Typing Documents on the UNIX System:
Using the −ms Macros with Troff and Nroff

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ABSTRACT

This document describes a set of easy-to-use macros for preparing documents on the UNIX system. Documents may be produced on either the phototypesetter or a on a computer terminal, without changing the input.

The macros provide facilities for paragraphs, sections (optionally with automatic numbering), page titles, footnotes, equations, tables, two-column format, and cover pages for papers.

This memo includes, as an appendix, the text of the “Guide to Preparing Documents with −ms” which contains additional examples of features of −ms.

This manual is a revision of, and replaces, “Typing Documents on UNIX,” dated November 22, 1974.

November 2, 1997
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M. E. Lesk
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Introduction. This memorandum describes a package of commands to produce papers using the troff and nroff formatting programs on the UNIX system. As with other roff-derived programs, text is prepared interspersed with formatting commands. However, this package, which itself is written in troff commands, provides higher-level commands than those provided with the basic troff program. The commands available in this package are listed in Appendix A.

Text. Type normally, except that instead of indenting for paragraphs, place a line reading ``.PP'' before each paragraph. This will produce indenting and extra space. Alternatively, the command .LP that was used here will produce a left-aligned (block) paragraph. The paragraph spacing can be changed: see below under "Registers."

Beginning. For a document with a paper-type cover sheet, the input should start as follows:

[optional overall format .RP – see below]
.TL
Title of document (one or more lines)
.AU
Author(s) (may also be several lines)
.AI
Author’s institution(s)
.AB
Abstract; to be placed on the cover sheet of a paper.
Line length is 5/6 of normal; use .ll here to change.
.AE (abstract end)
text ... (begins with .PP, which see)

To omit some of the standard headings (e.g. no abstract, or no author’s institution) just omit the corresponding fields and command lines. The word ABSTRACT can be suppressed by writing ``.AB no'' for ``.AB''.

Several interspersed .AU and .AI lines can be used for multiple authors. The headings are not compulsory: beginning with a .PP command is perfectly OK and will just start printing an ordinary paragraph. Warning: You can’t just begin a document with a line of text. Some -ms command must precede any text input. When in doubt, use .LP to get proper initialization, although any of the commands .PP, .LP, .TL, .SH, .NH is good enough. Figure 1 shows the legal arrangement of commands at the start of a document.

Cover Sheets and First Pages. The first line of a document signals the general format of the first page. In particular, if it is ``.RP'' a cover sheet with title and abstract is prepared. The default format is useful for scanning drafts.

In general -ms is arranged so that only one form of a document need be stored, containing all information; the first command gives the format, and unnecessary items for that format are ignored.

Warning: don’t put extraneous material between the .TL and .AE commands. Processing of the titling items is special, and other data placed in them may not behave as you expect. Don’t forget that some -ms command must precede any input text.

Page headings. The -ms macros, by default, will print a page heading containing a page number (if greater than 1). A default page footer is provided only in nroff, where the date is used. The user can make minor adjustments to the page headings/footings by redefining the strings LH, CH, and RH which are the left, center and right portions of the page headings, respectively; and the strings LF, CF, and RF, which are the left, center and right portions of the page footer. For more complex formats, the user can redefine the
macros PT and BT, which are invoked respectively at the top and bottom of each page. The margins (taken from registers HM and FM for the top and bottom margin respectively) are normally 1 inch; the page header/footer are in the middle of that space. The user who redefines these macros should be careful not to change parameters such as point size or font without resetting them to default values.

**Multi-column formats.** If you place the command “.2C” in your document, the document will be printed in double column format beginning at that point. This feature is not too useful in computer terminal output, but is often desirable on the typesetter. The command “.1C” will go back to one-column format and also skip to a new page. The “.2C” command is actually a special case of the command

```
.MC [column width [gutter width]]
```

which makes multiple columns with the specified column and gutter width; as many columns as will fit across the page are used. Thus triple, quadruple, ... column pages can be printed. Whenever the number of columns is changed (except going from full width to some larger number of columns) a new page is started.

