badness **1**

`badness.` The *badness* of a line is a measure of how far the interword spaces in the line deviate from their natural values, i.e., the values specified in the fonts used in the line. The greater the deviation, the greater the badness. Similarly, the badness of a page is a measure of how far the spaces between the boxes that make up the page deviate from their ideal values. (Ordinarily, most of these boxes are single lines of paragraphs.)

More precisely, the badness is a measure of how much the glue associated with these spaces needs to stretch or shrink to fill the line or page exactly. TEX computes the badness as approximately 100 times the cube of the ratio by which it must stretch or shrink the glue in order to compose a line or a page of the required size. For example, stretching the glue by twice its stated stretch yields a ratio of 2 and a badness of 800; stretching it by half its stated stretch yields a ratio of .5 and a badness of 13. TEX treats a badness greater than 10000 as equal to 10000.

TEX uses the badness of a line when it's breaking a paragraph into lines (see "line break", p. '`line+break`'). It uses this information in two stages:

1) When TEX is choosing line breaks, it will eventually accept lines whose badness is less than or equal to the value of `\tolerance` (p. '`\tolerance`'). If TEX cannot avoid setting a line whose badness exceeds this value, it will set it as an underfull or overfull hbox. TEX will set an overfull or underfull hbox only as a last resort, i.e., only if there's no other way to break the paragraph into lines.
2) Assuming that all lines are tolerably bad, TEX uses the badness of lines in order to evaluate the different ways of breaking the paragraph into lines. During this evaluation it associates "demerits" with each potential line. The badness increases the number of demerits. TEX then breaks the paragraph into lines in a way that minimizes the total demerits for the paragraph. Most often TEX arranges the paragraph in a way that minimizes the badness of the worst line. See pages 97–98 of *The TEXbook* for the details of how TEX breaks a paragraph into lines.

TEX's procedure for assembling a sequence of lines and other vertical mode material into pages is similar to its procedure for line breaking. However, assembling pages is not as complicated because TEX only considers one page at a time when it looks for page breaks. Thus the only decision it must make is where to end the current page. In contrast, when TEX is choosing line breaks it considers several of them simultaneously. (Most word processors choose line breaks one at a time, and thus don't do as good a job at it as TEX does.) See pages 111–113 of *The TEXbook* for the details of how TEX chooses its page breaks.