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 `\box`n surpass `\dimen`n, when it is

---

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

---

means that 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⟩⟨horizontal skip⟩. Here ⟨horizontal skip⟩ refers to one of the first five glue-appending commands just mentioned; the formal syntax for ⟨leaders⟩

Page A292, line 15 (12/02/02)

are defined as in the second alternative of a ⟨math field⟩, are recorded in a "choice

Page A308, lines 25 and 26 (06/17/02)

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

Page A311, line 14 (12/02/02)

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

Page A311, line 17 (12/29/07)

```
  \leavevmode\copy0\kern-\wd0\makelightbox}
```

Page A318, lines 24 and 25 (10/01/03)

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

Page A364, lines 12–15 from the bottom (02/29/08)

```
\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}
```

Page A364, line 5 from the bottom (02/29/08)

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

Page A373, lines 4 and 5 from the bottom (01/02/14)

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`):

Page A373, line 2 from the bottom (01/02/14)

```
\loop \ifnum\m>0 \t=\expandafter{\the\t*}\advance\m-1 \repeat
```

Page A399, line 18, through what used to be page A400, line 14 (02/26/08)

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 hboxes. Notice how `\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 `\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.

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{}%
```

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\\}
```

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

3. If the current item is a style change, set C to the specified style and move on to the next item.

Page A450, lines 14–16 from the bottom (12/19/02)

$$\texttt{s}_1\texttt{tic }_1\texttt{exp x}_3\texttt{p pi}_3\texttt{a }_2\texttt{i}_1\texttt{a i}_2\texttt{al }_2\texttt{id }_1\texttt{do }_1\texttt{ci }_2\texttt{io ou}_2\ {}_2\texttt{us}$$

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

$$.{}_0\texttt{s}_0\texttt{u}_1\texttt{p}_0\texttt{e}_0\texttt{r}_1\texttt{c}_0\texttt{a}_0\texttt{l}_1\texttt{i}_0\texttt{f}_0\texttt{r}_0\texttt{a}_0\texttt{g}_1\texttt{i}_0\texttt{l}_4\texttt{i}_0\texttt{s}_1\texttt{t}_2\texttt{i}_0\texttt{c}_1\texttt{e}_0\texttt{x}_3\texttt{p}_2\texttt{i}_3\texttt{a}_0\texttt{l}_2\texttt{i}_1\texttt{d}_0\texttt{o}_1\texttt{c}_2\texttt{i}_0\texttt{o}_2\texttt{u}_2\texttt{s}_0.$$

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

Page A459, left column (03/17/06)

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

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

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

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

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

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

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.

Page Bxiii (formerly Bxv), line −7 (12/27/11)

Format specs have no effect on the corresponding Pascal program, but they do influence

Page B2, line 10 from the bottom (01/02/14)

define *banner* ≡ ´This␣is␣TeX,␣Version␣3.14159265´ { printed when TEX starts }

Page B3, new paragraph to follow line 9 (12/20/02)

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.

Page B21, lines 33 and 34 (09/11/07)

[´41 .. ´46, ´60 .. ´71, ´136, ´141 .. ´146, ´160 .. ´171] must be printable. Thus, at least 81 printable characters are needed.

Page B109, line 16 (01/06/14)

begin *print_esc*("csname"); *print_esc*("endcsname"); *print_char*(" "); **end**

Page B114, line 25 (09/11/07)

define *save_index*(#) ≡ *save_stack*[#].*hh*.*rh* { *eqtb* location or token or *save_stack* location }

Page B139, line 20 (12/19/02)

begin while (*state* = *token_list*) ∧ (*loc* = *null*) ∧ (*token_type* ≠ *v_template*) **do**
end_token_list; { conserve stack space }

Page B144, line 14 (09/11/07)

cat: 0 .. *max_char_code*; { *cat_code*(*cur_char*), usually }

Page B153, lines 2 and 3 (09/11/07)

In fact, these three procedures account for almost every use of *get_next*.