**Headings.** To produce a special heading, there are two commands. If you type

```
.NH
```

```text

type section heading here
```

```text

may be several lines
```

you will get automatically numbered section headings (1, 2, 3, ...), in boldface. For example,

```
.NH
```

Care and Feeding of Department Heads

produces

1. Care and Feeding of Department Heads

Alternatively,

```
.SH
```

```text

Care and Feeding of Directors
```

will print the heading with no number added:

**Care and Feeding of Directors**

Every section heading, of either type, should be followed by a paragraph beginning with .PP or .LP, indicating the end of the heading. Headings may contain more than one line of text. The .NH command also supports more complex numbering schemes. If a numerical argument is given, it is taken to be a “level” number and an appropriate sub-section number is generated. Larger level numbers indicate deeper sub-sections, as in this example:

```
.NH
```

Erie-Lackawanna

```
.NH 2
```

Morris and Essex Division

```
.NH 3
```

Gladstone Branch

```
.NH 3
```

Montclair Branch

```
.NH 2
```

Boonton Line

generates:

2. Erie-Lackawanna

2.1. Morris and Essex Division

2.1.1. Gladstone Branch

2.1.2. Montclair Branch

2.2. Boonton Line

An explicit “.NH 0” will reset the numbering of level 1 to one, as here:

```
.NH 0
```

Penn Central

1. Penn Central

**Indented paragraphs.** (Paragraphs with hanging numbers, e.g. references.) The sequence

```
.IP [1]
```

```text

Text for first paragraph, typed normally for as long as you would like on as many lines as needed.
```

```
.IP [2]
```

```

Text for second paragraph, ...
```

produces

[1]Text for first paragraph, typed normally for as long as you would like on as many lines as needed.

[2]Text for second paragraph, ...

A series of indented paragraphs may be followed by an ordinary paragraph beginning with .PP or .LP, depending on whether you wish indenting or not. The command .LP was used here. More sophisticated uses of .IP are also possible. If the label is omitted, for example, a plain block indent is produced.

```
.IP
This material will just be turned into a block indent suitable for quotations or such matter.

.LP

will produce

This material will just be turned into a block indent suitable for quotations or such matter.

If a non-standard amount of indenting is required, it may be specified after the label (in character positions) and will remain in effect until the next .PP or .LP. Thus, the general form of the .IP command contains two additional fields: the label and the indenting length. For example,

.IP first: 9
Notice the longer label, requiring larger indenting for these paragraphs.
.IP second:
And so forth.
.LP

produces this:

first: Notice the longer label, requiring larger indenting for these paragraphs.
second: And so forth.

It is also possible to produce multiple nested indents; the command .RS indicates that the next .IP starts from the current indentation level. Each .RE will eat up one level of indenting so you should balance RS and RE commands. The .RS command should be thought of as "move right" and the .RE command as "move left". As an example

.IP 1.
Bell Laboratories
.RS
.IP 1.1
Murray Hill
.IP 1.2
Holmdel
.IP 1.3
Whippany
.RS
.IP 1.3.1
Madison
.RE
.IP 1.4
Chester
.RE
.LP

will result in

1. Bell Laboratories
1.1 Murray Hill
1.2 Holmdel
1.3 Whippany
1.3.1 Madison
1.4 Chester

All of these variations on .LP leave the right margin untouched. Sometimes, for purposes such as setting off a quotation, a paragraph indented on both right and left is required.

A single paragraph like this is obtained by preceding it with .QP. More complicated material (several paragraphs) should be bracketed with .QS and .QE.

**Emphasis.** To get italics (on the typesetter) or underlining (on the terminal) say

.I
as much text as you want
can be typed here
.R

as was done for these three words. The .R command restores the normal (usually Roman) font. If only one word is to be italicized, it may be just given on the line with the .I command,

.I word

and in this case no .R is needed to restore the previous font. **Boldface** can be produced by

.B
text to be set in boldface
goes here
.R

and also will be underlined on the terminal or line printer. As with .I, a single word can be placed in boldface by placing it on the same line as the .B command.

A few size changes can be specified similarly with the commands .LG (make larger), .SM (make smaller), and .NL (return to normal size). The size change is two points; the commands may be repeated for increased effect (here one .NL canceled two .SM commands).

If actual underlining as opposed to italicizing is required on the typesetter, the command

.UL word

will underline a word. There is no way to underline multiple words on the typesetter.

**Footnotes.** Material placed between lines with the commands .FS (footnote) and .FE (footnote end) will be collected, remembered, and finally placed at the bottom of the current page*. By
default, footnotes are 11/12th the length of normal
text, but this can be changed using the FL register.

Displays and Tables. To prepare displays of lines, such
as tables, in which the lines should not be re-arranged, en-
close them in the commands .DS and .DE

