is performed but not that the calculation’s results are actually returned to a user or program module. Don’t use this term without an explanation; compare with liveness.
SAMLS: Security Assertion Markup Language; an OASIS standard
SAN: storage area network; system area network
SATAN: Security Administrator Tool for Analyzing Networks. Don’t lowercase the acronym.
SAX: Simple API for XML
scalable
ScaLapack: a benchmarking package. See also Lapack.
scan-in; scan-out (n.)
scan line (n.): one of the lines that make up a graphics display
scatterplot
Scene: Scientific Computation Environment for Numerical Experimentation; a scientific visualization environment developed at Rutgers
schema: a term used in artificial intelligence and in modeling to represent an approach, scheme, or relation precisely and usually diagrammatically. Ensure that the generic “scheme” is inappropriate before using “schema.” The plural is “schemas,” not the Greek schemata.
Scheme: an artificial intelligence language
Schrödinger equation: Spell this with an umlaut, not oe.
SCI: scalable coherent interface
scratchpad: a fast auxiliary computer memory, usually used for temporary data storage
screen dump (n.), screenshot (n.), screensaver (n.)
scroll bar (n.)
Scrum: a framework for software development
SCSI: Small Computer System Interface. It’s pronounced “skuzzy” and takes “a” as its article.
SDI: serial digital interface
SDK: software developer’s kit
SDRAM: synchronous DRAM (dynamic random access memory)
SE: “southeast” in addresses
SEBoK Guide: This is the preferred abbreviated form when referring to the Systems Engineering Body of Knowledge. Don’t confuse this with the SWEBOK Guide.
sec.: nontechnical abbreviation for second. Use “s” unless confusion could result.

second sourcing (n.): in manufacturing, the practice of using an alternate company to produce something that the original manufacturer designed and produces itself—for example, when the original manufacturer can’t make enough to meet demand

SEI: Software Engineering Institute, a US Defense Dept. research arm (managed by the US Navy) based at Carnegie Mellon University. In IEEE Software, SEI doesn’t need CMU with it.

Semantic Web: an extension of the current Web using standards such as RDF along with ontologies and other mechanisms to define meaning for abstract data to facilitate machine–machine communication

semi (prefix): Don’t hyphenate this.

Senior Fellow, Senior Member
September 11, 2001 (9/11)

Serial ATA
Series 1000: but “the 1000 series”

servocontroller: “Servo” by itself isn’t sufficient.

servomechanism: an automatic feedback system that monitors an operation and makes necessary adjustments. “Servo” by itself isn’t sufficient.

set-top box: an interactive television device that sits on top of the television

setup (n.), set up (v.)

SGI: formerly Silicon Graphics Inc.

SGML: Standard Generalized Markup Language

SGMP: Simple Gateway-Monitoring Protocol

shar: shell archive; a file combination protocol

shrink-wrapped

SI: an acronym for the French version of International System of Units, a scientific method of expressing the magnitude or quantity of seven specific natural phenomena

SIA: Semiconductor Industry Association

SIAM: Society for Industrial and Applied Mathematics

SID: Society for Information Display

SIG: special-interest group. See ACM.

Siggraph; Sigmod

Sigma: a project to develop a software development workstation environment, staffed by a consortium of companies working under the direction of Japan’s Ministry of International Trade and Industry (MITI) through the Information-Processing Technology Agency (IPA)

signs: See the “Numbers and Symbols” section.

SIIA: Software Information Industry Assoc.

Sim: a benchmark

SIMD: single instruction, multiple data—the simplest form of parallel architecture. It’s pronounced “sim-dee” and takes “a” as its article. Spell it out on first use if necessary for contextual clarity. Use hyphens when it’s written out and used as a modifier.

* SIMM: single, in-line memory module

Simox: separation by implanted oxygen
single-sign-on

single-stuck-at fault model: See stuck-at.

the singularity: Note the lowercase s.

SIP: Session Initiation Protocol

SITA: Société Internationale de Télécommunications Aéronautiques

sizeable: Webster’s also uses “sizable.”

SkinnyDIP: a trademark name for thin-packaged DIP chips. DIP stands for “dual in-line package.”

Slim: Software Life-Cycle Management, a project-estimation system developed by Lawrence Putnam

SLOC: source lines of code. Don’t spell this out in IEEE Software.

SLP: Service Location Protocol

small-scale (adj.)

smart card (n.)

smart home (n.), smart-home (adj.)

smartphone (n.)

