This is a list of all substantial corrections made to Computers & Typesetting between the publication of the second “Millennium Edition” at the close of the year 2001 and the beginning of the year 2014. (More precisely, it lists errors corrected in 16th to 19th printings of Volume A, the 7th and 8th printings of Volume B, the 6th and 19th printings of Volume C, the 4th and 5th printings of Volume D, and the 5th and 6th printings of Volume E.) Corrections made to the softcover version of The T\TeXbook, beginning with its 32nd printing, are the same as corrections to Volume A. Corrections to the softcover version of The METAFONTbook, beginning with its 11th printing, are the same as corrections to Volume C. Changes to the mini-indexes and master indexes of Volumes B, D, and E are not shown here unless they are not obviously derivable from what has been shown. All of these errors have supposedly been corrected in more recent printings, unless they were subsequently found to be wrong.

Page A7, line 4 from the bottom (01/15/04)

since control sequences of the second kind always have exactly one symbol after

Page A123, line 7 from the bottom (02/27/08)

that it won’t make the natural height-plus-depth of \box n surpass \dimen n, when it is

Page A124, lines 12 and 13 (02/27/08)

means that T\TeX has tried to split an \insert254 to height 180.2 pt; the natural height-
plus-depth of the best such split is 175.3 pt, and the penalty for breaking there is 100.)

Page A153, line 7 (01/03/14)

of three fonts: one for text size, one for script size, and one for scriptscript size. The

Page A206, lines 12–17 (05/21/07)

or alignment template is also considered to be \outer in this sense; for example, a file
shouldn’t end in the middle of a definition. If you are designing a format for others to
use, you can help them detect errors before too much harm is done, by using \outer
with all control sequences that should appear only at “quiet times” within a document.
For example, Appendix B defines \proclaim to be \outer, since a user shouldn’t be
stating a theorem as part of a definition or argument or preamble.

Page A216, line 3 from the bottom (12/20/07)

\openin(number)= (file name)

Page A290, lines 25–26 (02/24/08)

\leaders/box or rule/领导者/box or rule (horizontal skip). Here (horizontal skip) refers to one of
the first five glue-appending commands just mentioned; the formal syntax for (leaders)
are defined as in the second alternative of a ⟨math field⟩, are recorded in a ‘choice

\def\appendroman#1#2#3{\expandafter\def\expandafter#1\expandafter
{\csname\expandafter\gobble\string#2\romannumeral#3\endcsname}}

\def\\{(\if\space\next\ % assume that \next is unexpandable

\leavevmode\copy0\kern-\wd0\makelightbox

15.13. Yes, in severe circumstances. (1) Previous footnotes might have left no room
for any more footnotes on the page. (2) If \vadjust{\eject} occurs on the same line

\def\loggingall{\tracingcommands=2 \tracingstats=2
\tracingpages=1 \tracingoutput=1 \tracinglostchars=1
\tracingmacros=2 \tracingparagraphs=1 \tracingrestores=1
\showboxbreadth=\maxdimen \showboxdepth=\maxdimen}
\def\tracingall{\tracingonline=1 \loggingall}

\def\fmtversion{3.141592653} % identifies the current format

And here’s another solution (which may be faster, because token list registers can be
expanded more quickly than macros on some implementations, using \the):

\loop \ifnum\m>0 \t=\expandafter{\the\t}\advance\m-1 \repeat
Finally, the reformatting of \texttt{\textbackslash box\footins} can be achieved easily with an elegant technique suggested by David Kastrup, using the following TeX code within the \texttt{\textbackslash output} routine:

\begin{verbatim}
def\makefootnoteparagraph{\unvbox\footins
  \baselineskip=\footnotebaselineskip \removehboxes}
def\removehboxes{\unskip\setbox0=\lastbox
  \ifhbox0{\removehboxes}\unhbox0 \else\noindent \fi}
\end{verbatim}

The key idea here is \texttt{\textbackslash removehboxes}, a macro that has the magical ability to take a vertical box such as \texttt{\vbox{\box1\box2\box3\removehboxes}} and transform it into \texttt{\vbox{\noindent\unhbox1\unhbox2\unhbox3}}, if \texttt{\box1}, \texttt{\box2}, and \texttt{\box3} are hboxes. Notice how \texttt{\textbackslash removehboxes} introduces braces so that TeX’s save stack will hold all of the hboxes before they are unboxed. Each level of recursion in this routine uses one cell of input stack space and three cells of save stack space; thus, it is generally safe to do more than 100 footnotes without exceeding TeX’s capacity.

In our application there is no interline glue within \texttt{\textbackslash box\footins}, so the \texttt{\textbackslash unskip} command could be deleted from \texttt{\textbackslash removehboxes}.

Incidentally, the \texttt{\textbackslash unskip} and \texttt{\textbackslash lastbox} operations have running times of the approximate form \texttt{a + mb}, where \texttt{m} is the number of items on the list preceding the glue or box that is removed. Hence \texttt{\textbackslash removehboxes} has a running time of order \texttt{n^2} when it removes \texttt{n} boxes. But the constant \texttt{b} is so small that for practical purposes it’s possible to think of \texttt{\textbackslash unskip} and \texttt{\textbackslash lastbox} as almost instantaneous.