```
.DS
  table lines, like the
examples here, are placed
between .DS and .DE.
.DE
```

By default, lines between .DS and .DE are indented and left-adjusted. You can also center lines, or retain the left
margin. Lines bracketed by .DS C and .DE commands are centered (and not re-arranged); lines bracketed by .DS L
and .DE are left-adjusted, not indented, and not re-arranged. A plain .DS is equivalent to .DS I, which indents and
left-adjusts. Thus,

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.DE
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examples here, are placed
between .DS and .DE.
.DE
```

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margin. Lines bracketed by .DS C and .DE commands are centered (and not re-arranged); lines bracketed by .DS L
and .DE are left-adjusted, not indented, and not re-arranged. A plain .DS is equivalent to .DS I, which indents and
left-adjusts. Thus,
document is stored in several files, just list all the filenames where we have used “file”. If equations or tables are used, eqn and/or tbl must be invoked as preprocessors.

References and further study. If you have to do Greek or mathematics, see eqn [1] for equation setting. To aid eqn users, −ms provides definitions of .EQ and .EN which normally center the equation and set it off slightly. An argument on .EQ is taken to be an equation number and placed in the right margin near the equation. In addition, there are three special arguments to EQ: the letters C, I, and L indicate centered (default), indented, and left adjusted equations, respectively. If there is both a format argument and an equation number, give the format argument first, as in

.EQ L (1.3a)

for a left-adjusted equation numbered 1.3a.

Similarly, the macros .TS and .TE are defined to separate tables (see [2]) from text with a little space. A very long table with a heading may be broken across pages by beginning it with .TS H instead of .TS, and placing the line .TH in the table data after the heading. If the table has no heading repeated from page to page, just use the ordinary .TS and .TE macros.

To learn more about troff see [3] for a general introduction, and [4] for the full details (experts only). Information on related UNIX commands is in [5]. For jobs that do not seem well-adapted to −ms, consider other macro packages. It is often far easier to write a specific macro packages for such tasks as imitating particular journals than to try to adapt −ms.

Acknowledgment. Many thanks are due to Brian Kernighan for his help in the design and implementation of this package, and for his assistance in preparing this manual.

References

Appendix A
List of Commands

1C Return to single column format.
2C Start double column format.
AB Begin abstract.
AE End abstract.
AI Specify author's institution.
AU Specify author.
B Begin boldface.
DA Provide the date on each page.
DE End display.
DS Start display (also CD, LD, ID).
EN End equation.
EQ Begin equation.
FE End footnote.
FS Begin footnote.
I Begin italics.
IP Begin indented paragraph.
KE Release keep.
KF Begin floating keep.
KS Start keep.

Register Names
The following register names are used by \texttt{-ms} internally. Independent use of these names in one's own macros may produce incorrect output. Note that no lower case letters are used in any \texttt{-ms} internal name.

Number registers used in \texttt{-ms}

<table>
<thead>
<tr>
<th>:</th>
<th>DW</th>
<th>GW</th>
<th>HM</th>
<th>IQ</th>
<th>LL</th>
<th>NA</th>
<th>OJ</th>
<th>PO</th>
<th>T</th>
<th>TV</th>
</tr>
</thead>
<tbody>
<tr>
<td>#T</td>
<td>EF</td>
<td>H1</td>
<td>HT</td>
<td>IR</td>
<td>LT</td>
<td>NC</td>
<td>PD</td>
<td>PQ</td>
<td>TB</td>
<td>VS</td>
</tr>
<tr>
<td>1T</td>
<td>FL</td>
<td>H3</td>
<td>IK</td>
<td>KI</td>
<td>MM</td>
<td>NF</td>
<td>PF</td>
<td>PX</td>
<td>TD</td>
<td>YE</td>
</tr>
<tr>
<td>AV</td>
<td>FM</td>
<td>H4</td>
<td>IM</td>
<td>L1</td>
<td>MN</td>
<td>NS</td>
<td>PI</td>
<td>RO</td>
<td>TN</td>
<td>YY</td>
</tr>
<tr>
<td>CW</td>
<td>FP</td>
<td>H5</td>
<td>IP</td>
<td>LE</td>
<td>MO</td>
<td>OI</td>
<td>PN</td>
<td>ST</td>
<td>TQ</td>
<td>ZN</td>
</tr>
</tbody>
</table>