Page B161, line 19 (12/19/02)

while (*state* = *token_list*) ∧ (*loc* = *null*) ∧ (*token_type* ≠ *v_template*) **do**
end_token_list; { conserve stack space }

Page B163, line 29 (12/19/02)

long_state ← *call*; *cur_tok* ← *par_token*; *ins_error*; **goto** *continue*;

Page B172, lines 2–6 from the bottom (09/11/07)

else if $m = vmode$ **then** *scanned_result*(*prev_depth*)(*dimen_val*)
  else *scanned_result*(*space_factor*)(*int_val*)

Page B178, line 4 (09/11/07)

cur_val ← 0; *cur_val_level* ← *int_val*; *radix* ← 0; *cur_order* ← *normal*;

Page B184, line 9 from the bottom (04/18/07)

and denominator sum to 32768 or less. According to the definitions here, 2660 dd ≈ 1000.33297 mm;

Page B206, line 14 (10/30/02)

used input files like `webmac.tex`.

Page B206, new paragraph to follow line 22 (12/20/02)

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.

Page B227, new line to precede line 23 (09/11/07)

if $(nw = 0) \vee (nh = 0) \vee (nd = 0) \vee (ni = 0)$ **then** *abort*;

Page B256, line 25 (12/20/02)

  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*);

Page B258, line 5 from the bottom (12/20/02)

begin *g* ← *glue_ptr*(*p*); *rule_wd* ← *width*(*g*) − *cur_g*;

Page B258, bottom line (12/20/02)

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

Page B259, line 4 (12/20/02)

begin *cur_glue* ← *cur_glue* − *shrink*(*g*); *vet_glue*(*float*(*glue_set*(*this_box*)) ∗ *cur_glue*);
cur_g ← *round*(*glue_temp*);

Page B259, new line to precede old line 7 (12/20/02)

rule_wd ← *rule_wd* + *cur_g*;

Page B260, line 21 (12/19/02)

```
    else begin lx ← lr div (lq + 1);
```

Page B261, line 9 (12/20/02)

```
    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);
```

Page B262, line 10 from the bottom (12/20/02)

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

Page B262, line 6 from the bottom (12/20/02)

```
      begin cur_glue ← cur_glue + stretch(g); vet_glue(float(glue_set(this_box)) ∗ cur_glue);
      cur_g ← round(glue_temp);
```

Page B262, line 2 from the bottom (12/20/02)

```
      begin cur_glue ← cur_glue − shrink(g); vet_glue(float(glue_set(this_box)) ∗ cur_glue);
      cur_g ← round(glue_temp);
```

Page B263, new line to precede old line 2 (12/20/02)

```
  rule_ht ← rule_ht + cur_g;
```

Page B264, line 10 (12/19/02)

```
    else begin lx ← lr div (lq + 1);
```

Page B266, line 29 (09/11/07)

total_pages $\geq$ 65536, the `DVI` file will lie. And if *max_push* $\geq$ 65536, the user deserves whatever chaos might ensue.

Page B279, line 19 (09/11/07)

```
    p: pointer;  { a new glue node }
```

Page B288, lines 18–20 (09/11/07)

```
left_noad: begin print_esc("left"); print_delimiter(delimiter(p));
  end;
right_noad: begin print_esc("right"); print_delimiter(delimiter(p));
```

Page B290, line 12 (09/11/07)

```
  begin if s = text_size then print_esc("textfont");
```

Page B299, line 9 (12/20/02)

```
if type(r) = kern_node then    { unneeded italic correction }
```

Page B332, line 6 (12/19/02)

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

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)

$j - i + min\_quarterword$ in their *link* fields. The values of 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 `\parshape` is in

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

```
if count(t) = 1000 then t ← height(r)
else t ← x_over_n(height(r), 1000) * count(t);
print_scaled(t)
```

Page B438, lines 1–3 (09/11/07)

1035. If *link*(*cur_q*) is nonnull when *wrapup* is invoked, *cur_q* points to the list of characters that were consumed while building the ligature character *cur_l*.

