Table Diversions*

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Abstract

Characteristics of existing table macro collections are given. A kaleidoscope of tables—as next best to a taxonomy—is presented. Newly introduced is the class of bordered tables. Variations in print—ruled, nonruled, framed, nonframed, dotted, centered, flushed—can be obtained via the invoke of parameter setting macros; no modification of user mark up. Simultaneous row and column spans, partial rules, and dotted lines are dealt with. The listing of the macro `\btable`, with auxiliaries, is included.

Keywords: (Bordered) Tables, framed and non-framed, ruled and non-ruled, simultaneous row and columns spans, partial rules, connected cells, plain TEX, SGML, education.

1 Introduction

The formatting of tables is considered complex, time consuming and expensive. Table making via TEX, or LATEX, needs too complex descriptions for simple tables, except when the table can be formatted via `\settabs`. For `\halign` use, there is no default template provided by plain. The $\langle X \rangle$TEX macros I have seen don't reflect the logical structure of the table. An apparently simple change of representation, for example from a ruled into a non-ruled, or from a framed into a non-framed table, requires in TEX, and LATEX, some non-negligible effort.

Therefore, there is a need for an easy to use macro on top of plain's powerful $\backslash\langle X \rangle$`halign`-s, which accounts for the structure of the table.

Characteristics of existing table macros are given in the Existing TEX Table Packages section. In the Kaleidoscope section an anthology of tables is presented. Peculiar are the deterministic tables, and the tables which update memory. The section ends with the bordered table model. In the Bordered Table section the macro and examples of use are given. In the Blocks section blocks and connected cells are dealt with.

No landscape vs. portrait issues are discussed, nor the general use of rotated fonts. Tables which extend the page will not be discussed either. See for the latter for example supertabular.sty, [7], or longtable.sty, [4]. I also refrained from the issues which come from mapping the 'main vertical list' onto pages, under the restriction not to split tables over page boundaries.

2 Existing TEX table packages

Cowan, [5], provided a nice package in order to facilitate the formatting of simple tables. A main feature of his macros is that no template and no explicit number of columns, have to be provided. The template is created dynamically from the data and the 'attributes.' This is powerful and Hi-TEX on the one hand, but restrictive and time consuming on the other. The automatism can't be easily superseded, as opposed to a default repetitive template, which I have adopted. The functionality as demonstrated by his examples can be easily obtained via the bordered table macro.

Khanh, [8], introduced table macros which mainly deal with complex header rows. Because I consider those complicated header rows the exception rather than the rule, and because the material is not in the public domain, I will not consider it further.

Spivak, [23], provided some powerful macros for formatting tables separately from the main document. His merging, at the dvi level, of the formatted table into the main document, is Hi-TEX. He also provided some interesting examples of simultaneous row and column spans. Good, but complex, and perhaps too advanced for daily use. It is in the public domain.

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Lamport, [19], mainly provided facilities for placing a table appropriately within the context.[1] He also developed `\cline`, for partial horizontal rules, which is a powerful and a handy feature. I don't consider his way of framing nice, nor his way of specifying the ruling.

Hendrickson, [8], has an approach similar to mine. No bordered table model, however, and less pronunciated 'attributes.'

There exist more table macros. Of those I had access to, the ones discussed above seemed relevant to me. Now and then visual mark up packages appear, like Type and Set, [2]. With bars and visual mark up the table is specified on the screen, and from that TEX code is generated. However useful this might be within the 'conversion' of wordwhatever into TEX area, I don't like the resulting TEX encoding. It is clumsy. If such simple tables generate such an encoding then we are lost with really something a little more complex. Besides, the purpose of this paper is to introduce some new ways of formatting *simple* tables, next to the general accepted formatting TEXniques. The TEXbook considers alignment the general issue. I like to approach the issue from the structure point of view, and to couple it to what is already available via plain.[2] This work is a continuation of my earlier work on the SGML-TEX relation, [13].

3 Kaleidoscope

Some examples of special tables are given in order to illustrate the diversity. With respect to programming, the deterministic tables and the tables which update the computer memory, deserve special attention. The latter category is induced by *computer* typography.