SMD: surface-mount device

SME: Society of Manufacturing Engineers; small and medium enterprise

SMEs: small and medium enterprises

SMIL: Synchronized Multimedia Integration Language. Use “a” before the acronym. It’s pronounced “smile.”

S/MIME: secure MIME

SMS: short message service

SMT: surface-mount technology

SMTP: Simple Mail-Transfer Protocol

SNAP: scalable networks and platforms; a phrase coined by Gordon Bell and Jim Gray at the University of California, Berkeley

SNMP: Simple Network Management Protocol

SNR: signal-to-noise ratio

SOA: service-oriented architecture. It’s pronounced “soh-uh,” as in “a SOA.”

* SOAP: a Web services messaging protocol. Originally the acronym for Simple Object Access Protocol, the term is no longer defined in common use.

SOC: service-oriented computing; service-oriented collaboration

SoC: system-on-chip (adj.); system on chip (n.); systems on chip (n. pl.). The abbreviated plural noun form is SoCs.

social media (n., adj.)

social network

soft copy (n.), soft-copy (adj.)

software engineering (n., adj.)

software-hardware development (n.)

Softwire

soho: small office/home office
SOJ: small-outline, J-lead

**solid modeling** (n.), **solid-modeling** (adj.).

**son**: one of several family words used to describe relationships among nodes in databases. The term is legitimate; don’t edit it out.

**Sonet**: Synchronous Optical Network; a Bellcore standard

**Sony PlayStation**

**source code** (n., adj.): no hyphen

**SPA**: Software Publishers Association, now part of SIIA (see the related entry); also “scratchpad area” (from IEEE)

**spam**: junk email

**Sparc**: Sun Microsystems’ scalable processor architecture; a RISC-based CPU used primarily in engineering workstations

**Sparcstation**: Examples are Sparcstation IPX and Sparcstation 2.

**SPC**: Software Productivity Consortium, a research group

**SPEC**: Standard Performance Evaluation Corporation (formerly System Performance Evaluation Cooperative); a vendor-sponsored source of the SPEC benchmarks. Examples are the SPECint92 and SPECfp92.

**Speedup** (n.)

**Spice**: a simulation program with integrated circuit emphasis

* **SPIE**: Society of Photo-Optical Instrumentation Engineers. The organization now styles itself “the international society for optical engineering.”

**Spreadsheet** (n.)

**Springer**: a book publisher. Use this in all references (instead of Springer-Verlag, for example).

* **sq ft**: square foot

* **SQL**: Structured Query Language

**squash-and-stretch** (n.): a function that enlarges and reduces, not necessarily in proportion to all dimensions; also called **rubberbanding**

**SRAM**: static RAM. Takes “an” when used as an adjective.

**SRI**: Stanford Research Institute

**SSH**: Secure Shell or Secure Socket Shell; a security protocol

**SSI**: small-scale integration, typically from one to four circuits

* **SSL**: Secure Sockets Layer; a security protocol

* **SSL/TLS**

**stand-alone** (adj.)

**Staran**

**Stars**: Software Technology for Adaptable, Reliable Systems; a US Defense Dept. project

**Star Tap**

**StarTLS**

**start-up** (n., adj.)

**statechart**: not state chart or state-chart

**state of the art** (n.), **state-of-the-art** (adj.): represents the highest level of available technology (as compared with “state of the practice,” which is the highest level in general
use). It’s an overworked phrase; consider substituting “current technology.”

state-transition (adj.)

stereo pair (n.): two pictures that produce a 3D image

stuck-at (adj.), stuck-at fault (n.): a type of circuit defect in which a gate can be stuck at either 1 or 0—for example, “stuck-at-1 fault” or “stuck-at-0 fault”; can also be abbreviated as SA1 and SA0

stuck-open fault (n.): not synonymous with stuck-at fault

stylesheet (n., adj.)

Styrofoam: use “foam” or “plastic foam” when referring to generic consumer or packaging products. Capitalize this term when it’s used as a trademark.

subsystem (n.)