String registers used in \texttt{-ms}

| , | A5 | CB | DW | EZ | I  | KF | MR | R1 | RT | TL |
|` | AB | CC | DY | FA | I1 | KQ | ND | R2 | S0 | TM |
| `| AE | CD | E1 | FE | I2 | KS | NH | R3 | S1 | TQ |
| "| AI | CF | E2 | FJ | I3 | LB | NL | R4 | S2 | TS |
| : | AU | CH | E3 | FK | I4 | LD | NP | R5 | SG | TT |
| , | B  | CM | E4 | FN | I5 | LG | OD | RC | SH | UL |
| 1C| BG | CS | E5 | FO | ID | LP | OK | RE | SM | WB |
| 2C| BT | CT | EE | FQ | IE | ME | PP | RF | SN | WH |
| A1| C  | D  | EL | FS | IM | MF | PT | RH | SY | WT |
| A2| C1 | DA | EM | FV | IP | MH | PY | RP | TA | XD |
| A3| C2 | DE | EN | FY | IZ | MN | QF | RQ | TE | XF |
| A4| CA | DS | EQ | HO | KE | MO | R  | RS | TH | XK |
A Guide to Preparing Documents with −ms

M. E. Lesk
Bell Laboratories August 1978

This guide gives some simple examples of document preparation on Bell Labs computers, emphasizing the use of the −ms macro package. It enormously
information in
1. *Typing Documents on UNIX and GCOS*, by M. E. Lesk;
These memos are all included in the *UNIX Programmer’s Manual, Volume 2*. The new user should also have *A Tutorial Introduction to the UNIX Text Editor*, by B. W. Kernighan.

For more detailed information, read *Advanced Editing on UNIX* and *A Troff Tutorial*, by B. W. Kernighan, and (for experts) *Nroff/Troff Reference Manual* by J. F. Ossanna. Information on related commands is found (for UNIX users) in *UNIX for Beginners* by B. W. Kernighan and the *UNIX Programmer’s Manual* by K. Thompson and D. M. Ritchie.

Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A TM</td>
<td>2</td>
</tr>
<tr>
<td>A released paper</td>
<td>3</td>
</tr>
<tr>
<td>An internal memo, and headings</td>
<td>4</td>
</tr>
<tr>
<td>Lists, displays, and footnotes</td>
<td>5</td>
</tr>
<tr>
<td>Indents, keeps, and double column</td>
<td>6</td>
</tr>
<tr>
<td>Equations and registers</td>
<td>7</td>
</tr>
<tr>
<td>Tables and usage</td>
<td>8</td>
</tr>
</tbody>
</table>

Throughout the examples, input is shown in this Helvetica sans serif font while the resulting output is shown in this Times Roman font.

UNIX Document no. 1111

Commands not needed in a particular format are ignored.
**A Released Paper with Mathematics**

The solution to the torque handle equation

\[ \sum_{i=0}^{\infty} F(x_i) = G(x) \]

is found with the transformation $x = \rho \theta$ where $\rho = G'(x)$ and $\theta$ is derived ...

---

**An Internal Memorandum**

Plaintiff, United States of America, having filed its complaint herein on January 14, 1949; the defendants having appeared and filed their answer to such complaint denying the substantive allegations thereof; and the parties, by their attorneys, ...

