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 7th 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 \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 \texttt{\textbackslash box \textit{n}} surpass \texttt{\textdimen \textit{n}}, when it is

Page A124, lines 12 and 13 (02/27/08)
means that \TeXX has tried to split an \texttt{\textbackslash insert \textit{254}} 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 \texttt{\textbackslash 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 \texttt{\textbackslash outer} with all control sequences that should appear only at “quiet times” within a document. For example, Appendix B defines \texttt{\textbackslash proclaim} to be \texttt{\textbackslash 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)

\texttt{\textbackslash openin(number)=\texttt{(file \ name)}}

Page A290, lines 25–26 (02/24/08)

- \texttt{(leaders)\textbackslash box or rule\texttt{(horizontal \ skip)}}. Here \texttt{(horizontal \ skip)} refers to one of the first five glue-appending commands just mentioned; the formal syntax for \texttt{(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 `\box\footins` can be achieved easily with an elegant technique suggested by David Kastrup, using the following \TeX code within the `\output` routine:

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

The key idea here is `\removehboxes`, a macro that has the magical ability to take a vertical box such as `\vbox{\box1\box2\box3\removehboxes}` and transform it into `\vbox{\noindent\unhbox1\unhbox2\unhbox3}`, if `\box1`, `\box2`, and `\box3` are hboxs. Notice how `\removehboxes` introduces braces so that \TeX's save stack will hold all of the hboxs 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 `\box\footins`, so the `\unskip` command could be deleted from `\removehboxes`.

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

```
\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
  \vbox to 10pt{}% strut to position the baseline
  \llap{\tenbf\folio\kern1pc}% folio to left of text
  \tenit\rhead\hfil}} % running head flush left
```

### Page A416, lines 18–22 (06/08/07)

```
\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
  \vbox to 10pt{}% strut to position the baseline
  \llap{\tenbf\folio\kern1pc}% folio to left of text
  \tenit\rhead\hfil}} % running head flush left
```

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

```
\def\(#3)\advance\hsize by -18mm
```

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

```
\halign{\line{\titlefont\hss##}\#4\unskip\} \hfill\hfill}
```

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

3. If the current item is a style change, set \textit{C} to the specified style and move on to the next item.
s_{1t1c_1} e_{xp_3} p_{i_3a_2} i_{2a_1} d_{1o_1} o_{2u_2} u_{2s_0} \ (\text{where subscripts that aren’t shown are zero}), \text{ and this yields} 

s_{0u_1p_0e_1c_0a_0l_1i_0f_0r_0a_0g_1i_0l_1i_0s_1t_2i_0c_1e_0 x_{3p_2i_3a_0l_2i_1d_0c_2i_0a_0l_2i_0u_2s_0} .

\begin{align*}
\text{Page A458, left column} & \quad (01/11/07) \\
\text{Page A459, left column} & \quad (03/17/06) \\
\text{Page A461, left column} & \quad (02/24/08) \\
\text{Page A468, right column} & \quad (02/26/08) \\
\text{Page A469, left column} & \quad (02/26/08) \\
\text{Kastrup, David Friedrich,} & \quad 399. \\
\text{Page A470, left column} & \quad (01/21/03) \\
\text{Page A477, right column} & \quad (06/08/07) \\
\text{Page A479, right column} & \quad (09/11/07) \\
\text{Page A483, line 5 from the bottom} & \quad (11/18/03) \\
\end{align*} 

\begin{quotation}
— HIERONYMUS HORNsCHUCH, \textit{Oρϑoτυπογραφ\'ιας} (1608)
\end{quotation} 

\begin{align*}
\text{Page Bv, page number change} & \quad (12/27/11) \\
\text{Page Bv (formerly Bvii), bottom two lines} & \quad (01/06/14) \\
\end{align*} 

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 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.

In fact, these three procedures account for almost every use of get_next.
else if \( m = vmode \) then
\[
\text{scanned_result}(\text{pren_depth})(\text{dimen_val})
\]
else
\[
\text{scanned_result}(\text{space_factor})(\text{int_val})
\]

\[
\text{cur_val} \leftarrow 0; \text{cur_val_level} \leftarrow \text{int_val}; \text{radix} \leftarrow 0; \text{cur_order} \leftarrow \text{normal};
\]

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.