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

```
begin if link(cur_q) > null then
  if character(tail) = qi(hyphen_char[main_f]) then ins_disc ← true;
```

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

```
link(tail) ← lig_stack; tail ← lig_stack    { main_loop_lookahead is next }
```

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

```
if main_p > null then tail_append(main_p);    { append a single character }
```

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

```
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 $((cur\_cmd = hskip) \wedge (abs(mode) \neq vmode)) \vee ((cur\_cmd = vskip) \wedge (abs(mode) = vmode))$ **then**

Page B472, new paragraph to follow line 10 (12/20/02)

A devious user might force an *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 $base\_ptr \leftarrow input\_ptr$; $input\_stack[base\_ptr] \leftarrow cur\_input$;
while $(input\_stack[base\_ptr].index\_field \neq v\_template) \wedge$
$(input\_stack[base\_ptr].loc\_field = null) \wedge$
$(input\_stack[base\_ptr].state\_field = token\_list)$ **do** $decr(base\_ptr)$;
if $(input\_stack[base\_ptr].index\_field \neq v\_template) \vee$
$(input\_stack[base\_ptr].loc\_field \neq null) \vee$
$(input\_stack[base\_ptr].state\_field \neq token\_list)$ **then**
$fatal\_error($`(interwoven␣alignment␣preambles␣are␣not␣allowed)`$)$;
if $cur\_group = align\_group$ **then**

Page B505, line 19 (09/11/07)

("since␣the␣result␣is␣out␣of␣range.");
if $p \geq glue\_val$ **then** $delete\_glue\_ref(cur\_val)$;
$error$; **return**;

Page B506, line 1 (10/13/03)

1237. Here we use the fact that the consecutive codes *int_val* .. *mu_val* and *assign_int* ..

Page B520, line 8 (06/25/04)

says, for example, '`(preloaded format=plain 1982.11.19)`', showing the year, month, and day

Page B535, new line to follow line 11 (09/11/07)

if $last\_glue \neq max\_halfword$ **then** $delete\_glue\_ref(last\_glue)$;

Page B578, new entry (06/04/06)

Trabb Pardo, Luis Isidoro, 2.

Page Cxi, line 4 (05/20/07)

Page C11, line 11 (10/11/01)

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)

```
20  penpos1(stem,15); penpos2(.9stem,12); penpos3(stem,10);
```

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

line 12, where it says '`x1l`', not '`x11`' or '`xll`'); be sure to distinguish between

Page C55, lines 5 and 6 (01/05/14)

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

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

⟨path subexpression⟩ ⟶ ⟨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)

Let's conclude this chapter by applying what we've learned about paths to a real-life example. The *Journal of Algorithms* 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 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,

Page C156, line 15 from the bottom (09/09/01)

be the values they had upon entry to the group.)

Page C159, lines 12–15 (12/01/06)