---

**The Role of the Allen Wrench in Modern Electronics**

J. Q. Pencilpusher
X. Y. Hardwired
Bell Laboratories
Murray Hill, New Jersey 07974

**ABSTRACT**

This abstract should be short enough to fit on a single page cover sheet. It must attract the reader into sending for the complete memorandum.

April 1, 1976

---

**The Role of the Allen Wrench in Modern Electronics**

J. Q. Pencilpusher
X. Y. Hardwired
Bell Laboratories
Murray Hill, New Jersey 07974

1. Introduction
The solution to the torque handle equation

\[ x = \frac{\rho}{\theta} \]

where $\rho = G'(x)$ and $\theta$ is derived from well-known principles.

---

**Headings**

- Introduction
- Appendix I
- Appendix I
A Simple List


Displays

text text text text text text
d.S
and now
for something
completely different
def
text text text text text text

hoboken harrison newark roseville avenue grove street east
orange brick church orange highland avenue mountain station
south orange maplewood millburn short hills summit
new providence

and now
for something
completely different

murray hill berkely heights gillette stirling millington
lyons basking ridge bernardsville far hills peapack gladstone

Options: .DS L: left-adjust; .DS C: line-by-line center; .DS B: make block, then center.

Footnotes

Among the most important occupants of the workbench are the long-nosed pliers. Without these basic tools* few assemblies could be completed. They may lack the popular appeal of the sledgehammer

* As first shown by Tiger & Leopard (1975).

Multiple Indents

This is ordinary text to point out the margins of the page.

1. First level item
   a) Second level.
   b) Continued here with another second level item, but somewhat longer.
2. Return to previous value of the indenting at this point.
3. Another line.

Keeps

Lines bracketed by the following commands are kept together, and will appear entirely on one page:

.DS not moved .KF may float .KE through text .KE in text

Double Column

The Declaration of Independence

When in the course of human events, it becomes necessary for one people to dissolve the political bonds which have connected them with another, and to assume among the powers of the earth the separate and equal station to which the laws of Nature and of Nature's God entitle them, a decent respect to the opinions of mankind requires that they should declare the causes which impel them to the separation.

The Declaration of Independence

We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable rights, that among these are life, liberty, and the pursuit of happiness. That to secure these rights, governments are instituted among men,
Equations

A displayed equation is marked
with an equation number at the right margin
by adding an argument to the EQ line:

```
\text{EQ (1.3)}
```

A displayed equation is marked with an equation number at
the right margin by adding an argument to the EQ line:

```
\frac{x^2}{a^2} = \sqrt{p z^2 + q z + r}
\text{ (1.3)}
```

(2.2a)

bold $V$ bar $\nu$ = left [ pile { a above b above c } right ] + left { matrix { A(11) above . . . } } above A(33) ] right |

dot

(\nu \rightarrow \infty)

\hat{\Gamma}(\chi) = |\mathbf{V}|^2

\left( \frac{\partial^2 V}{\partial x^2} \right)^2 + \left( \frac{\partial^2 V}{\partial y^2} \right)^2

| \lambda \rightarrow \infty |

TS (with delim $|$ on, see panel 3)

doublebox, allbox, tab ($\times$) and linesize ($n$).

Some Registers You Can Change

Line length
\text{.nr LL 7i}
Title length
\text{.nr LT 7i}
Point size
\text{.nr PS 9}
Vertical spacing
\text{.nr VS 11}
Column width
\text{.nr CW 3i}
Intercolumn spacing
\text{.nr GW .5i}
Margins – head and foot
\text{.nr HM .75i}
\text{.nr FM .75i}
Paragraph indent
\text{.nr PI 2n}

Paragraph spacing
\text{.nr PD 0}
Page offset
\text{.nr PO 0.5i}
Page heading
\text{.ds CH Appendix (center)}
\text{.ds RH 7-25-76 (right)}
\text{.ds LH Private (left)}
Page footer
\text{.ds CF Draft}
\text{.ds LF similar}
Page numbers
\text{.nr % 3}

Usage

Documents with just text:
troff -ms files

With equations only:
eqn files | troff -ms
With tables only:
tbl files | troff -ms

With both tables and equations:
tbl files | eqn | troff -ms

The above generates STARE output on GCOS: replace –st
with –ph for typesetter output.