TEX – visual matters

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Notes for CS 594 – Fall 2004

Paragraphs

Paragraph start

- Paragraph starts triggered by text, math, certain commands
- Vertical space added: `\parskip`; horizontal indentation: `\parindent`
- Also inserted `\everypar` token list

```
\everypar{\onebold} \def\onebold#1{\textbf{#1}}
First paragraph\par Second one\par
```

Output:

F*irst paragraph*
S*econd one*

```
\newcounter{vcount}
\def\Header#1{\medskip
  \hbox{\bfseries #1}
  \setcounter{vcount}{1}
  \everypar{\arabic{vcount}\stepcounter{vcount}\ }
  }

\Header{The Title}

One line of text that is long enough to wrap as a paragraph
that is long enough to wrap as a paragraph

two lines of text that are long enough to wrap as a paragraph
that is long enough to wrap as a paragraph

more lines of text that are long enough to wrap as a paragraph
that is long enough to wrap as a paragraph
```

Output:

The Title
1 One line of text that is long enough to wrap as a paragraph that is long enough to wrap as a paragraph
2 two lines of text that are long enough to wrap as a paragraph that is long enough to wrap as a paragraph
3 more lines of text that are long enough to wrap as a paragraph that is long enough to wrap as a paragraph

Paragraph end

- Paragraph ends because of `\par` (empty line), display math, other vertical commands
- End of paragraph:
  `\unskip\penalty10000\hskip\parfillskip`

  `\parfillskip=0pt`
  `lots of lots of lots of lots of lots of lots of lots of text`

  Output:

  lots of lots of lots of lots of lots of lots of lots of text
- Normal `\parfillskip` is `0pt plus 1fil`

```
\renewenvironment{proof}
  {Proof.\ }
  {\hfill$\bullet$\par}
\begin{proof}
This is a long long long long long long long
long long long proof
\end{proof}
```

Output:

Proof. *This is a long long long long long long long long long long proof* •

Paragraph shape

```
\begin{minipage}{2in}
\parindent=0pt \hangindent=15pt \hangafter=-3
This paragraph has several lines of text
so that it can show off the ‘hanging indentation’
of \TeX, which can be used for all sorts of purposes.
\end{minipage}
```

Output:

This paragraph has several lines of text so that it can show off the ‘hanging indentation’ of TEX, which can be used for all sorts of purposes.

Margin parameters

- `\leftskip`, `\rightskip` at the margins
- `\parindent` start of first line
- `\parfillskip` end of last
- `\hangindent` extra shift
- `\parshape`

Margin tricks

```
\leftskip=0cm plus 0.5fil \rightskip=0cm plus -0.5fil
\parfillskip=0cm plus 1fil
This style of paragraph setting is rather old fashioned,
typically used for the last paragraph of a chapter.
```

Output:

This style of paragraph setting is rather old fashioned, typically used for the last paragraph of a chapter.

Line breaking

- Global minimization of 'badness' from glue setting and other penalties
- Badness from glue setting: Line is 'decent' is less than half the stretch or shrink is used; 'loose' and 'tight' if more than used; 'very loose' if more than the stretch is used. Add `\adjdemerits` if adjacent line not of same or adjacent classification
- also `\doublehyphendemerits`, `\finalhyphendemerits`

- First pass: without hyphenation; maximum badness `\pretolerance`
- Second pass: with hyphenation; maximum allowed is `\tolerance`
- Third pass: add `\emergencystretch`

Line break problems

```
\tolerance500 \emergencystretch=0pt
Paragraphs with words such as the German ‘Weltschmerz’
can be hard to set, even if
anti-disestablishmentarianism comes into play.
Other topics can also give
superduperhyperbig problems. As you can see.
```

Output:

> *Paragraphs with words such as the German ‘Weltschmerz’ can be hard to set, even if anti-disestablishmentarianism comes into play. Other topics can also give superduperhyperbig problems. As you can see.*

```
\tolerance500 \emergencystretch=20pt
Paragraphs with words such as the German ‘Weltschmerz’
can be hard to set, even if
anti-disestablishmentarianism comes into play.
Other topics can also give
superduperhyperbig problems. As you can see.
```

Output:

> *Paragraphs with words such as the German ‘Weltschmerz’ can be hard to set, even if anti-disestablishmentarianism comes into play. Other topics can also give superduperhyperbig problems. As you can see.*

Boxes

Horizontal Boxes

Horizontal: `\hbox`

```
A \raise 2pt \hbox{B c d E} F
\lower -7pt \hbox{G} H
```

Output:

$$A\ B\ c\ d\ E\ F\ ^{G}\ H$$

Tight fit: one line.

