Hour 17

Miscellaneous I

Previous Hours were devoted on various issues related to the preparation of a general document. This Hour discusses about some special effects that can be produced in a document, such as important notes and equations in boxes, geometric transformation, etc.

17.1 Boxed Items

Important pieces of information can be produced in different types of boxes in order to make them prominent, which are discussed in this section.

17.1.1 Texts in Plain Boxes

Various commands for printing a single-line texts in a box include **\frame{}**, **\framebox{}**, **\fbox{}**, **\doublebox{}**, **\ovalbox{}**, **\Ovalbox{}**, **\shadowbox{}**, **\shabox{}**, etc. Details of these commands are shown in Table 17.1 on the next page, in which the types of boxes produced under different commands may be noticed. The commands of Table 17.1 can be used in running texts, e.g., **\fbox**`{boxed note}` prints boxed note in this line.

The width of lines and space for starting contents in the boxes produced by the commands of Table 17.1 (excluding **\frame{}** and **\shabox{}**) can be controlled by the **\fboxrule{}** and **\fboxsep{}** commands, e.g., **\setlength{\fboxrule}{**`2`**pt}** for producing a box of line width of 2 pt (default is 0.4 pt) and **\setlength{\fboxsep}{**`5`**pt}** for printing the contents at a distance of 5 pt (default is 3 pt) from all the lines of a box. Further, the commands of Table 17.1 can be nested for a combined effect, e.g., **\fbox{\fbox{**`double boxes`**}}** for producing double boxes.

D. Datta, *LaTeX in 24 Hours: A Practical Guide for Scientific Writing*,
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Table 17.1 Single-line texts in boxes

Command	Package	LaTeX input	Output
\frame{}	–	\frame{A single-line box}	A single-line box
\framebox{}	–	\framebox{A single-line box}	A single-line box
\fbox{}	–	\fbox{A single-line box}	A single-line box
\doublebox{}	fancybox	\doublebox{A double-line box}	A double-line box
\ovalbox{}	fancybox	\ovalbox{An oval box}	An oval box
\Ovalbox{}	fancybox	\Ovalbox{A thick oval box}	A thick oval box
\shadowbox{}	fancybox	\shadowbox{A shaded box}	A shaded box
\shabox{}	shadow	\shabox{A big shaded box}	A big shaded box

Note that the arguments of the commands of Table 17.1 are printed in LR-mode (from left to right) in a single line, and the length of a box is calculated automatically according to the size of the argument of a command. If a box of a user-specified length or different alignments of the argument are required, the \framebox{} command may be used with two optional arguments, i.e., as \framebox[alen][algn]{acont}, where acont is the contents to be printed with algn alignment in the box of length alen. The available alignment options are l, c, r, and s, applied respectively for left-aligned, centered (default), right-aligned, and stretching full length of the box. For example, \framebox[8cm][r]{Box of user-defined length and alignment} will print Box of user-defined length and alignment. Similar to \framebox[][]{}, the \makebox[alen][algn]{acont} command may also be used, in which however the box remains invisible. In a special application, particularly in the picture environment (refer §10.5 on page 97 for detail), \makebox[][]{} may be applied with zero length for printing texts in a particular position. The command may also be used for printing overlapping texts, e.g., '\makebox[0mm][l]{-----}CUT' will print 'CUT', or \makebox[0mm][l]{/}L will produce Ł.

17.1.2 Texts in Color Boxes

The \colorbox{bcol}{atext} and \fcolorbox{brcol}{bcol}{atext} commands are defined in the color package for printing texts in colored boxes, where atext is the texts to be produced in the box, bcol is the background color of the box and brcol is the border color of the box. For example, \colorbox{black}{\textcolor{white}{White texts in black box}} and

`\fcolorbox{red}{black}{\textcolor{white}{White texts in black box with red border}}` will produce, respectively, White texts in black box and White texts in black box with red border.

The **color** package provides the `\pagecolor{}` command also (e.g., `\pagecolor{green}`), which changes the background color of all the remaining pages of a document starting from the current page.