```
def --- = ..tension infinity.. enddef;
```

it makes 'z_1 `---` z_2' become 'z_1 .. tension *infinity* .. z_2'. 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.

Page C171, line 16 from the bottom (06/18/02)

⟨loop⟩ ⟶ ⟨loop header⟩`:`⟨loop text⟩ `endfor`

Page C179, line 7 from the bottom (09/09/01)

next time METAFONT gets to the end of an input line, it will stop reading from the

Page C180, lines 14–16 (04/25/03)

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.

Page C180, new line to be inserted 4 from the bottom (06/25/04)

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

Page C203, line 12 from the bottom (04/25/03)

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

Page C213, line 26 (02/21/08)

⟨path subexpression⟩ ⟶ ⟨path expression not ending with direction specifier⟩

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)

`independent variables` (distinct numeric variables)

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

7.4. False. After '`newinternal x;`' you can't say '`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

Page C250, lines 13 and 14 (02/19/08)

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 `ENDFOR` into the replacement text of `asts`, because

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

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

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

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

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

given angle ϕ. We can consider the common angle θ of $z_{1r} - z_{1l}$ 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, *Philosophia Botanica* (1751)

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

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

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

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

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

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

Page C352, right column (02/29/08)

Linné, Carl von (= Linnæus, 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)

define *banner* ≡ ´This␣is␣METAFONT,␣Version␣2.7182818´ { printed when METAFONT starts }

Page D2, lines 4 and 5 from the bottom (12/23/02)

types; there are no '**var**' parameters, except in the case of files or in the system-dependent *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 **goto**, the statement '**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 **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 $(2^{29} * p + q)$ **div** $(2 * q)$. 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)

if *j_random* = 0 **then** *new_randoms* **else** *decr*(*j_random*)

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

Locations of *mem* between *mem_min* and *mem_top* may be dumped as part of preloaded base

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

define *fi_or_else* = 2 { delimiters for conditionals (**elseif**, **else**, **fi**) }

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

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

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

define *lig_kern_token* = 76 { 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)

METAFONT user assigns a type to a variable like `x20a.b` by saying, for example, '`boolean x[]a.b`'.

Page D102, lines 10–16 (06/25/04)

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).

Page D102, lines 7 and 8 from the bottom (06/25/04)

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 D103, line 6 (06/25/04)

The value of variable `x20b` appears in node *qqq2* = *link*(*qqq1*), as you can well imagine. Similarly, the value of '`x.a`' appears in node *q2* = *link*(*q1*), where *attr_loc*(*q2*) = $h(a)$ and *parent*(*q2*) = *p*.

Page D114, line 12 (06/25/04)

Such save stack entries are generated by **save** commands.

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 θ_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 $x_0 \le x_1$ and $x_2 \le x_3$, and either $x_1 \le x_2$ or $(x_1-x_2)^2 \le (x_1-x_0)(x_3-x_2)$.

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

Page D142, lines 21–23 (06/25/04)

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 $\bar{x}$ to be within ϵ 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, ..., t_m, and if $m \le max\_quarterword$, we have $t_{k-1} \le t_k$ 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) ∧ (*chopped* = 0) **then** *xy_round*;

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

if (*internal*[*autorounding*] > *unity*) ∧ (*chopped* = 0) **then** *diag_round*;

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

if (*internal*[*autorounding*] ≤ 0) ∨ (*chopped* ≠ 0) **then** *print_spec*(`",␣after␣subdivision"`)

Page D185, lines 15–19 (12/21/02)

```
define procrustes(#) ≡ if abs(#) ≥ 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* ← *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 $x'(t) \ge 0$ and regions where $x'(t) \le 0$. 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 $x'(t) \ge 0$ we have *right_type* = *first_octant* or *right_type* = *eighth_octant*; in regions where $x'(t) \le 0$, we have *right_type* = *fifth_octant* or *right_type* = *fourth_octant*.

Page D196, lines 15 and 16 (06/25/04)

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 round(x_0)

Page D200, line 4 (06/25/04)

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.]

Page D212, line 18 (06/25/04)

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

Page D216, bottom line (06/25/04)

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

Page D217, lines 2–10 (06/25/04)

$$w_2\ w_2\ w_2 \ \mapsto\ (-5,6)\ (-5,6)\ (-5,6)$$

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

$$\begin{aligned}
w_2\ w_2\ w_2 &\mapsto (7,-6)\ (7,-6)\ (7,-6) && \text{in the third;}\\
w_2\ w_2\ w_3\ w_3 &\mapsto (-7,1)\ (-7,1)\ (-3,2)\ (-3,2) && \text{in the fourth;}\\
w_3\ w_3\ w_3 &\mapsto (3,-2)\ (3,-2)\ (3,-2) && \text{in the fifth;}\\
w_3\ w_3\ w_0\ w_0 &\mapsto (-3,1)\ (-3,1)\ (1,0)\ (1,0) && \text{in the sixth;}\\
w_0\ w_0\ w_0 &\mapsto (1,0)\ (1,0)\ (1,0) && \text{in the seventh;}\\
w_0\ w_0\ w_0 &\mapsto (-1,1)\ (-1,1)\ (-1,1) && \text{in the eighth.}
\end{aligned}$$

Page D218, lines 2 and 3 (06/25/04)

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

Page D218, line 15 (06/25/04)

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

Page D227, line 11 (06/25/04)

endpoint. The cubics all have monotone-nondecreasing $x(t)$ and $y(t)$.