Vertical boxes

Vertical: \vbox, \vtop

```
A \vbox{\hsize=3cm Lots of text, organised in one paragraph
And one paragraph more, with lots of text text text}
B C \vtop{\hsize=3cm Lots of text in one paragraph.}
D E
```

Output:

Lots of text, organised in one paragraph.
And one paragraph more, with lots of
A text text text *B C Lots of text in one D*
paragraph.
E

Acts like normal text, page width

Boxes and skips

```
A \hbox{B\hskip 1cm} C D \hbox{\hskip-5mm E F\hskip 3mm} G
```

Output:

```
A \hbox to 20pt{B\hfill} C D \hbox to 0pt{E F\hss}G H
```

Output:

Modes

Horizontal mode

- Starts with letter, math, commands like `\hskip`
- Material lines up horizontally
- Inner horizontal mode: inside `\hbox` – one line, no paragraph building.
- Example

  ```
  A \hbox{b} \raise 2pt \vbox{\hsize=20pt c} d
  ```

  Output:

  $A\ b^{c}\quad d$

Vertical mode

- After paragraph, display math, vertical commands like `\vskip`
- Material stacked vertically
- Inner vertical mode: inside `\vbox` – this *does* build paragraphs
- Example

```
A b

\hbox{b} c d
```

Output:

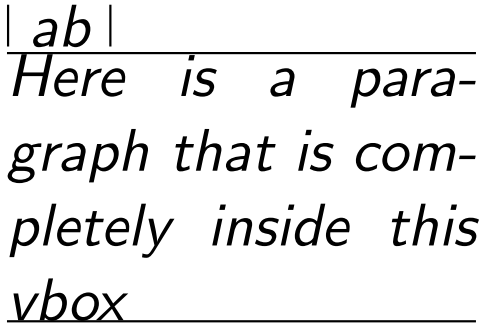
A b
b
c d

Rules

- `\hrule` is vertical command, `\vrule` horizontal
- rules extend to fill surrounding box

```
\par
\hbox{\vrule\ ab\ \vrule}
\vbox{\hsize=3cm \hrule
  Here is a paragraph that is completely
  inside this vbox \hrule}
```

Output:



- Horizontal lines in horizontal mode are a bit more tricky

Math

Math styles

- Styles: display, text, script, scripscript

```
\[ {\displaystyle\sum_i^\infty 1/i},\qquad
          {\textstyle\sum_i^\infty 1/i} \]
\[ x^{x^x}, {\textstyle x},{\scriptstyle x},
           {\scriptscriptstyle x} \]
```

Output:

$$\sum_{i}^{\infty} 1/i, \qquad \textstyle\sum_i^\infty 1/i$$

$$x^{x^x}, x, \scriptstyle x, \scriptscriptstyle x$$

- Display math starts in display style, inline math in text style

Math character codes

- \mathcode $n =$ "xyzz: class, font position
- \delcode $n =$ "uvvxyy: two font positions, small and large
- \mathaccent $n <$ expr $>$
- \mathchardef \sum $=$ "1350

Math spacing

- Spaces are ignored, any spacing inserted automatically
- Three sizes of spaces: thick, med, thin

```
$a=b$ vs $a{=}b$\par % thick
$a+b$ vs $a{+}b$\par % med
$a,b$ vs $a{,}b$
```

Output:

$a = b$ *vs* $a{=}b$
$a + b$ *vs* $a{+}b$
a, b *vs* $a{,}b$

Math object classes

- Spacing depends on function of an object ('class')
- Binary operators: `$x\mathrm{e}y$` is '$x\mathrm{e}y$'
  `$x\mathbin{\mathrm{e}}y$` is '$x\,\mathrm{e}\,y$'
- Similar: `\mathop` for large operators, `\mathrel` for binary relations (equals &c); `\mathopen`, `\mathclose`, `\mathord`, `\mathpunct`

Output

Vertical list

- Objects are added to vertical list: lines from paragraph, display math
- Various penalties: `\abovedisplaypenalty`, `\widowpenalty`
- Page breaking algorithm minimizes balance of penalties and stretch/shrink

Output routine

```
\output={
  \setbox255=\vbox
     {\headline \box255 \footline}
  \shipout\box255
}
```

Marks

- Remember `\markright` and `\markboth` in LaTeX.
- Basic: `\mark` in TeX
- During output: `\firstmark` is first mark on this page
  `\botmark` is last mark on this page
  `\topmark` is last mark of previous page
- If no marks on this page, all three equal to `\botmark` of last page