17.1.3 Mathematical Expressions in Boxes

The direct command for producing mathematical expressions in boxes is `\boxed{}` defined in the **amsmath** package, whose argument is processed in math-mode as shown in the first example in Table 17.2. The commands of Table 17.1, as well as

Table 17.2 Equations in boxes

LaTeX input	Output
`\boxed{x^2 + y^2 = r^2}`	$x^2 + y^2 = r^2$
`\shabox{$x^2 + y^2 = r^2$}`	$x^2 + y^2 = r^2$

`\begin{equation}`
`\boxed{x^2 + y^2 = r^2}`
`\end{equation}`
	$x^2 + y^2 = r^2$ (17.1)

`\begin{equation}`
`\shabox{$x^2 + y^2 = r^2$}`
`\label{eq_in_box}`
`\end{equation}`
	$x^2 + y^2 = r^2$ (17.2)

`\colorbox{}{}` and `\fcolorbox{}{}{}`, can also be used for producing mathematical expressions in boxes. However, since the arguments of these commands are processed in text-mode, a mathematical expression is to be inserted in an inline math-mode (refer §11.3 on page 104 for detail), say in a pair of `$` as shown in the second example in Table 17.2 for producing an equation through `\shabox{}`. If the equation in a box is to be numbered (which can be referred also through a reference key), the `\boxed{}` or `\shabox{}` command may be put in the **equation** environment as shown in the third and fourth examples in Table 17.2.

17.1.4 Paragraphs in Boxes*

One drawback with the commands of Table 17.1 is that the entire argument of a command is printed in a single line without any line break, even continuing beyond

the width of a page. A new line or a line break command (**\newline** or ****) is also not accepted by these commands. Hence, a long piece of texts may be produced through the **\parbox[**`valgn`**]{**`ahorz`**}{**`atext`**}** command, which prints `atext` in an invisible box of `ahorz` length with optional `valgn` for vertical alignment, with proper line breaking if required. The permitted vertical alignments of the box of **\parbox[]{}{}** include **t** for top alignment, **c** (default) for centered, and **b** for bottom alignment. In order to produce a visible box, **\parbox[]{}{}** may be put in a command given in Table 17.1.

Some applications of **\parbox[]{}{}** are shown in Table 17.3. Note that, if `ahorz` is not sufficient to hold a word, it may go even beyond the box produced by **\parbox[]{}{}**, which is demonstrated in the first example in Table 17.3. Hence, as shown in the second example, **\hspace{**`0`**pt}** is used before `atext` for automatic hyphenation of a long word to accommodate it within the box. The third example in Table 17.3 shows how a long `atext` is produced in a full-justified paragraph with automatic line break, while the fourth example shows that the manually set line break command '****' is also accepted by **\parbox[]{}{}**. Further, the optional vertical alignment of a box produced by **\parbox[]{}{}** may also be noticed in the third and fourth examples in Table 17.3 (top aligned in the third example and centered in the fourth example).

Table 17.3 Paragraphs in boxes through the **\parbox[]{}{}** command

LaTeX input	Output
\fbox{\parbox{`17`**mm}{**`Characteristics`**}}**	Characteristics
\fbox{\parbox{`17`**mm}{\hspace{**`0`**pt}**`Characteristics`**}}**	Character-istics
`See it` **\fbox{\parbox[t]{**`2.8`**cm}{\hspace{**`0`**pt}** `Characteristics may be studied in a systematic way.`**}}** `carefully.`	See it Characteristics may be studied in a systematic way. carefully.
`See it` **\fbox{\parbox[c]{**`2.8`**cm}{\hspace{**`0`**pt}** `Characteristics may be studied in a` **** `systematic way.`**}}** `carefully.`	See it Characteristics may be studied in a systematic way. carefully.

17.1.5 Set of Items in a Box

It is discussed in §17.1.4 how a long item in a box can be printed in multiple lines in the form of a paragraph with automatic line breaking. However, that process cannot be applied conveniently for printing a set of items in a single box, like an array of equations or some pointed items. The simplest process for such a requirement is to use the **boxedminipage** environment defined in the **boxedminipage** package. It is similar with the **minipage** environment (refer §4.4 on page 31 for detail), with the only difference that the mini page under the **boxedminipage** environment is enclosed in a box.

Moreover, the commands of Table 17.1 accept some environments in their arguments, which also facilitate to print different items in individual lines in a single box.

Table 17.4 Array of equations in a box through the **tabular** environment in **\shabox{}**

LaTeX input	Output

\begin{equation}
\shabox{
\begin{tabular}{l}
$s = vt$\\
$v = v_0 + at$\\
$v^2 = v_0^2+ 2as$
\end{tabular}
}
\end{equation}
	$s = vt$
	$v = v_0 + at$
	$v^2 = v_0^2 + 2as$ (17.3)

Table 17.4 shows an array of equations produced through a single-column **tabular** environment as the argument of **\shabox{}**, which is put in the **equation** environment for assigning a serial number to the equations.