Sun OS: Sun Microsystems’ version of the Unix operating system

SunSoft: a division of Sun Microsystems that provides system software

Sun workstation: initial capital on “Sun”; from Sun Microsystems

Sunmos: a Sandia / University of New Mexico operating system; an operating system for the Intel Paragon parallel supercomputer

super: no hyphen when used to form a compound word—for example, supercomputer

supercomputer (n.): There’s no fixed processing speed definition for a supercomputer; it changes with advances in technology.

supermini: short for superminicomputer, which is the preferred usage

surface: Don’t use this as a transitive verb in the sense of “bringing to the top.” A whale surfaces, but a speaker doesn’t surface an idea. If you must give buoyancy to ideas, “float” them. However, “surface” can be used as a transitive verb in the sense of “refining or smoothing a physical surface,” as in “surfacing lumber.”

surface-mount device, surface-mount technology: a board manufacturing method in which chips are “glued” to boards

SW: “southwest” in addresses


SWIG: simplified wrapper and interface generator

system on chip (n.); system-on-chip (adj.); systems on chip (n. pl.): The abbreviations are SoC (sing.) and SoCs (pl.)

systemwide
24/7
* 2D: two-dimensional, no hyphen
* 3D: three-dimensional, no hyphen
3DES: (say “triple DES”)
T1: digital transmission at 1.544 Mbits per second; T3 is a faster line
_tape out_
tar: tape archive; file combination protocol
task ID: Use the one-word form, taskid, only in program statements.
task type: Use the one-word form, tasktype, only in program statements.
* Tbyte: terabyte; one billion bytes
TC: technical committee. Spell this out on first use.
Tcl/Tk: a computer language developed by John Ousterhout of UC Berkeley. The elements can also be separate—Tcl and Tk.
* TCP: Transmission Control Protocol
TCPA: Microsoft’s Trusted Computing Platform Architecture, formerly called Palladium
* TCP/IP
TDM: time-division multiplexing
TDMA: time division multiple access
_television numbers:_ See the “Numbers and Symbols” section and _CMS 6.77._
teletext: a noninteractive (broadcast) text and graphics communications system
Teletype: use only when describing Teletype Corp. equipment. The generic word is _teletypewriter._
teletypewriter: See above; abbreviated TTY.
television: okay to abbreviate as TV
telex: the acronym for teletype exchange, a service that permits the transmission of data using commercial telecommunication facilities comprising a network of teletypewriters
Tell-A-Graf: graphics software by Computer Associates International
_Telenet_ (n.): Terminal Emulation Protocol; US Sprint’s switching network originally developed for Arpanet
testbed (n.): an environment containing all the components necessary for testing a system
tests (statistical): F-test; t-test, chi-square test; _p_ value; Wilcoxon rank sum test
TeX: _see_ _LaTeX_; pronounced “tech”
Tflops: teraflops; one billion flops
TFT: thin-film transistor
_the:_ Normally, when referring to the name of an academic institution or corporate entity that starts with “the” (such as “the University of Texas”), lowercase or delete “the.” Delete “the” in a byline (except for “The Ohio State University” and “The Hong Kong University of Science and Technology).
_ThinDIP:_ a trademark name for thin-packaged DIP chips; “DIP” stands for dual in-line
package

Thomas J. Watson Research Center, T.J. Watson Research Center: an IBM facility; refer to as the “IBM T.J. Watson Research Center” on first use

Thomas J. Watson: When referring to the persons, distinguish between Jr. and Sr.

three-space, three-dimensional space: a mathematical term; also 3-space. It can be written as $S^3$ or $\mathbb{R}^3$.

throughput
tif: an electronic file format
*TIFF: tagged image-file format; graphics-file format. Even though the filename extension is .tif, the acronym is TIFF.
tiling: a nonoverlapping approach to window management
time-consuming
time frame
time line: a description of events during a particular historical period; timeline: a schedule of events or procedures
time-multiplexed (adj.)
time-out (n.), time out (v.)
times: When indicating the use of “times” with a number, use a multiplication sign instead of $\times$—for example, $2 \times$ speedup. However, you may use “times” when it seems appropriate—for example, “The new version has 10 times the memory.”
time-shared (adj.)
time-sharing (n.): simultaneous use of a central computer by many users at remote locations
time sheet (n.)
time stamp (n.)
time step (n.), time-step (adj.)
time to market
TI OMAP: Texas Instruments Open Multimedia Applications Platform
TIP: terminal interface processor
TLB: translation look-aside buffer
*TLS: Transport Layer Security
TMS32010, TMS34010: processors from Texas Instruments; no space between the letters and numbers

toolbox (n.), toolkit (n.), toolset (n.): one word when used in computer contexts
tonnes: Use “metric tons” instead.
TOP: Technical Office Protocol. See MAP/TOP.
top-down design
touch pad (n.): a touch-sensitive user interface
touchscreen (n.): a touch-sensitive user interface
TP0-TP4: Transport Protocol Class 0 to 4; a set of transmission protocols in the ISO protocol suite
traceable; traceback; traceroute
trackball (n.)