Page A416, lines 18–22 (06/08/07)

\begin{verbatim}
def\leftheadline{\hbox to \pagewidth{\spaceskip=0pt
  \vbox to 10pt{}% strut to position the baseline
  \llap{\tenbf\folio\kern1pc}% folio to left of text
  \tenit\rhead\hfil}} % running head flush left
def\rightheadline{\hbox to \pagewidth{\spaceskip=0pt
\end{verbatim}

Page A418, line 8 from the bottom (12/13/11)

\begin{verbatim}
def\(#3) \advance\hsize by -18mm
\end{verbatim}

Page A418, line 3 from the bottom (12/13/11)

\begin{verbatim}
ahalign{\line{\titlefont\hspace{##3}}\#4\unskip\}
\end{verbatim}

Page A442, lines 7 and 8 from the bottom (01/03/14)

3. If the current item is a style change, set \texttt{C} to the specified style and move on to the next item.
\[ s_{\text{tic}} \exp x_{3p} \pi_{3a} \, i_{2i\alpha} \, i_{2i\text{do} \, i_{2i\text{ci} \, 2i\text{o} \, 2i\text{ious}}} \]

(where subscripts that aren’t shown are zero), and this yields

\[ .0\, s_{0u_{0}P_{0}e_{0}r_{1}c_{0}a_{0}l_{0}i_{0}f_{0}r_{0}a_{0}l_{0}l_{0}i_{0}s_{1}t_{2i0}c_{1}e_{0}x_{3p}2i_{3a_{0}l_{2i}l_{0}d_{0}0_{1}c_{2i0}0_{2u_{2}a_{0}}}. \]

\[ \backslash, \, 38, \, 356, \, 378, \, 418. \]

Page A458, left column (01/11/07)

angle brackets \( ( \) \( ) \), 59, 146–147, 150, 156, 268, 420, 437; see also \backslash angle, \backslash angle.

Page A461, left column (02/24/08)

\backslash boxit, 223, 331.

Page A468, right column (02/26/08)

interline glue, 78–79, 80, 104, 105, 125, 221, 245, 263, 281–282, 335, 352, 399, 409.

Page A469, left column (02/26/08)

Kastrup, David Friedrich, 399.

Page A470, left column (01/21/03)

\backslash logging\all, 364.

Page A477, right column (06/08/07)

\backslash spaceskip, 76, 274, 317, 356, 416, 429.

Page A479, right column (09/11/07)

\backslash undefined, 350, 384.

Page A483, line 5 from the bottom (11/18/03)

— HIERONYMUS HORNSCHUCH, Ορθοτυπογραφίας (1608)

Page Bv, page number change (12/27/11)

[For consistency with Volumes A, C, and E, the preface now begins on page v instead of page vii. This change was first made in the ninth printing.]

Page Bv (formerly Bvii), bottom two lines (01/06/14)

all of those changes. I now believe that the final bug was discovered on 14 September 2008 and removed in version 3.14159265. The finder’s fee has converged to $327.68.
Format specs have no effect on the corresponding Pascal program, but they do influence

Incidentally, Pascal’s standard \textit{round} function can be problematical, because it disagrees with the IEEE floating-point standard. Many implementors have therefore chosen to substitute their own home-grown rounding procedure.

\begin{Verbatim}
\texttt{begin \texttt{print_esc}("csname"); print_esc("endcsname"); print_char(" "); end}
\end{Verbatim}

\begin{Verbatim}
\texttt{begin \texttt{while (state = token_list) \land (loc = null) \land (token_type \neq \texttt{v_template}) \texttt{do}}}
\begin{Verbatim}
\texttt{\texttt{end_token_list; \{ conserve stack space \}}}
\end{Verbatim}
\end{Verbatim}

\begin{Verbatim}
\texttt{long_state \leftarrow \texttt{call}; \texttt{cur_tok \leftarrow \texttt{par_token}; ins_error; \texttt{goto continue;}}}
\end{Verbatim}
else if \( m = \text{vmode} \) then \( \text{scanned\_result(\text{pre\_depth})(dimen\_val)} \)
  else \( \text{scanned\_result(\text{space\_factor})(int\_val)} \)

\( \text{cur\_val} \leftarrow 0; \text{cur\_val\_level} \leftarrow \text{int\_val}; \text{radix} \leftarrow 0; \text{cur\_order} \leftarrow \text{normal}; \)

and denominator sum to 32768 or less. According to the definitions here, 2660 \( \text{dd} \approx 1000.33297\text{mm} \);

The following procedures don’t allow spaces to be part of file names; but some users seem to
like names that are spaced-out. System-dependent changes to allow such things should probably
be made with reluctance, and only when an entire file name that includes spaces is “quoted” somehow.