If the array of equations of Table 17.4 are to be aligned or numbered individually, the **Beqnarray** environment, defined in the **fancybox** package, may be used instead of the **tabular** environment. The **Beqnarray** is a math-mode environment and it is similar with the **eqnarray** environment, the only difference is that the former can be used as the argument of a command of Table 17.1 for producing an array of equations in a box. An application of the **Beqnarray** environment is shown in Table 17.5, where it is

Table 17.5 Array of equations in a box through the **Beqnarray** environment in **\shabox{}**

LaTeX input	Output

\shabox{
\begin{Beqnarray}
s &=& vt \\
v &=& v_0 + at \\
v^2 &=& v_0^2+ 2as
\end{Beqnarray}
}
	$s = vt$ (17.4)
	$v = v_0 + at$ (17.5)
	$v^2 = v_0^2 + 2as$ (17.6)

applied as the argument of **\shabox{}**. On the other hand, if none of the equations is to be numbered, the **Beqnarray** environment may be replaced by the **Beqnarray*** environment.

The **fancybox** package defines some more environments, such as **Bcenter**, **Bflushleft**, **Bflushright**, **Benumerate**, **Bitemize**, and **Bdescription**. The **Bcenter**, **Bflushleft**, and **Bflushright** environments are similar with the **center**, **flushleft**, and **flushright** environments (refer §3.3 on page 18 for detail), which are used for making a paragraph center-aligned, left-aligned, and right-aligned, respectively. On the other hand, the **Benumerate**, **Bitemize**, and **Bdescription** are similar, respectively, with the **enumerate**, **itemize**, and **description** environments (refer §6.1 on page 49 for detail), which are used for producing different listed items. The main advantage of these environments of the **fancybox** package is that they can be used in a box producing command for printing their contents in a box. However, they suffer from a drawback also, that they do not have any automatic line braking facility, for which a line may continue even beyond the margin of a page. To be within the page margin, a line

break is to be provided manually. As an example, Table 17.6 shows the use of the **Bitemize** environment in **\shabox{}**.

Table 17.6 Unnumbered list in a box through the **Bitemize** environment in **\shabox{}**

LaTeX input	Output

\shabox{
\begin{Bitemize}
\item Beqnarray produces an array of\\
equations, similar to the\\
eqnarray environment.
\item Benumerate, Bitemize and\\
Bdescription produce different\\
types of listed items, similar to\\
the enumerate, itemize and\\
description environments respectively.
\item Bcenter, Bflushleft and Bflushright\\
make a paragraph center-aligned,\\
left-aligned and right-aligned\\
respectively, similar to the center,\\
flushleft and flushright environments.
\end{Bitemize}
}
	• Beqnarray produces an array of equations, similar to the eqnarray environment.
	• Benumerate, Bitemize and Bdescription produce different types of listed items, similar to the enumerate, itemize and description environments respectively.
	• Bcenter, Bflushleft and Bflushright make a paragraph center-aligned, left-aligned and right-aligned respectively, similar to the center, flushleft and flushright environments.

17.2 Rotated Items*

It is discussed in §7.4 on page 62 that a piece of texts or a table can be rotated by 90° in the counter-clockwise direction through the **sideways** environment. In a general case, the **rotate** environment, defined in the **rotating** package, can be used for rotating the contents of the environment by any amount specified as its mandatory argument in the form **\begin{rotate}**{`adeg`}, where `adeg` is the angle (in degree) by which the content is to be rotated (the **sideways** environment is a special case of the **rotate** environment for rotating by 90°). A positive value of `adeg` rotates the contents in the counter-clockwise direction, while a negative value rotates in the clockwise direction. Some applications of the **rotate** environment are given in Table 17.7.

Table 17.7 Rotated items through the **rotate** environment

LaTeX input	Output
\begin{rotate}{30} Rotated by 30 degree. \end{rotate}	Rotated by 30 degree.
\begin{rotate}{-20} \fbox{Rotated by -20 degree.} \end{rotate}	Rotated by -20 degree.
The item rotated through the rotate environment … Such an example is shown here, \begin{rotate}{30} \fbox{\bf Rotated item.} \end{rotate}, which got overlapped with some lines.	The item rotated through the rotate environment has the drawback that it may overlap with the contents of a document. Such an example is shown here, Rotated item. which got overlapped with some lines.