**trademark**: The registered-trademark (®) symbol indicates that the trademark is registered in the US Patent and Trademark Office; (™) indicates that it’s pending. Avoid using trademark symbols in text. However, oblige an author who owns a trademark and insists on its use. In this case, use the company’s name before the product on first reference to establish ownership—for example, Sun’s Sbus. Thereafter, use the product name by itself.

**tradeoff** (n.): **trade off** (v.)

**transition**: Don’t use this as a verb.

**transputer** (n.) *(transistor computer)*: a microprocessor with local memory and communication links. It’s both an Inmos product and a generic term.

**troff**: text run-off; a Unix text-format front-end (coding) and output (printing) processor. It’s pronounced “tee-roff.” Variations include nroff and ditroff (device-independent troff)

**Trojan horse**

**TRON**: The Real-Time Operating-System Nucleus; a Japanese computer project to develop hardware and software technology to run household systems that are independent but communicate with each other for smart homes and the like. Modules include MTRON, BTRON, ITRON, CTTRON, and ITRON.

**TSR**: terminate-and-stay-resident

**TTL**: transistor-transistor logic

**TTS** (adj.): text-to-speech

**t-test**: a statistical test that deals with the problems associated with inference based on small samples

-tuple: a suffix for a set of <<so many>> elements

**turnaround**

**turnkey** (adj.): describes a system delivered ready to run without adding any hardware or software; a synonym for “off the shelf”

* **TU Wien**

* **TV**: the abbreviation for television

**TWAIN**: technology without an interesting name; a programming interface that lets a graphics application activate a scanner or other image-capturing device

**tweet** (n., v.)
UBE: unsolicited bulk e-mail
ubicomp: abbreviation for ubiquitous computing
ubiquitous computing (n.), ubiquitous-computing (adj.)
UCE: unsolicited commercial email
UCS: universal character set
* UDDI: universal description, discovery, and integration
UDP: User Datagram Protocol
UHD: ultra-high-definition
UI: unit interval; a measure of time
UIMS: user-interface management system; UIMSs (pl.)
UIP: user-interface presentation
UIST: user-interface software and technology
UK: United Kingdom (no periods), comprising England, Scotland, Northern Ireland, and Wales; not synonymous with Britain. Don’t use UK if the country name is sufficient.
ULSI: ultralarge-scale integration; can be used as a stand-alone noun when referring to the concept but not to physical objects—for example, “ULSI circuit” or “ULSI chip”
Ultracomputer: IBM and New York University’s supercomputer
ultra-high-definition (adj.): The abbreviation is UHD.
Ultranet
ultrawideband (adj.): See also UWB.
UMTS: Universal Mobile Telecommunications System
UN: United Nations (no periods)
underway (adv.), under way (adj.)
Uni (prefix): not hyphenated—for example, uniprocessor
unicode
UniForum
Univac: Universal Automatic Computer
University X at Y, or University X, Y, or University X–Y: Follow the specific institution’s usage. Although some universities capitalize “the” and consider it part of their name, Computer Society style either deletes or lowerscases the word when the name appears in regular text. So, it’s “the Ohio State University” (not “The Ohio State University”) and “the University of Kansas” (not “The University of Kansas”). Also delete “the” in a byline (except for “The Ohio State University” and “The Hong Kong University of Science and Technology). It’s “the University of California at Santa Barbara,” but all other UC campuses use this format: University of California, Berkeley.
Unix: a multilanguage operating system developed at AT&T Bell Laboratories. Various versions exist.
upgradable
UPnP: universal plug and play

uppercase

* URI: uniform resource identifier
* URL: uniform resource locator
* URN: uniform resource name
* US (n., adj.): United States; no periods
US$: Don’t place “US” in front of the dollar sign except to avoid confusion.
* USB: Universal Serial Bus

USENIX

user-friendly (adj.): frequently overused; avoid unless appropriate to the context

username

USRA: Universities Space Research Association
UTF-8: Unicode Transformation Format-8
UUCPnet: Unix-to-Unix copy network

* UV: ultraviolet
UWB: ultrawideband, a wireless communication technology
V: volts—for example, 45 V (n.) and 45-V (adj.) power supply

v.: the abbreviation for “versus” in a legal context—for example, Smith v. Jones. See also vs.