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

\[
\text{cur_glue}: \text{ real}; \quad \{ \text{glue seen so far}\}
\]
\[
\text{cur_g}: \text{ scaled}; \quad \{ \text{rounded equivalent of cur_glue times the glue ratio}\}
\]

\[
\begin{align*}
\text{begin} & \quad \text{cur_g} \leftarrow 0; \text{cur_glue} \leftarrow \text{float_constant}(0); \\
& \quad \text{this_box} \leftarrow \text{temp_ptr}; \text{g_order} \leftarrow \text{glue_order}(\text{this_box}); \text{g_sign} \leftarrow \text{glue_sign}(\text{this_box});
\end{align*}
\]

\[
\begin{align*}
\text{begin} & \quad \text{g} \leftarrow \text{glue_ptr}(p); \text{rule_wd} \leftarrow \text{width}(g) - \text{cur_g};
\end{align*}
\]

\[
\begin{align*}
\text{begin} & \quad \text{cur_glue} \leftarrow \text{cur_glue} + \text{stretch}(g); \text{vet_glue}(\text{float}(\text{glue_set}(\text{this_box})) \ast \text{cur_glue}); \\
& \quad \text{cur_g} \leftarrow \text{round}(\text{glue_temp});
\end{align*}
\]

\[
\begin{align*}
\text{begin} & \quad \text{cur_glue} \leftarrow \text{cur_glue} - \text{shrink}(g); \text{vet_glue}(\text{float}(\text{glue_set}(\text{this_box})) \ast \text{cur_glue}); \\
& \quad \text{cur_g} \leftarrow \text{round}(\text{glue_temp});
\end{align*}
\]

\[
\text{rule_wd} \leftarrow \text{rule_wd} + \text{cur_g};
\]
else begin lx ← br \div (lq + 1);

\begin{verbatim}
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);
\end{verbatim}

begin g ← glue_ptr(p); rule_ht ← width(g) − cur_g;

\begin{verbatim}
begin cur_glue ← cur_glue + stretch(g); vet_glue(float(glue_set(this_box)) * cur_glue);
cur_g ← round(glue_temp);
\end{verbatim}

\begin{verbatim}
begin cur_glue ← cur_glue − shrink(g); vet_glue(float(glue_set(this_box)) * cur_glue);
cur_g ← round(glue_temp);
\end{verbatim}

\begin{verbatim}
rule_ht ← rule_ht + cur_g;
\end{verbatim}

else begin lx ← br \div (lq + 1);

\begin{verbatim}
total_pages \geq 65536, the DVI file will lie. And if max_push \geq 65536, the user deserves whatever chaos might ensue.
\end{verbatim}

\begin{verbatim}
begin if s = text_size then print_esc("textfont");
\end{verbatim}
if type(r) = kern_node then { unneeded italic correction }

Page B332, line 8 (12/19/02)

begin if (scanner_status = aligning) ∨ (cur_align = null) then

Page B336, line 11 from the bottom (10/13/03)

j − i + \text{min.quarterword} in their link fields. The values of \textit{w}_{ii} were initialized to null_flag,

Page B342, lines 5 and 6 (09/11/07)

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

Page B343, line 25 (01/02/13)

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

Page B416, line 22 (02/29/08)

if \texttt{count(t)} = 1000 then \texttt{t ← height(r)}
else \texttt{t ← x_over_n(height(r), 1000) * count(t)};
\texttt{print_scaled(t)}

Page B438, lines 1–3 (09/11/07)

1035. \textit{If} link(\texttt{cur.q}) is nonnull when wrapup is invoked, \texttt{cur.q} points to the list of characters that were consumed while building the ligature character \texttt{cur.l}.

Page B438, lines 19 and 20 (09/11/07)

\begin{verbatim}
begin if link(cur.q) > null then
  if character(tail) = qi(hyphen_char[main.f]) then ins_disc ← true;
\end{verbatim}

Page B438, line 4 from the bottom (09/11/07)

\texttt{link(tail) ← lig_stack; tail ← lig_stack} \{ main_loop.lookahead is next \}

Page B439, line 3 (09/11/07)

if main_p > null then \texttt{tail.append(main_p)}; \{ append a single character \}

Page B440, new line to follow line 9 (09/11/07)

\texttt{if cur_r = non_char then goto main_loop_wrapup;}
Page B452, line 18 (28/03/11)
hmode, where the latter two are used to denote \vbox and \hbox, respectively.