An item rotated by the **rotate** environment can easily be put in a box using any command of Table 17.1, which is demonstrated in the second example in Table 17.7. As shown in the third example in Table 17.7, however, the **rotate** environment suffers from the drawback that a rotated item may get overlapped with other contents of a document. To avoid this drawback, an item may be rotated though the **turn** environment, instead of the **rotate** environment.

The **turn** environment, which is also defined in the **rotating** package, works exactly in the same way with that of the **rotate** environment, but prints its contents in a separate space without any overlapping. Some applications of the **turn** environment are given in Table 17.8. As in the case of the **rotate** environment, the contents of the **turn** environment also can be printed in a box as shown in the second and third examples in Table 17.8. Further, notice in these two examples that a rotated item can also be put in **\parbox[]{}{}** for printing it in the form of a paragraph with automatic line breaking. The effects of the optional vertical alignment of **\parbox[]{}{}** may also be noticed in these two examples (refer §17.1.4 for detail).

Table 17.8 Rotated items through the **turn** environment

LaTeX input	Output

`As shown with the help of an example here,`
`\begin{turn}{30}`
`  Rotated item.`
`\end{turn},`
`the turn environment prints its contents without any overlapping.`
	As shown with the help of an example here, Rotated item. , the turn environment prints its contents without any overlapping.

`A long rotated item is printed in this example`
`\begin{turn}{30}`
`\fbox{\parbox[t]{2cm}{It is rotated by 30 degree.}}`
`\end{turn}`
`in multiple lines with automatic line breaking.`
	A long rotated item is printed in this example It is rotated by 30 degree. in multiple lines with automatic line breaking.

`A long rotated item is printed here`
`\begin{turn}{30}`
`\fbox{\parbox[b]{2cm}{It is rotated by 30 degree.}}`
`\end{turn}`
`in multiple lines with automatic line breaking.`
	A long rotated item is printed in this example It is rotated by 30 degree. in multiple lines with automatic line breaking.

17.3 Items at Different Levels and Forms*

Observe the word 'LaTeX', produced by the **\LaTeX** command, whose letters are printed in different heights, sizes, and spacing. Such patterns can be obtained through the **\raisebox{}[][]{}** command, in the form of

`\raisebox{ahgt}[atop][abot]{atext}` for raising (printing) `atext` at a height of `ahgt` from the current line (a negative value of `ahgt` will lower it) with optional `atop` and `abot` to create space, respectively, above and below the line for printing `atext` (`atop` is required while raising `atext`, and `abot` is required while lowering it).

Table 17.9 shows some applications of `\raisebox{}[][]{}`. In the first example, two words are raised at a height of 1 ex, which is accommodated with an optional vertical space of 3.5 ex above the line. Similarly, two words in the second example are lowered by 1 ex (i.e., raised at a height of -1 ex), which is accommodated with an optional vertical space of 2.5 ex below the line. Note that the first optional argument to `\raisebox{}[][]{}` (used to create a vertical space above the line) is also required in the second example, without which the second optional argument (used to create a vertical space below the line) will be treated as the first optional argument. However, since no extra vertical space above the line is required in this example, the first optional argument to `\raisebox{}[][]{}` is assigned the value of 0 ex. The third example in Table 17.9 is slightly different. No optional argument is used in `\raisebox{}[][]{}`, but the space between two letters is reduced through a negative value to `\hspace{}`. In the fourth example, on the other hand, not only the space between two letters is reduced, the vowels are printed in a smaller size. If a form like the ones shown in the third and fourth examples in Table 17.9 is to be used repeatedly, a shorter

Table 17.9 Texts at different levels and forms through the `\raisebox{}[][]{}` command