\( \text{if} \ (nw = 0) \lor (nh = 0) \lor (nd = 0) \lor (ni = 0) \text{ then abort; } \)

\( \text{cur\_glue: real; \{ glue seen so far \}} \)
  \( \text{cur\_g: scaled; \{ rounded equivalent of cur\_glue times the glue ratio \}} \)
  \( \text{begin cur\_g \leftarrow 0; cur\_glue \leftarrow float\_constant(0); this\_box \leftarrow temp\_ptr; g\_order \leftarrow glue\_order(this\_box); g\_sign \leftarrow glue\_sign(this\_box); } \)

\( \text{begin g \leftarrow glue\_ptr(p); rule\_wd \leftarrow width(g) - cur\_g; } \)

\( \text{begin cur\_glue \leftarrow cur\_glue + \text{stretch}(g); vet\_glue(float(glue\_set(this\_box)) \ast cur\_glue); cur\_g \leftarrow round(glue\_temp); } \)

\( \text{begin cur\_glue \leftarrow cur\_glue - \text{shrink}(g); vet\_glue(float(glue\_set(this\_box)) \ast cur\_glue); cur\_g \leftarrow round(glue\_temp); } \)

\( \text{rule\_wd \leftarrow rule\_wd + cur\_g; } \)
else begin lx ← br div (lq + 1);

cur_glue: real; { glue seen so far }
cur_g: scaled; { rounded equivalent of cur_glue times the glue ratio }
begin cur_g ← 0; cur_glue ← float_constant(0);
this_box ← temp_ptr; g_order ← glue_order(this_box); g_sign ← glue_sign(this_box);

begin cur_g ← 0; cur_glue ← float_constant(0);
this_box ← temp_ptr; g_order ← glue_order(this_box); g_sign ← glue_sign(this_box);

begin cur_glue ← cur_glue + stretch(g); vet_glue(float(glue_set(this_box)) * cur_glue);
cur_g ← round(glue_temp);
begin cur_glue ← cur_glue - shrink(g); vet_glue(float(glue_set(this_box)) * cur_glue);
cur_g ← round(glue_temp);

rule ht ← rule ht + cur_g;

else begin lx ← br div (lq + 1);

total_pages ≥ 65536, the DVI file will lie. And if max_push ≥ 65536, the user deserves whatever chaos might ensue.

p: pointer; { a new glue node }

left_noad: begin print_esc("left"); print_delimiter(delimiter(p));
end;
right_noad: begin print_esc("right"); print_delimiter(delimiter(p));
if \texttt{type\((r) = kern\_node\)} then \{ unneeded italic correction \}

is being scanned, or when no alignment preamble is active.

\begin{align*}
\text{begin if } (\text{scanner\_status} = \text{aligning}) \lor (\text{cur\_align} = \text{null}) \text{ then}
\end{align*}

\( j - i + \text{min\_quarterword} \) in their link fields. The values of \( w_{ii} \) were initialized to \text{null\_flag},

In restricted horizontal mode, the \texttt{clang} part of aux is undefined; an over-cautious Pascal runtime system may complain about this.

should begin in the sequence of line numbers, in case hanging indentation or \texttt{parshape} is in

\begin{align*}
\text{if } \text{count}\((t) = 1000\) \text{ then } t \leftarrow \text{height}\((r)\)
\text{else } t \leftarrow \text{x\_over\_n} \left(\text{height}(r), 1000\right) \times \text{count}(t);
\text{print\_scaled}(t)
\end{align*}

If \texttt{link\((\text{cur\_q})\)} is nonnull when \texttt{wrapup} is invoked, \texttt{cur\_q} points to the list of characters that were consumed while building the ligature character \texttt{cur\_l}.

\begin{align*}
\text{begin if } \text{link}\((\text{cur\_q}) > \text{null} \text{ then}
\text{if } \text{character}\((\text{tail}) = q_i(\text{hyphen\_char}[\text{main\_f}]) \text{ then } \text{ins\_disc} \leftarrow \text{true};
\end{align*}

\texttt{link\((\text{tail}) \leftarrow \text{lig\_stack}; \text{tail} \leftarrow \text{lig\_stack} \{ \text{main\_loop\_lookahead is next} \}}

\texttt{if } \text{main\_p} > \text{null} \text{ then } \text{tail\_append}(\text{main\_p}); \{ \text{append a single character} \}

\texttt{if } \text{cur\_r} = \text{non\_char} \text{ then goto } \text{main\_loop\_wrapup};
hmode, where the latter two are used to denote \vbox and \hbox, respectively.

if (\textit{cur\_cmd} = \textit{hskip}) \& (abs(\textit{mode}) \neq \textit{vmode}) \lor ((\textit{cur\_cmd} = \textit{vskip}) \& (abs(\textit{mode}) = \textit{vmode})) then

A devious user might force an \texttt{endv} command to occur just about anywhere; we must defeat such hacks.

begin base\_ptr \leftarrow \textit{input\_ptr}; \textit{input\_stack}[base\_ptr] \leftarrow \textit{cur\_input}; while (\textit{input\_stack}[base\_ptr].index\_field \neq \textit{v\_template}) \&
\textit{input\_stack}[base\_ptr].loc\_field = \textit{null}) \lor (\textit{input\_stack}[base\_ptr].state\_field = \textit{token\_list}) do decr(base\_ptr);

if (\textit{input\_stack}[base\_ptr].index\_field \neq \textit{v\_template}) \lor
(\textit{input\_stack}[base\_ptr].loc\_field \neq \textit{null}) \lor
(\textit{input\_stack}[base\_ptr].state\_field \neq \textit{token\_list}) then
\textit{fatal\_error}('\texttt{(interwoven\_alignment\_preambles\_are\_not\_allowed)}');
if \textit{cur\_group} = \texttt{align\_group} then

("since\_the\_result\_is\_out\_of\_range.");
if \textit{p} \geq \textit{glue\_val} then \textit{delete\_glue\_ref} (\textit{cur\_val});
\textit{error}; \textit{return};