Page B455, lines 3 and 4 (09/11/07)
if \((\text{cur}_cmd = \text{hskip}) \land (\text{abs}(\text{mode}) \neq \text{vmode})) \lor (\text{(cur}_cmd = \text{vskip}) \land (\text{abs}(\text{mode}) = \text{vmode})) \text{ then}

Page B472, new paragraph to follow line 10 (12/20/02)
A devious user might force an \texttt{endv} command to occur just about anywhere; we must defeat such hacks.

Page B472, replacement for what used to be line 13 (12/20/02)
\begin{verbatim}
begin base_ptr ← input_ptr; input_stack[base_ptr] ← cur_input;
while (input_stack[base_ptr],index_field ≠ v_template) ∧
   (input_stack[base_ptr],loc_field = null) ∧
   (input_stack[base_ptr],state_field = token_list) do decr(base_ptr);
if (input_stack[base_ptr],index_field ≠ v_template) ∨
   (input_stack[base_ptr],loc_field ≠ null) ∨
   (input_stack[base_ptr],state_field ≠ token_list) then
   fatal_error('\texttt{(interwoven alignment preambles are not allowed)}');
if \texttt{cur_group} = \texttt{align_group} then
\end{verbatim}

Page B505, line 19 (09/11/07)
\begin{verbatim}
("since the result is out of range.");
if \(p ≥ \text{glue_val}\) then delete_glue_ref(cur_val);
error; return;
\end{verbatim}

Page B506, line 1 (10/13/03)
\textbf{1237}. Here we use the fact that the consecutive codes \texttt{int_val .. mu_val} and \texttt{assign_int ..}

Page B520, line 8 (06/25/04)
says, for example, ‘\texttt{(preloaded format=plain 1982.11.19)}’, showing the year, month, and day

Page B535, new line to follow line 11 (09/11/07)
\begin{verbatim}
if last_glue ≠ max_halfword then delete_glue_ref(last_glue);
\end{verbatim}

Page B578, new entry (06/04/06)
Trabb Pardo, Luis Isidoro, 2.

Page Cxi, line 4 (05/20/07)
\textbf{27} Recovery from Errors
the area below the bar to the area above it equal to \( (\sqrt{5} + 1)/2 \approx 1.61803 \), the

Page C29, illustration for exercise 4.11 (09/09/01)
[points 2 and 5 should not be labeled twice]

Page C32, line 5 from the bottom (01/04/14)

\[
\begin{align*}
&\text{penpos1(stem,15); penpos2(.9stem,12); penpos3(stem,10);}
\end{align*}
\]

Page C36, line 5 from the bottom (01/05/14)

line 12, where it says ‘x11’, not ‘x1l’ or ‘x1l’); be sure to distinguish between

Page C355, lines 5 and 6 (01/05/14)
suffixed or subscripted. Thus, the syntax rule for \( \langle \text{variable} \rangle \) should actually be replaced by a slightly more complicated pair of rules:

Page C129, line 16 (02/21/08)

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

Page C130, lines 13–15 from the bottom (09/13/03)
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.

Page C137, lines 5–7 from the bottom (02/21/08)

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

Page C137, bottom two lines (02/21/08)

A \textsc{Metapost} 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,

Page C156, line 15 from the bottom (09/09/01)
be the values they had upon entry to the group.)
def --- = .tension infinity.. enddef;
it makes ‘z1 --- z2’ become ‘z1 .. tension infinity .. z2’. The replacement text
can be any sequence of tokens not including ‘enddef’; or it can include entire
subdefinitions like ‘def ..., enddef’, according to certain rules that we shall
explain later.

⟨loop⟩−→⟨loop header⟩:⟨loop text⟩endfor

next time METAFONT gets to the end of an input line, it will stop reading from the
digits should be a file name that works in essentially the same way on all installations
of METAFONT. Uppercase letters are considered to be distinct from their lowercase
counterparts, on many systems.

When METAFONT is reading the symbolic tokens to be saved by save.

point 3 at the right of the triangle might digitize into a

(path subexpression) −→ ⟨path expression not ending with direction specifier⟩

following nineteen things will be mentioned:

independent variables (distinct numeric variables)

7.4. False. After ‘newinternal x;’ you can’t say ‘x(tag)’ in a ⟨suffix list⟩.

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.)

following (boolean primary).