Vac: volts of alternating current—for example, 25 Vac.

validation: testing a product or product specification to ensure that it meets the requirements (that it has the specified functions); compare with verification

Vanet: vehicular ad hoc network

VAR: value-added reseller

variable-length field

VAX: a mainframe made by Digital Equipment Corp. The plural is VAXs; “VAX” reportedly comes from “virtual address extension” (to the PDP-11)


VAX/VMS: an operating system for VAX computers. VMS stands for VAX Management System.

VCCS: voltage-controlled current source

* VCR: videocassette recorder

Vdc: volts of direct current—for example, 25 Vdc

VDT: video display terminal; a generic term; not interchangeable with CRT

verification: determining whether a product meets its requirements (whether it does what it’s supposed to); compare with validation

Versabus

VersaDOS

version: Capitalize it only when it’s used with the name of a product—for example, Microsoft Word Version 6.0. An acceptable informal abbreviation (except at the beginning of a sentence) is v, closed up next to a number—for example, Macsyma v2.0. The word “version” or its abbreviation isn’t always necessary—for example, “Word 6.0 is a major release.”

versus: see v. and vs.

vertices: the plural of vertex

* VGA: video graphics adapter (or array); an IBM color-display standard allowing 256 colors

VHDL: very high density logic; also VHSIC Hardware Description Language.

VHSIC: very high speed integrated circuit

via: Use this word sparingly (It means “by way of,” “through the medium or agency of,” or “by means of.”) Often, “through” works just as well and sounds less formal.

VIC: video interface chip

vice president: see CMS 8.21; capitalize when referring to the Vice President of the United States

videocassette, videocassette recorder

videoconference, videoconferencing
videodisk; video game

video on demand (n.), video-on-demand (adj.), VoD (abbrev.)

videotape (n., v.)

videotex: an interactive text and graphics communications system; also called “viewdata”

video over IP

viewport

virtual memory

virtual reality (n.), virtual-reality (adj.): The abbreviation is VR.

VisiCalc: a financial spreadsheet program from now-defunct Software Arts Products

* VLSI: very large-scale integration. VLSI can be used as a stand-alone noun when referring to the concept but not to physical objects—for example VLSI circuit or VLSI chip. VLSI also is acceptable for VLSI Technology Inc.

VM: virtual machine; also JVM or Java virtual machine

VMEbus

VMS: VAX Management System, an operating system for DEC VAX computers

Vnet: an IBM internal network

VoD (n.): video on demand

* VoIP: voice over IP

von Neumann (adj.): refers to the concept of storing data and the instructions that apply to that data together; the stored-program concept (for example, “von Neumann sort” or “non–von Neumann architecture”). Note that the second example takes an en dash, not a hyphen.

voxel: loosely speaking, a 3D pixel

VPE: visual programming environment

VPL: visual programming language

* VPN: virtual private network

* VR: virtual reality

VRAM: video random-access memory

Vrije Universiteit, Amsterdam: Free University, Amsterdam. The commonly used acronym (VU University Amsterdam) doesn’t work—it’s redundant.

VRML: Virtual Reality Modeling Language

vs.: the normal abbreviation for versus, except in a legal context (see v.). Spell it out in text; the abbreviation is acceptable elsewhere.

VT52, VT100, VT101, VT102, VT131, VT220: Digital Equipment Corp. video display terminals
* **W**: watts—for example, 25-W dissipation
  