1237. Here we use the fact that the consecutive codes \texttt{int\_val .. mu\_val} and \texttt{assign\_int ..}

says, for example, \texttt{\texttt{(preloaded format=plain 1982.11.19)}}, showing the year, month, and day

if \textit{last\_glue} \neq \textit{max\_halfword} then \textit{delete\_glue\_ref} (\textit{last\_glue});

if \textit{last\_glue} \neq \textit{max\_halfword} then \textit{delete\_glue\_ref} (\textit{last\_glue});

Page Cxi, line 4

27 Recovery from Errors
the area below the bar to the area above it equal to \((\sqrt{5} + 1)/2 \approx 1.61803\),

points 2 and 5 should not be labeled twice

\[\text{penpos1(stem,15); penpos2(.9stem,12); penpos3(stem,10);}\]

line 12, where it says ‘\(x_{11}\)’ not ‘\(x11\)’ or ‘\(x11\)’; be sure to distinguish between

suffixed or subscripted. Thus, the syntax rule for \langle variable \rangle should actually be replaced by a slightly more complicated pair of rules:

\((\text{path subexpression}) \rightarrow \text{path expression not ending with direction specifier})\)

point but not after it, the nonempty one is duplicated in a similar way. A basic path join ‘.. controls \(u\) and \(v\) ..’ specifies explicit control points that override any direction specifiers that may immediately surround it.

Let’s conclude this chapter by applying what we’ve learned about paths to a real-life example. The \textit{Journal of Algorithms} was published for many years by Academic Press, and its cover page carried the following logo, which was designed

A \texttt{METAFONT} program to produce this logo made it possible for the editors of the journal to use it on letterheads in their correspondence. Here is one way to do that job,

be the values they had upon entry to the group.)
def --- = ..tension infinity.. enddef;

it makes ‘\texttt{z}_1 \texttt{--- z}_2’ become ‘\texttt{z}_1 \texttt{.. tension infinity .. z}_2’. The replacement text can be any sequence of tokens not including ‘\texttt{enddef}’; or it can include entire subdefinitions like ‘\texttt{def \ldots enddef}’, according to certain rules that we shall explain later.

Page C226, line 23 (02/21/08)

following nineteen things will be mentioned:

Page C226, new line to be second from the bottom (02/21/08)

\begin{itemize}
\item independent \texttt{variables} \hspace{1cm} (distinct numeric variables)
\end{itemize}

Page C236, line 7 from the bottom (01/05/14)

\textbf{7.4.} False. After ‘\texttt{newinternal x;}’ you can’t say ‘\texttt{\textbackslash x(tag)}’ in a (suffix list).

Page C246, line 12 (02/21/08)

is performed whenever METAFont uses the last two alternatives in the definition
19.3. Yes, if and only if \( n - \frac{1}{2} \) is a nonnegative even integer. (Because ambiguous values are rounded upwards.)

Page C250, line 12 from the bottom (04/25/03)

following (boolean primary).

Page C286, line 25 (09/09/01)

problem; it would simply have put \texttt{ENDFOR} into the replacement text of \texttt{asta}, because

Page C289, line 7 (09/09/01)

\[
\text{if if pair } x: x>(0,0) \text{ else: false fi: A else: B fi.}
\]

Page C292, line 10 from the bottom (09/09/01)

be known by saying ‘if known \( p - q: p = q \text{ else: false fi’; transforms could be handled

Page C293, line 5 from the bottom (04/25/03)

given angle \( \phi \). We can consider the common angle \( \theta \) of \( z_1r - z_4l \) and \( z_0r - z_0l \) to be

Page C315, line 15 from the bottom (04/25/03)

‘b’ was shipped out.) The second letter, ‘o’, is placed in a second little box adjacent

Page C325, bottom line (02/29/08)

— CAROLUS LINNÆUS, \textit{Philosophia Botanica} (1751)

Page C332, line 4 from the bottom (04/25/03)

(The proofsheet resolution will be 50 pixels per inch, because \texttt{cheapo} has 200 pixels per

Page C346, left column (06/18/02)


Page C346, right column (07/09/01)

*\texttt{angle}, 29, 67, \texttt{72}, 107, 135, 211, 238.

Page C346, right column (10/04/04)

\texttt{arccosine, arccotangent, see \texttt{angle}.}

Page C351, right column (02/21/08)

\texttt{independent variables, 21–23, 88, 224, 226.}
Page C352, right column
(02/29/08)
Linné, Carl von (= Linnaeus, Carolus), 325.

Page C355, right column
(02/29/08)

*save, 155-156, 160, 173, 178, 180, 218, 236, 244, 296, 299.

Page Dv, page number change
(12/27/11)
[For consistency with Volumes A, C, and E, the preface now begins on page v instead of page vii. This change was first made in the sixth printing.]

Page Dv (formerly Dvii), bottom two lines
(01/06/14)
corporate all of those changes. I now believe that the final bug was discovered on 03 June 2008, and removed in version 2.7182818. The finder’s fee has converged to $327.68.

Page Dxiii (formerly Dxv), line −7
(12/27/11)
Format specs have no effect on the corresponding Pascal program, but they do influence

Page D2, line −17
(01/03/14)
\texttt{define} \texttt{banner} \equiv \texttt{This is METAfont, Version 2.7182818} \quad \{ \text{printed when METAfont starts} \}

Page D2, lines 4 and 5 from the bottom
(12/23/02)
types; there are no \texttt{var} parameters, except in the case of files or in the system-dependent \texttt{paint_row} procedure; there are no tag fields on variant records; there are no real variables; no procedures are declared local to other procedures.)