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

if if pair x: x>(0,0) else: false fi: A else: B fi.

be known by saying ‘if known $p - q$: $p = q$ else: false fi’; transforms could be handled

given angle $\phi$. We can consider the common angle $\theta$ of $z_{1r} - z_{1l}$ and $z_{0r} - z_{0l}$ to be

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

— CAROLUS LINNÆUS, *Philosophia Botanica* (1751)

(The proofsheet resolution will be 50 pixels per inch, because cheapo has 200 pixels per

arccosine, arcsine, arctangent, see angle.

independent variables, 81–83, 88, 224, 226.
Page C352, right column (02/29/08)
Linné, Carl von (= Linnaeus, Carolus), 325.

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

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)
corporates 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 banner \equiv \texttt{This\_is\_METAFONT,\_Version\_2.7182818}} \{ printed when \texttt{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 \texttt{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 \texttt{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 [\texttt{60 .. 71}, \texttt{136 .. 141} .. \texttt{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
Page D42, replacement for lines 8–13 
(12/23/02)

Notice that if 64-bit integer arithmetic were available, we could simply compute \((2^{29} \times p + q) \text{ div } (2 \times q)\). 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 D43, line 20 
(12/23/02)

language or 64-bit substitute is advisable.

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_min} and \text{mem_top} may be dumped as part of preloaded base

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

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

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

\text{define type_name} = 30 \quad \{ \text{declare a type (numeric, pair, etc.)} \}

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

\text{define lig Kern_token} = 76 \quad \{ \text{the operators ‘kern’ and ‘=:’ and ‘:=:1’, 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{x20a.b} by saying, for example, \text{‘boolean x[]a.b’}. 
variable that is relevant when no attributes are attached to the parent. The 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 link field in this special node points to an attribute node whose attr_loc field is zero; the latter node represents a collective subscript ‘[]’ attached to the parent, and its link field points to the first non-special attribute node (or to end_attr if there are none).

subscr_head(q1) = qq1; qq is a three-word “attribute-as-value” node with type(qq) = numeric_type (assuming that x5 is numeric, because qq represents ‘x[ ]’ with no further attributes), name_type(qq) = structured_root, attr_loc(qq) = 0, parent(qq) = p.

Page D120, line 3 (06/25/04) [delete the line ‘The code here . . .’, since the code doesn’t use the stated fact]

Page D126, line 10 (06/25/04) If \( \theta_0 \) is supposed to have a given value \( E_0 \), we simply define \( C_0 = 1, D_0 = 0, \) and \( R_0 = E_0 \).

Page D138, line 11 from the bottom (10/26/06) for the bisected interval are \( z'_0 = z_0 \) and \( z''_0 = z_0 + (Z'_1 + Z'_2 + \cdots + Z'_n)/2^{l+1} \).

Page D142, line 3 (06/25/04) 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 \( (x_1-x_2)^2 \leq (x_1-x_0)(x_3-x_2) \).

Page D142, line 8 (10/26/06) 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 \( B(0, 2 - \sqrt{3}, 1 - \sqrt{3}, 3; t) \).)
cur_x, cur_y: scaled; \{ outputs of skew, unskew, and a few other routines \}

399. If the segment numbers on the cycle are $t_1, t_2, \ldots, t_m$, and if $m \leq \text{max\_quarterword}$, 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 $t_k$.

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

\begin{align*}
\text{if } (\text{internal}[\text{autorounding}] > 0) \land (\text{chopped} = 0) \text{ then } & \text{xy\_round;} \\
\text{if } (\text{internal}[\text{autorounding}] > \text{unity}) \land (\text{chopped} = 0) \text{ then } & \text{diag\_round;} \\
\text{if } (\text{internal}[\text{autorounding}] \leq 0) \lor (\text{chopped} \neq 0) \text{ then } & \text{print\_spec(\text{",\_after\_subdivision\"})}
\end{align*}

\texttt{define} procrustes(#) \equiv \text{if } \text{abs}(#) \geq dmax \text{ then} \\
\text{if } \text{abs}(#) > \text{max\_allowed} \text{ then} \\
\text{begin} \text{chopped} \leftarrow 1; \\
\text{if } # > 0 \text{ then } # \leftarrow \text{max\_allowed} \text{ else } # \leftarrow -\text{max\_allowed}; \\
\text{end} \\
\text{else if } \text{chopped} = 0 \text{ then } \text{chopped} \leftarrow -1

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 \texttt{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} = \texttt{first\_octant} or \texttt{right\_type} = \texttt{eighth\_octant}; in regions where $x'(t) \leq 0$, we have \texttt{right\_type} = \texttt{fifth\_octant} or \texttt{right\_type} = \texttt{fourth\_octant}. 
current pen might be unsymmetric in such a way that $x$ coordinates should round differ-
ently in different parts of the curve. These considerations imply that round($x_0$) and that there are similar ways to address other important offsets.