* **W**: “west” in addresses

**W3C**: World Wide Web Consortium

**wafer-scale integration**

**WAN**: wide area network. Don’t spell this out in *IEEE Software* or *IEEE Security & Privacy*.

**WAP**: Wireless Application Protocol

**Washington, DC**

**watts**

**waveform**

**wave front**

**wave function**

**WCGA**: World Computer Graphics Association

**WDM**: wavelength-division multiplexing

**WDP**: World Data Processing

**web**: the short name for the World Wide Web. Net is the short name for the Internet.

**web browser, web services**

**webcam, webcast, weblog, webmaster, webpage, webservice, website**

**well**: a well-defined concept; the concept is well defined. (Don’t hyphenate “well” words following being verbs.)

**WG**: see *working group*

**Whetstone**: benchmarks

**whiteboard**

**white list, white pages**

**white paper**

**-wide (suffix)**: see *CMS* 7.85, Table 3

**wideband** (adj.)

**Wi-Fi**: wireless products certified by the Wi-Fi Alliance to be interoperable

**Wii Remote**

**wiki**: computer software for creating, editing, and linking webpages

**Wikipedia**: a multilingual, Web-based encyclopedia project operated by the Wikimedia Foundation.

**wild cards**

**John Wiley & Sons**

**WiMax**

**WIMP**: windows, icons, menus, pointing devices

**Windows 95/98/NT/2000/Me**

**WinZip**: a file compression program
**wireframe** (adj.): refers to a line drawing of a 2D or 3D object (a wireframe image)

**wire wrap** (n.): a method of making an electrical connection in a circuit by wrapping wires around terminals

**wire-wrapping** (adj.): as in “wire-wrapping techniques”

**WISC**: writable-instruction-set computing

**WLAN**: wireless local area network

**word**: a sequence of bits that a processor can act on simultaneously. More bits per word let the processor work on more data simultaneously. A word can be defined in terms of bytes (a two-byte word equals a 16-bit word), but bits are the more common unit. See also *Mword* and *Kword*.

**word-slice processor**

**workaround**

**working group**: Use initial capitals if in a title—for example, “Working Group on Posix Definitions.” Lowercase the term if it’s generic.

**workflow, workload, workplace, worksheet**

**workspace**: the amount of memory a program requires, over and above the amount necessary to store the program itself

**workstation**

**worldwide**

**World Wide Web**: abbreviated WWW. See *Web* and *WWW*.

**WORM**: write-once, read-many (times)

**WoZ**

**wrap-up** (n.), **wrap up** (v.)

**WSCI**: Web service choreography interface

**WSDL**: Web Services Description Language; pronounced “whizzle”

**WSN**: wireless sensor network

**WVGA**: wide VGA

**WWW**: see *World Wide Web* and *Web*. Depending on the context, the abbreviated form is acceptable on first reference.

**WYSIWYG**: stands for “what you see is what you get.” The abbreviation is acceptable on first reference in departments, but spell it out on first reference in regular articles.
9/07 Xen: open source virtualization software
X.25: the network layer protocol in the ISO protocol suite
X.400: an ISO mail protocol
x-axis (n., adj.)
Xbox
X client (n.), X-client (adj.): See also X Window System.
XDR: External Data Representation; a protocol
Xenix: an operating system similar to Unix from Microsoft for PCs based on the Intel 8088, 80286, and 80386 chips
Xerox PARC: now just PARC
XGA: extended graphics array; a high-resolution graphics standard that IBM introduced in 1990
XLANG
XLink: XML Linking Language
XML: XML Metadata Interchange
Xmodem: the abbreviation of cross-modem, an error-free file-transfer protocol
* XML: Extensible Markup Language
XMPP: Extensible Messaging and Presence Protocol
XMS: extended memory specification; used to address memory greater than 1 Mbyte in the 80286 and later CPUs
XMT: extensible MPEG-4 textual format
XNS: Xerox Network Services
XOR: the exclusive-OR operation used in cryptography
XPath: XML Path Language
XPointer: XML Pointer Language
x-ray (n., adj., v.)
XHTTP, XHTML, XML
XT: See IBM PC.
XScale: an Intel processor
X11 Windows
xy-plane: also yz-plane and xz-plane
XSL: Extensible Style Sheet Language
XSLT: Extensible Style Sheet Language Transformation
y: year (unit of measurement)

**Y2K Problem:** the crisis that didn’t happen in 2000

**YACC:** a compiler compiler; a Unix tool

**Yahoo**

**y-axis:** (n., adj.)

**years:** to form the plural, add s—for example, 1990s. When referring to just the decade, spell it out—for example, nineties.

**yellow pages**

**Ymodem:** file transfer protocol
Z80: a microprocessor from Zenith Data Systems
Z80-A
z-axis: (n., adj.)
z-buffer: storage for z-axis values for 3D images; sometimes called the “depth buffer”
Zadeh, Lotfi: a pioneer in fuzzy logic. Note the first name, which is often misspelled.
zero-day: refers to the timing of viruses released the same day as a patch. Don’t use “0-day.”
ZIP: zigzag in-line package; a file-compression technique; ZIP code
Zmodem: successor to Xmodem and Ymodem