Page D228, lines 4–7 from the bottom (06/25/04)

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 $0 = s_0 \le s_1 \le \cdots \le s_n = \infty$. 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

Page D231, line 7 (06/25/04)

if $abs(du) \ge abs(dv)$ **then** { $s_{k-1} \le 1$ or $s_k \le 1$ }

Page D231, line 16 (06/25/04)

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

Page D246, line 4 from the bottom (06/25/04)

dinate fields. Hence, for example, the point $\big(x\_coord(p) - left\_v(q), y\_coord(p) + right\_u(p)\big)$ also

Page D248, lines 14 and 15 (01/06/14)

the x-axis at the point $\big((a^2 - b^2)\sin\theta\cos\theta/\rho\big) + i\rho$, 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 $\sigma =$

Page D248, line 24 (06/25/04)

else begin *beta* ← *minor_axis*; *gamma* ← *major_axis*; *theta* ← 0;

Page D251, line 1 (01/06/14)

536. Only the coordinates need to be copied, not the class numbers and other stuff. At this point either $link(p)$ or $link(link(p))$ is *null*.

Page D251, line 10 (01/06/14)

done1: **if** $(link(p) \ne null)$ **then** *free_node*$(link(p), knot\_node\_size)$;
link(p) ← *s*; *beta* ← $-y\_coord(h)$;

Page D256, line 2 from the bottom (06/25/04)

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

Page D261, line 5 (06/25/04)

tol: *integer*; { bound on the uncertainty in the overlap test }

Page D262, lines 26 and 27 (06/25/04)

uv ← *uv* + *int_packets*; { switch from *l_packets* to *r_packets* }
decr(*cur_tt*); *xy* ← *xy* − *int_packets*; { switch from *r_packets* to *l_packets* }

Page D262, line 11 from the bottom (06/25/04)

$xy \leftarrow xy + int\_packets$; { switch from *l_packets* to *r_packets* }

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

```
begin if serial_no > el_gordo − s_scale then
  overflow("independent␣variables", serial_no div s_scale);
type(#) ← independent; serial_no ← serial_no + s_scale; value(#) ← serial_no;
```

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)

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)

cur_type = *unknown_boolean* 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)

cur_type = *unknown_string* 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)

cur_type = *unknown_pen* 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)

cur_type = *unknown_path* 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)

cur_type = *unknown_picture* 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)

cur_type = *token_list* means that *cur_exp* points to a linked list of tokens.

Page D356, lines 2–3 (06/25/04)

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.

Page D368, line 13 (06/25/04)

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

Page D378, line 9 from the bottom (06/25/04)

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

Page D380, line 12 (06/25/04)

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

Page D390, lines 2 and 3 (06/25/04)

by a previous operation. We must maintain the value of *right_type*(*q*) in cases such as '`..{curl2}z{0,0\}..`'.

Page D437, line 1 (06/25/04)

996. And *do_assignment* is similar to *do_equation*:

Page D439, line 10 becomes two lines (06/25/04)

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

Page D443, line 11 (06/25/04)

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

Page D452, line 9 (06/25/04)

though they don't necessarily correspond to primitive tokens.

Page D476, line 12 from the bottom (06/25/04)

if *nl* − *skip_table*[*c*] > 128 **then**

Page D483, line 7 (06/25/04)

max_tfm_dimen ← 16 ∗ *internal*[*design_size*] − 1 − *internal*[*design_size*] **div** *'10000000*;

Page D483, lines 15–17 (06/25/04)

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)

selector ← *old_setting*; *gf_out*(*cur_length*); *gf_string*(0, *make_string*); *decr*(*str_ptr*);

Page D506, lines 8–10 (06/25/04)

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.