[Also delete the definitions of 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

\[
\begin{align*}
w_2 & \rightarrow (-5, 6) (-5, 6) (-5, 6) \\
\end{align*}
\]

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

\[
\begin{align*}
w_2 & \rightarrow (7, -6) (7, -6) (7, -6) \quad \text{in the third;} \\
w_2 & \rightarrow (-7, 1) (-7, 1) (-3, 2) (-3, 2) \quad \text{in the fourth;} \\
w_3 & \rightarrow (3, -2) (3, -2) (3, -2) \quad \text{in the fifth;} \\
w_3 & \rightarrow (-3, 1) (-3, 1) (1, 0) (1, 0) \quad \text{in the sixth;} \\
w_0 & \rightarrow (1, 0) (1, 0) (1, 0) \quad \text{in the seventh;} \\
w_0 & \rightarrow (-1, 1) (-1, 1) (-1, 1) \quad \text{in the eighth.}
\end{align*}
\]

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

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

endpoint. The cubics all have monotone-nonincreasing $x(t)$ 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 ($\ast$).

dinate fields. Hence, for example, the point $(x_{\text{coord}}(p) - \text{left}_v(q), y_{\text{coord}}(p) + \text{right}_u(p))$ also reaches furthest to the right of the $y$-axis at the point $\sigma + i(a^2 - b^2) \sin \theta \cos \theta / \sigma$, where $\sigma =$}

\[
\begin{aligned}
536. & \text{ Only the coordinates need to be copied, not the class numbers and other stuff. At this point either } link(p) \text{ or } link(link(p)) \text{ is } \text{null.}
\end{aligned}
\]

\[
\begin{aligned}
done1: & \text{ if } (\text{link}(p) \neq \text{null}) \text{ then free_node(link(p), knot_node_size);} \\
& \text{link(p) } \leftarrow s; \text{ beta } \leftarrow -y_{\text{coord}}(h);
\end{aligned}
\]

we have $2l_{u_{\text{min}}} = 2l_{u_0} + U_{\text{min}}$, etc.; the condition for overlap reduces to

\[
\begin{aligned}
tol: & \text{ integer}; \quad \text{\{ bound on the uncertainty in the overlap test \}}
\end{aligned}
\]

\[
\begin{aligned}
\text{uv } \leftarrow \text{uv } + \text{int_packets}; \quad \text{\{ switch from l_packets to r_packets \}}
\end{aligned}
\]

\[
\begin{aligned}
\text{decr(cur_t)}; \text{ xy } \leftarrow \text{xy } - \text{int_packets}; \quad \text{\{ switch from r_packets to l_packets \}}
\end{aligned}
\]
Page D262, line 11 from the bottom (06/25/04)

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

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

\[
\begin{align*}
\text{begin if } & \text{serial\_no} > \text{el\_gordo} - \text{s\_scale} \text{ then} \\
& \text{overflow("independent\_variables", serial\_no div s\_scale)}; \\
& \text{type(#)} \leftarrow \text{independent}; \text{serial\_no} \leftarrow \text{serial\_no} + \text{s\_scale}; \text{value(#)} \leftarrow \text{serial\_no}; 
\end{align*}
\]

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

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

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

\[ \text{macro\_def or iteration).} \]

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

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

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

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

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

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

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

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

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

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

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

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

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

\[ \text{cur\_type} = \text{token\_list} \text{ means that cur\_exp points to a linked list of tokens.} \]
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.

\[\text{my_var_flag: 0 . . max_command_code; \{ initial value of var_flag \}}\]

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:

\[\text{begin \ nonlinear_eq(v, cur_exp, false); \ cur_type \leftarrow t; \ goto \ done;}\]

\[\text{done: if eq_type(x) mod outer_tag \neq tag_token then clear_symbol(x, false);}\]

though they don’t necessarily correspond to primitive tokens.