LaTeX input	Output
`Placement of two words may be seen here \raisebox{1ex}[3.5ex]{\bf Raised texts} raised with some vertical space above the line.`	Placement of two words may be seen here **Raised texts** raised with some vertical space above the line.
`Placement of two words may be seen here \raisebox{-1ex}[0ex][2.5ex]{\bf Lowered texts} lowered with some vertical space below the line.`	Placement of two words may be seen here **Lowered texts** lowered with some vertical space below the line.
`W\hspace{-0.2em}\raisebox{0.4ex}{A}\hspace{-0.2em}% V\hspace{-0.15em}\raisebox{0.4ex}{E}`	WAVE
`{\LARGE\bf\sim% D\hspace{-0.05em}\raisebox{0.55ex}{\large I}L% \hspace{-0.19em}\raisebox{0.55ex}{\large I}P\sim% D\hspace{-0.1em}\raisebox{0.15ex}{\large A}% \hspace{-0.15em}T\hspace{-0.13em}T% \hspace{-0.15em}\raisebox{0.15ex}{\large A}% }`	DILIP DATTA

new command may be defined (in the preamble) instead of using a long expression every time, e.g., '`\newcommand{\wave}{\mbox{W\hspace{-0.2em}\raisebox{0.4ex}{A}\hspace{-0.2em}V\hspace{-0.15em}\raisebox{0.4ex}{E}}}`' to print WAVE using `\wave`. Note that the entire second argument of `\newcommand{}{}` is put here in `\mbox{}` in order to print WAVE without breaking or hyphening in between, as well as to make its effect local without affecting the remaining contents of a document.

17.4 Geometric Transformation of Items*

The **graphics** package has the provision for geometric transformations of texts and figures, such as scaling, rotation, and reflection. There are two commands for scaling, `\scalebox{}[]{}` and `\resizebox{}{}{}`. The `\scalebox{hsc}[vsc]{atext}` command scales `atext` in the horizontal direction by `hsc`, and also optionally in the vertical direction by `vsc` (`hsc` and `vsc` take numerical values only), while `\resizebox{hlen}{vlen}{atext}` prints `atext` in a horizontal length of `hlen` and a vertical height of `vlen` (`hlen` and `vlen` take values in units of length). The `\resizebox{hlen}{vlen}{atext}` command will print `atext` in proportion to `hlen` if the `!` symbol is used in place of `vlen`, while in proportion of `vlen` if `!` is used in place of `hlen`. On the other hand, the `\rotatebox{deg}{atext}` command rotates `atext` by an angle of `deg` in degree (a positive value of `deg` rotates `atext` in the counter-clockwise direction and a negative value in the clockwise direction), while the `\reflectbox{atext}` command reflects `atext` about a direction perpendicular to it.

Some geometric transformations made through the above four commands are shown in Table 17.10. Note that the commands can also be used in a combination for multiple transformations, like `\rotatebox{}{\scalebox{}[]{}}`, `\reflectbox{\rotatebox{}{}}`, and `\reflectbox{\rotatebox{}{\scalebox{}[]{}}}` as shown in examples 6–8 in Table 17.10.

Table 17.10 Geometric transformation of texts

#	LaTeX input	Output
1	`\scalebox{0.8}[2]{Scale} / \scalebox{2}[0.8]{Scale}`	Scale / Scale
2	`\resizebox{7mm}{6mm}{\bf Raise} / \resizebox{4cm}{4mm}{\bf Raise}`	Raise / Raise
3	`\resizebox{5mm}{!}{\bf Raise} / \resizebox{!}{5mm}{\bf Raise}`	Raise / Raise
4	`\rotatebox{30}{Rotate}`	Rotate
5	`\reflectbox{\bf Reflect}`	Reflect
6	`\rotatebox{20}{\scalebox{2}[0.8]{Rot.\ scale}}`	Rot. scale
7	`\reflectbox{\rotatebox{-30}{\bf Refl.\ rotate}}`	Refl. rotate
8	`\reflectbox{\rotatebox{-15}{% \scalebox{2}[0.8]{Refl.\ rot.\ scale}}}`	Refl. rot. scale
9	`{\LARGE\bf~% D\hspace{-0.07em}\raisebox{0.55ex}{\resizebox% {2.5mm}{3mm}{I}}\hspace{-0.05em}L\hspace% {-0.26em}\raisebox{0.55ex}{\resizebox{2.5mm}% {3mm}{I}}\hspace{-0.06em}P~D\hspace{-0.16em}% \raisebox{0.15ex}{\resizebox{6mm}{2.5mm}{A}}% \hspace{-0.29em}T\hspace{-0.13em}T\hspace% {-0.29em}\raisebox{0.15ex}{\resizebox{6mm}% {2.5mm}{A}} }`	DILIP DATTA

The last example in Table 17.10 is a more complex one. It combines the transformation command **\resizebox{}{}{}** with the raising command **\raisebox{}[][]{}** (refer §17.3 for detail) for printing characters in different levels and scales. Moreover, **\hspace{}** is used to adjust the space between two characters.