Page D514, line 14 from the bottom (06/25/04)

`CMMF`, should also be provided for commonly used bases such as `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)

- *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;

Page E7, line 11 (12/21/02)

hair, *vair*, *stem*, *curve*, *ess*, *flare*, *dot_size*, *bar*, *slab*,

Page E7, line 14 (12/21/02)

crisp, *tiny*, *fine*;

and *thin_join* should not be less than *fine*.

Page E19, line 19 (11/07/01)

cap_notch_cut	46/36	31/36	25/36	24/36	22/36	25/36

Page E41, line 8 (12/21/02)

extra_endchar ← *extra_endchar* & `"charcode:=charcode+code_offset;"`;

Page E53, line 7 (12/21/02)

numeric *mid_thickness*; *mid_thickness* = Vround $\frac{1}{3}$[*vair*, *stem*];

Page E125, line 6 from the bottom (07/10/05)

$top\ y_1 = top\ y_6 = h;\ z_2 = .5[z_3, z_1] + bend;$

Page E125, line 3 from the bottom (07/10/05)

draw $z_1 - flourish\_change\{up\} + (0, .15asc\_height)\{up\}$
$\ldots\ \{right\}(z_1 + (2u, 0))$ --- $z_6\ \ldots\ \{down\}z_7;$ % 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 (04/23/04)

$x_0 = x_1 = x_9;\ lft\ x_{0r} = \text{hround}(1.5u - .5hair);\ x_2 = x_4 = x_6 = x_8 = .5w - .25u;$

Page E147, line 8 from the bottom (04/23/04)

$y_5 = .5[y_4, y_6];\ top\ y_{6r} - bot\ y_{4r} = vstem + eps;\ bot\ y_{8r} = -oo;\ y_7 = y_9 = .55[y_6, y_8];$

Page E149, line 8 from the bottom (04/23/04)

$y_5 + .1x\_height = y_7 = .5[y_6, y_8];\ bot\ y_{6r} = -oo;$

Page E157, line 11 (02/29/08)

filldraw z_{1l} -- $z_{2l}\ \ldots\ (x_3, y_{2l})\ \ldots\ z$ -- z_{1r} -- cycle; % stem

Page E161, line 7 from the bottom (04/23/04)

$top\ y_{1r} = x\_height + oo;\ y_2 = y_4 = .5[y_1, y_3];\ bot\ y_{3r} = -oo;$

Page E209, line 3 (12/29/04)

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

Page E377, lines 3 and 4 from the bottom (12/22/02)

path p_-; $p_- = z_{\$\$l}\{z_{@1} - z_{\$\$l}\}\ \ldots\ darkness[z_{@1}, .5[z_{@2}, z_{\$\$l}]]\ \ldots\ z_{@2}$
--- $z_{\$l}$ -- $z_{\$r}$ -- $z_{@0}$ -- $z_{\$\$r}$ -- cycle;
if $(y_{\$\$} > y_{\$}) \neq (\text{ypart } \textbf{precontrol}\ 1\ \textbf{of}\ p_- > \text{ypart } \textbf{postcontrol}\ 1\ \textbf{of}\ p_-)$:
$p_- = z_{\$\$l}\{z_{@1} - z_{\$\$l}\}\ \ldots\ darkness[z_{@1}, .5[z_{@2}, z_{\$\$l}]]$
--- $z_{\$l}$ -- $z_{\$r}$ -- $z_{@0}$ -- $z_{\$\$r}$ -- cycle; **fi**
filldraw p_-; % arm and beak

Page E379, lines 17 and 18 become one line (01/06/14)

else: $rt\ x_{6r} = \text{hround}(w - 1.5u);\ y_6 = y_{5l} + eps;$ **fi**

Page E379, bottom line of the program (01/06/14)

math_fit$(0, ic^{\#} - 2.5u^{\#})$; **penlabels**$(0, 1, 2, 3, 4, 5, 6, 7)$; **endchar**;

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

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 `cmbase` is probably the *pos*

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

quantities needed in the `calu` programs are also established at this time.

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

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