\[\text{max_tfm_dimen \leftarrow 16 + internal[design_size] - 1 - internal[design_size] div 10000000;}\]

\[\text{if } x > 0 \text{ then } x \leftarrow \text{max_tfm_dimen else } x \leftarrow -\text{max_tfm_dimen};\]
\[\text{end;}\]
\[\text{x \leftarrow \text{make_scaled}(x * 16, internal[design_size]);}\]
a pointer to an edge structure. Its mission is to describe the positive pixels in GF form,

\[
\text{selector} \leftarrow \text{old\_setting}; \text{gf\_out}(\text{cur\_length}); \text{gf\_string}(0, \text{make\_string}); \text{decr}(\text{str\_ptr});
\]

METAFONT it says, for example, ‘(preloaded base=plain 1984.2.29)’, showing the year, month, and day that the base file was created. We have base\_ident = 0 before METAFONT’s tables are loaded.

CMMF, should also be provided for commonly used bases such as cmbase.

Zillions of alphabets can be generated by the programs in this book. All

square\_dots tells whether dots should be square, not rounded;

hefty tells whether weight-reducing strategies should be used;

monospace tells whether the characters should all be forced to have the same width;

hair, vair, stem, curve, ess, flare, dot\_size, bar, slab,

crisp, tiny, fine;

and thin\_join should not be less than fine.

cap\_notch\_cut 46/36 31/36 25/36 24/36 22/36 25/36

eextra\_endchar \leftarrow \text{extra\_endchar} \& "\text{charcode:=charcode+code\_offset;}";

numeric mid\_thickness; mid\_thickness = Vround \frac{1}{3}[vair, stem];
Page E125, line 6 from the bottom

\[ y_1 = \text{top} y_6 = h; \quad z_2 = 0.5[z_3, z_1] + \text{bend}; \]

Page E125, line 3 from the bottom

```
draw z_1 - \text{flourish\_change\{} \{up\} + (0, 1.5\text{asc\_height}) \{up\} \\
\ldots \{\text{right}\}(z_1 + (2u, 0)) \ldots z_6 \ldots \{\text{down}\} z_7; \quad \% \text{upper bar}
```

Page E146, also pages 164 and 540 (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.]

Page E147, line 11 from the bottom

\[ x_0 = x_1 = x_9; \quad lft x_0 r = hround(1.5u - .5\text{hair}); \quad x_2 = x_4 = x_6 = x_8 = 0.5w - .25u; \]

Page E147, line 8 from the bottom

\[ y_5 = 0.5[y_4, y_6]; \quad \text{top} y_6 r - \text{bot} y_4 r = \text{vstem} + \text{eps}; \quad \text{bot} y_8 r = -oo; \quad y_7 = y_1 = 0.55[y_6, y_8]; \]

Page E149, line 8 from the bottom

\[ y_5 + .1x\text{height} = y_7 = 0.5[y_6, y_8]; \quad \text{bot} y_6 r = -oo; \]

Page E161, line 7 from the bottom

\[ \text{top} y_1 r = x\text{height} + oo; \quad y_2 = y_4 = 0.5[y_1, y_3]; \quad \text{bot} y_3 r = -oo; \]

Page E209, line 3

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

Page E377, lines 3 and 4 from the bottom

```
\text{path} p_\ell; \quad p_\ell = z_8@1 \{z_0 - z_8@1\} \ldots \text{darkness}[z_0@1, 0.5[z_0@2, z_8@1]] \ldots z_8@2 \\
\ldots z_8@1 - z_8@1; \quad z_0@0 - z_8@1; \quad \text{-- cycle;}
\text{if} (y_8 > y_1) \neq (\text{ypart precontrol 0 of} p_\ell > y_\text{part postcontrol 0 of} p_\ell); \\
\quad p_\ell = z_8@1 \{z_0 - z_8@1\} \ldots \text{darkness}[z_0@1, 0.5[z_0@2, z_8@1]] \\
\quad \ldots z_8@1 - z_8@1; \quad z_0@0 - z_8@1; \quad \text{-- cycle;} \quad \text{fi}
\text{filldraw} p_\ell; \quad \% \text{arm and beak}
```

Page E379, lines 17 and 18 become one line

```
\text{else}: \quad rt x_6 r = hround(w - 1.5u); \quad y_6 = y_{\text{rd}} + \text{eps}; \quad \text{fi}
```
Page E379, bottom line of the program (01/06/14)

\texttt{math\_fit(0, \pi^{#} - 2.5\mu^{#}; \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 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)

\texttt{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.