Page D16, new paragraph to follow line 26
(06/25/04)
The first line is special also because it may be read before METAfont has input a base file. In such cases, normal error messages cannot yet be given. The following code uses concepts that will be explained later. (If the Pascal compiler does not support non-local \texttt{goto}, the statement \texttt{goto final_end} should be replaced by something that quietly terminates the program.)

Page D22, line 26
(09/11/07)
ASCII codes [60 .. 71, 136, 141 .. 146] must be printable.

Page D31, line 29
(06/25/04)
This is the only nontrivial \texttt{goto} statement in the whole program. It is used when there is no
Notice that if 64-bit integer arithmetic were available, we could simply compute \( (2^{29} \ast p + q) \div (2 \ast q) \). But when we are restricted to Pascal’s 32-bit arithmetic we must either resort to multiple-precision maneuvering or use a simple but slow iteration. The multiple-precision technique would be about three times faster than the code adopted here, but it would be comparatively long and tricky, involving about sixteen additional multiplications and divisions.

Page D44, lines 24–26 (12/23/02)

Once again it is a good idea to use 64-bit arithmetic if possible; otherwise take\_scaled will use more than 2% of the running time when the Computer Modern fonts are being generated.

Page D58, line 16 from the bottom (06/25/04)

\[
\text{if } j\_\text{random} = 0 \text{ then } \text{new}\_\text{randoms} \text{ else } \text{decr}(j\_\text{random})
\]

Page D63, line 21 (06/25/04)

Locations of \text{mem} between \text{mem}\_\text{min} and \text{mem}\_\text{top} may be dumped as part of preloaded base

Page D75, line 13 (06/25/04)

\[
\text{define } \text{fi}\_\text{or}\_\text{else} = 2 \quad \{ \text{delimiters for conditionals (elseif, else, fi)} \}
\]

Page D76, line 5 (06/25/04)

\[
\text{define } \text{type}\_\text{name} = 30 \quad \{ \text{declare a type (numeric, pair, etc.)} \}
\]

Page D77, line 16 (06/25/04)

\[
\text{define } \text{lig}\_\text{kern}\_\text{token} = 76 \quad \{ \text{the operators ‘kern’ and ‘=:’ and ‘=:|’; etc.} \}
\]

Page D98, bottom two lines (06/25/04)

They consist of zero or more parameter tokens followed by a code for the type of macro.

Page D101, line 3 (06/25/04)

\text{METAfont} user assigns a type to a variable like \text{x20\text{a.b}} by saying, for example, ‘\text{boolean } x[\text{a.b}}’. 
variable that is relevant when no attributes are attached to the parent. The \textit{attr\_head} node has the fields of either a value node, a subscript node, or an attribute node, depending on what the parent would be if it were not structured; but the subscript and attribute fields are ignored, so it effectively contains only the data of a value node. The \textit{link} field in this special node points to an attribute node whose \textit{attr\_loc} field is zero; the latter node represents a collective subscript \texttt{[\text{[]}]} attached to the parent, and its \textit{link} field points to the first non-special attribute node (or to \texttt{end\_attr} if there are none).

\texttt{subscr\_head}(\texttt{q1}) = \texttt{qq1}; \texttt{qq} is a three-word “attribute-as-value” node with \texttt{type(qq)} = \texttt{numeric\_type} (assuming that \texttt{x5} is numeric, because \texttt{qq} represents ‘\texttt{x[\text{[]}]}’ with no further attributes), \texttt{name\_type(qq)} = \texttt{structured\_root}, \texttt{attr\_loc(qq)} = 0, \texttt{parent(qq)} = \texttt{p}.

The value of variable \texttt{x20b} appears in node \texttt{qqq2} = \texttt{link(qqq1)}, as you can well imagine. Similarly, the value of ‘\texttt{x.a}’ appears in node \texttt{q2} = \texttt{link(q1)}, where \texttt{attr\_loc(q2)} = \texttt{h(a)} and \texttt{parent(q2)} = \texttt{p}.

Such save stack entries are generated by \texttt{save} commands.

If \(\theta_0\) is supposed to have a given value \(E_0\), we simply define \(C_0 = 1, D_0 = 0, \text{and } R_0 = E_0\).

for the bisected interval are \(z'_0 = z_0\) and \(z''_0 = z_0 + (Z'_1 + Z'_2 + \cdots + Z'_n)/2^{l+1}\).

out to hold if and only if \(x_0 \leq x_1\) and \(x_2 \leq x_3\), and either \(x_1 \leq x_2\) or \((x_1-x_2)^2 \leq (x_1-x_0)(x_3-x_2)\).

For example, if we start with \((x_1 - x_0, x_2 - x_1, x_3 - x_2) = (X_1, X_2, X_3) = (7, -16, 39), the monotonic cubic, then \(B(x_0, x_1, x_2, x_3; \frac{1}{2})\) is always between \(.06[x_0, x_3]\) and \(.94[x_0, x_3]\); and it is impossible for \(x\) to be within \(\epsilon\) of such a number. Contradiction! (The constant \(.06\) is actually \((2 - \sqrt{3})/4\); the worst case occurs for polynomials like \(B(0, 2 - \sqrt{3}, 1 - \sqrt{3}, 3; t)\).)
Page D177, line 18 (06/25/04)

`cur_x, cur_y: scaled;` \{ outputs of `skew`, `unskew`, and a few other routines \}

Page D182, lines 27–29 (06/25/04)

399. If the segment numbers on the cycle are $t_1, t_2, \ldots, t_m$, and if $m \leq \max_{\text{quarterword}}$, we have $t_{k-1} \leq t_k$ except for at most one value of $k$. If there are no exceptions, $f$ will point to $t_1$; otherwise it will point to the exceptional $t_k$.

Page D184, line 18 (12/21/02)

`chopped`: integer; \{ positive if data truncated, negative if data dangerously large \}

Page D184, line 25 (12/21/02)

if `(internal[autorounding] > 0) \land (chopped = 0)` then `xy_round`;

Page D184, line 27 (12/21/02)

if `(internal[autorounding] > \text{unity}) \land (chopped = 0)` then `diag_round`;

Page D184, line 32 (12/21/02)

if `(internal[autorounding] \leq 0) \lor (chopped \neq 0)` then `print_spec`("", after_subdivision")

Page D185, lines 15–19 (12/21/02)

`define procrustes(#) \equiv` if `abs(#) \geq dmax` then
  if `abs(#) > max_allowed` then
    begin `chopped ← 1`;
    if `# > 0` then `# ← max_allowed` else `# ← -max_allowed`;
    end
  else if `chopped = 0` then `chopped ← -1`;

Page D185, old line 22 (12/21/02)

$p ← cur_spec; k ← 1; chopped ← 0; dmax ← \text{half}(max_allowed)$;

Page D185, old line 28 (12/21/02)

if `chopped > 0` then

Page D196, lines 3–8 (06/25/04)

The first job is to fix things so that $x(t)$ plus the horizontal pen offset is an integer multiple of the current “granularity” when the derivative $x'(t)$ crosses through zero. The given cyclic path contains regions where $x'(t) \geq 0$ and regions where $x'(t) \leq 0$. The `quadrant_subdivide` routine is called into action before any of the path coordinates have been skewed, but some of them may have been negated. In regions where $x'(t) \geq 0$ we have \texttt{right_type = first_octant} or \texttt{right_type = eighth_octant}; in regions where $x'(t) \leq 0$, we have \texttt{right_type = fifth_octant} or \texttt{right_type = fourth_octant}. 
current pen might be unsymmetric in such a way that \( x \) coordinates should round differently in different parts of the curve. These considerations imply that \( \text{round}(x_0) \)

and that there are similar ways to address other important offsets.

[Also delete the definitions of \textit{north\_south\_edge}, etc., on lines 11–15; those definitions are never used.]

at \((x_0, y_0)\) and ends at \((x_1, y_1)\), it’s possible to prove (by induction on the length of the truncated

we list it twice (with coordinates interchanged, so as to make the second octant look like

\[
\begin{align*}
  w_2 & \mapsto (-5, 6) (-5, 6) (-5, 6) \\
  w_2 & \mapsto (7, -6) (7, -6) (7, -6) \\
  w_3 & \mapsto (-7, 1) (-7, 1) (-3, 2) (-3, 2) \\
  w_3 & \mapsto (3, -2) (3, -2) (3, -2) \\
  w_3 & \mapsto (-3, 1) (-3, 1) (1, 0) (1, 0) \\
  w_3 & \mapsto (1, 0) (1, 0) (1, 0) \\
  w_0 & \mapsto (-1, 1) (-1, 1) (-1, 1) \\
  w_0 & \mapsto (1, 0) (1, 0) (1, 0)
\end{align*}
\]

as the list of transformed and skewed offsets to use when curves that travel in the second octant. Similarly, we will have

\[
\begin{align*}
  w_2 & \mapsto (-5, 6) (-5, 6) (-5, 6) \\
  w_2 & \mapsto (7, -6) (7, -6) (7, -6) \\
  w_3 & \mapsto (-7, 1) (-7, 1) (-3, 2) (-3, 2) \\
  w_3 & \mapsto (3, -2) (3, -2) (3, -2) \\
  w_3 & \mapsto (-3, 1) (-3, 1) (1, 0) (1, 0) \\
  w_3 & \mapsto (1, 0) (1, 0) (1, 0) \\
  w_0 & \mapsto (-1, 1) (-1, 1) (-1, 1) \\
  w_0 & \mapsto (1, 0) (1, 0) (1, 0)
\end{align*}
\]

count followed by pointers to the eight offset lists, followed by an indication of the pen’s range of values.

The \textit{link} field of a pen header node should be \textit{null} if and only if the pen is a single point.

\textit{endpoint}. The cubics all have monotone-nondecreasing \( x(t) \) and \( y(t) \).
In odd-numbered octants, the numerator and denominator of this fraction will be nonnegative; in even-numbered octants they will both be nonpositive. Furthermore we always have $0 = s_0 \leq s_1 \leq \cdots \leq s_n = \infty$. The goal of offset_prep is to find an offset index $k$ to associate with each cubic, such that the slope $s(t)$ of the cubic satisfies

$$s_{k-1} \leq 1 \text{ or } s_k \leq 1$$

and return towards $s_{k-1}$ or $s_k$, respectively, yielding another solution of $(\ast)$. 

The $x$-axis at the point $\left( (a^2 - b^2) \sin \theta \cos \theta / \rho \right) + i \rho$, where $\rho = \sqrt{(a \sin \theta)^2 + (b \cos \theta)^2}$. It reaches furthest to the right of the $y$-axis at the point $\sigma + i(a^2 - b^2) \sin \theta \cos \theta / \sigma$, where $\sigma = \sqrt{\left( a \sin \theta \right)^2 + \left( b \cos \theta \right)^2}$. It
Page D262, line 11 from the bottom (06/25/04)

\[ xy \leftarrow xy + int\_packets; \quad \{ \text{switch from } l\_packets \text{ to } r\_packets \} \]

Page D274, line 15 from the bottom (06/25/04)

\[
\begin{align*}
\text{begin if} & \quad \text{serial} \_\text{no} > e_\text{gordo} - s\_\text{scale} \quad \text{then} \\
& \quad \text{overflow}("\text{independent}_\text{variables}", \text{serial} \_\text{no} \div s\_\text{scale}); \\
& \quad \text{type}(\#) \leftarrow \text{independent}; \quad \text{serial} \_\text{no} \leftarrow \text{serial} \_\text{no} + s\_\text{scale}; \quad \text{value}(\#) \leftarrow \text{serial} \_\text{no};
\end{align*}
\]

Page D309, line 21 (06/25/04)

670. We go to \textit{restart} instead of to \textit{switch}, because we might enter \textit{token\_state} after the error.

Page D314, line 6 from the bottom (06/25/04)

\textit{macro\_def or iteration}).

Page D330, line 1 (06/25/04)

728. A \textit{suffix} or \textit{text} parameter will have been scanned as a token list pointed to by \textit{cur\_exp},

Page D354, lines 15 and 16 from the bottom (06/25/04)

\textit{cur\_type} = \textit{unknown\_boolean} means that \textit{cur\_exp} points to a capsule node that is in a ring of equivalent bools whose value has not yet been defined.

Page D354, lines 11 and 12 from the bottom (06/25/04)

\textit{cur\_type} = \textit{unknown\_string} means that \textit{cur\_exp} points to a capsule node that is in a ring of equivalent strings whose value has not yet been defined.

Page D354, lines 7 and 8 from the bottom (06/25/04)

\textit{cur\_type} = \textit{unknown\_pen} means that \textit{cur\_exp} points to a capsule node that is in a ring of equivalent pens whose value has not yet been defined.

Page D355, lines 1 and 2 (06/25/04)

\textit{cur\_type} = \textit{unknown\_path} means that \textit{cur\_exp} points to a capsule node that is in a ring of equivalent paths whose value has not yet been defined.

Page D355, lines 5 and 6 (06/25/04)

\textit{cur\_type} = \textit{unknown\_picture} means that \textit{cur\_exp} points to a capsule node that is in a ring of equivalent pictures whose value has not yet been defined.

Page D355, lines 21 and 22 (06/25/04)

\textit{cur\_type} = \textit{token\_list} means that \textit{cur\_exp} points to a linked list of tokens.
nodes have name_type = capsule, and their type field is one of the possibilities for cur_type listed above. Also link ≤ void in capsules that aren’t part of a token list.

my_var_flag: 0 .. max_command_code; { initial value of var_flag }

begin cur_type ← known; cur_exp ← 0; free_node(q, dep_node_size);

begin type(r) ← known; value(r) ← 0; free_node(p, dep_node_size);

by a previous operation. We must maintain the value of right_type(q) in cases such as ‘..{cur12}z(0,0)‘.

996. And do_assignment is similar to do_equation:

begin nonlinear_eq(v, cur_exp, false); cur_type ← t; goto done;

done: if eq_type(x) mod outer_tag ≠ tag_token then clear_symbol(x, false);

though they don’t necessarily correspond to primitive tokens.

if nl – skip_table[c] > 128 then

max_tfm_dimen ← 16 * internal[design_size] – 1 – internal[design_size] div 10000000;

if x > 0 then x ← max_tfm_dimen else x ← –max_tfm_dimen;
end;
x ← make_scaled(x * 16, internal[design_size]);
Page D496, line 2 (06/25/04)
a pointer to an edge structure. Its mission is to describe the positive pixels in GF form,

Page D500, line 16 (06/25/04)
\[ \text{selector} \leftarrow \text{old_setting}; \text{gf}_{\text{out}}(\text{cur_length}); \text{gf}_{\text{string}}(0, \text{make_string}); \text{decr}(\text{str_ptr}); \]

Page D506, lines 8–10 (06/25/04)
\text{METAFONT} it says, for example, '(\text{preloaded base=plain 1984.2.29})', showing the year, month, and day that the base file was created. We have base.ident = 0 before \text{METAFONT}'s tables are loaded.

Page D514, line 14 from the bottom (06/25/04)
\text{CMMF}, should also be provided for commonly used bases such as \text{cmbase}.

Page E1, line 3 (01/06/06)
Zillions of alphabets can be generated by the programs in this book. All

Page E6, lines 16–19 (12/29/04)
- \text{square dots} tells whether dots should be square, not rounded;
- \text{hefty} tells whether weight-reducing strategies should be used;
- \text{monospace} tells whether the characters should all be forced to have the same width;

Page E7, line 11 (12/21/02)
\text{hair, vair, stem, curve, ess, flare, dot_size, bar, slab},

Page E7, line 14 (12/21/02)
\text{crisp, tiny, fine};
and \text{thin_join} should not be less than \text{fine}.

Page E19, line 19 (11/07/01)
\text{cap_notch_cut} \quad 46/36 \quad 31/36 \quad 25/36 \quad 24/36 \quad 22/36 \quad 25/36

Page E41, line 8 (12/21/02)
\text{extra_endchar} \leftarrow \text{extra_endchar} & \text{"charcode:=charcode+code_offset;"};

Page E53, line 7 (12/21/02)
\text{numeric mid_thickness; mid_thickness = Vround }^{\frac{1}{3}}[\text{vair, stem}];
\(\text{top } y_1 = \text{top } y_6 = h; \ z_2 = .5[z_3, z_1] + \text{bend};\)

\textbf{Page E125, line 3 from the bottom} \hspace{1cm} (07/10/05)

\texttt{draw \(z_1 - \text{flourish}\_\text{change}\{up\} + (0, 1.15\text{asc\_height})\{up\}\)}
\(\ldots\{\text{right}\}(z_1 + (2u, 0)) \ldots \{\text{down}\}z_7;\)
\% upper bar

\textbf{Page E146, also pages 164 and 540} \hspace{1cm} (02/08/03)

[The labels on the new illustrations of beta, omega, and spadesuit are too large, and the resolution of the shapes is too small.]

\textbf{Page E147, line 11 from the bottom} \hspace{1cm} (04/23/04)

\(x_0 = x_1 = x_0; \ \text{ift } x_{0r} = \text{hround}(1.5u - .5\text{hair}); \ x_2 = x_4 = x_6 = x_8 = .5w - .25u;\)

\textbf{Page E147, line 8 from the bottom} \hspace{1cm} (04/23/04)

\(y_5 = .5[y_4, y_6]; \ \text{top } y_{6r} - \text{bot } y_{4r} = \text{vstem} + \text{eps}; \ \text{bot } y_{6r} = -\text{oo}; \ y_7 = y_n = .55[y_6, y_6];\)

\textbf{Page E149, line 8 from the bottom} \hspace{1cm} (04/23/04)

\(y_5 + .1z_{\text{height}} = y_7 = .5[y_6, y_6]; \ \text{bot } y_{6r} = -\text{oo};\)

\textbf{Page E157, line 11} \hspace{1cm} (02/29/08)

\texttt{filldraw \(z_{11} - z_{12} \ldots (x_3, y_{32}) \ldots z - z_{1r} - \text{-cycle};\)}
\% stem

\textbf{Page E161, line 7 from the bottom} \hspace{1cm} (04/23/04)

\(\text{top } y_{1r} = x_{\text{height}} + \text{oo}; y_2 = y_4 = .5[y_1, y_1]; \ \text{bot } y_{3r} = -\text{oo};\)

\textbf{Page E209, line 3} \hspace{1cm} (12/29/04)

% This lowercase italic alphabet was prepared by D. E. Knuth in December, 1979,

\textbf{Page E377, lines 3 and 4 from the bottom} \hspace{1cm} (12/22/02)

\texttt{\textbf{path} \(p_z; \ p_z = z_{88}\{z_{81} - z_{88}\} \ldots \text{darkness}[z_{81}, .5[z_{82}, z_{88}] \ldots z_{w2}}\)
\(\ldots z_{81} - z_{84}; \ \text{-} z_{40} - z_{88} - \text{-cycle};\)
\texttt{\textbf{if} (\(y_{88} > y_{8}\)) \{\text{ypart \textbf{precontrol} 1 of } p_z > \text{ypart \textbf{postcontrol} 1 of } p_z\);}
\(p_z = z_{88}\{z_{81} - z_{88}\} \ldots \text{darkness}[z_{81}, .5[z_{82}, z_{88}]\}
\(\ldots z_{81} - z_{84}; \ \text{-} z_{40} - z_{88} - \text{-cycle}; \ \text{\bf fi}\)
\texttt{filldraw \(p_z;\)}
\% arm and beak

\textbf{Page E379, lines 17 and 18 become one line} \hspace{1cm} (01/06/14)

\texttt{\textbf{else} \ \texttt{rt} \(x_{0r} = \text{hround}(w - 1.5u); \ y_6 = y_{9d} + \text{eps}; \ \text{fi}\)}
Page E379, bottom line of the program (01/06/14)

\texttt{math\_fit(0, ax - 2.5\#); penlabels(0, 1, 2, 3, 4, 5, 6, 7); endchar;}

Page E489, bottom line (06/25/04)

\texttt{labels(1, 2, 3, 4, 5, 6); endchar;}

[Labels ‘5’ and ‘6’ should also be added to the lower illustration on page E488.]

Page E545, line 11 from the bottom (12/29/04)

The most important general routine in \texttt{cmbase} is probably the \texttt{pos}

Page E551, line 3 from the bottom (12/29/04)

quantities needed in the \texttt{calu} programs are also established at this time.

Page E577, right column (12/23/02)

p., 305, 377.
\texttt{padded, 103–111, 117–121, 549.}

Page E578, left column (12/23/02)

\texttt{postcontrol, 347, 377.}
\texttt{precontrol, 347, 377.}