- Pascal triangle, a deterministic table, [14]

$$\begin{array}{ccccc} & & 1 & & \\ & 1 & & 1 & \\ 1 & & 2 & & 1 \\ 1 & 3 & & 3 & 1 \end{array}$$

via

```
$$\displaylines{1\cr
  1\quad1\cr
  1\quad2\quad1\cr
  1\quad3\quad3\quad1\cr}$$
```

- Tower of Hanoi, deterministic, [15]. The process of replacement of the disks will be printed by the invoke of `\hanoi`$\langle n \rangle$, n an integer. No user mark up is needed.
- Young tableaux, irregular shape, [9], [25]

1	2	3	4
5	6	7	
8			

7	8	9	10
11	13		
16			

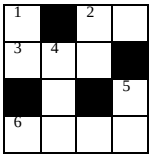
via

```
\def\young#1{\hbox{\vrule\vtop{\hrule\offinterlineskip\halign
{&\vbox{\hbox to\csize{\strut\hss##\hss\vrule}\hrule}\cr#1\crcr}}}}
%
\def\data{'&'&'\cr'&'&'\cr'}    \young\data\qquad
\def\data{7&8&9&10\cr11&13\cr16\cr}\young\data
```

with auxiliaries

```
\newdimen\csize\csize=3ex \newcount\cnt\catcode``=13
\def`{\global\advance\cnt1 \the\cnt}
```

- Much alignment occurs in typesetting mathematics: aligned equations in display, matrices, and the complex commutative diagrams. This has been dealt with elsewhere, for example [13], [14], and [23].
- Crosswords: puzzle, clues and solution, [16]



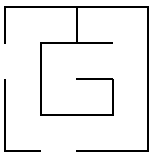
Across
2 Switch mode
3 Knuth
6 Prior to TEX

Down
1 Public domain
2 All right
4 All comes to it
5 Atari type

[1] As floating body, also called island by Spivak (1989).

[2] Jackie Damrau compiled a collection of table macros/styles resulting from the Portland workshop on the issue, which contains most of the works I mentioned above.

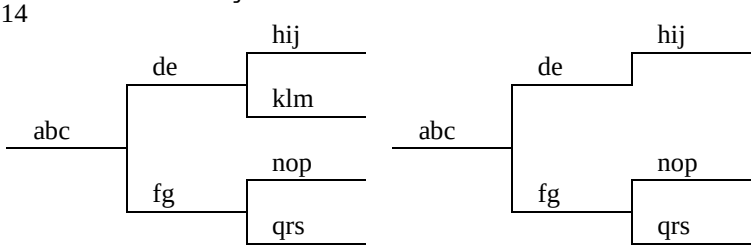
- Maze



via

```
\newdimen\csize \csize=3ex
\catcode`|=13 \def|{\vrule}
\catcode`_=13 \def_{\hrulefill}
\hbox{\vtop{\offinterlineskip\hrule
\halign{&\hbox to\csize
{\vrule height\csize width0pt#\hfil}\cr
          |&_&|_& \cr
           &|&_&  \cr
          |&|_&_&|\cr
          |_& &_&_\cr}%end \halign
 }\vrule%end \vbox
 }%end \hbox
```

- Chart, TEXbook ex22.14



via the following alternative code without `\halign`

```
\newdimen\dist \dist=2\baselineskip
\def\ent#1{\hbox{\vbox to0pt{\vss\hbox to10ex{\quad\strut#1\hss}\hrule}}}
\def\vl#1{\hbox{\vrule height#1\dist depth0pt}}
\def\bl#1{\kern#1\dist}%BLank of proper size
%Balanced
$$\offinterlineskip
 \vcenter{\ent{abc}}
 \vcenter{\ent{de} \vl2\ent{fg}}
 \vcenter{\ent{hij}\vl1\ent{klm}\bl1\ent{nop}\vl1\ent{qrs}}
\quad%Nearly balanced tree; pruning a branch
 \vcenter{\ent{abc}}
 \vcenter{\ent{de} \vl2\ent{fg}}
 \vcenter{\ent{hij}\vl{.5}%\bl{.5}\ent{klm}
                          \bl{1.5}\ent{nop}\vl1\ent{qrs}}$$
```

There exist some special tree packages, see [3], or consult Beebe's TUGlib server, especially the directory trees.bib.

- Row and/or column spans, partial horizontal rules[3]

Pair No	Contract		Results	Scores		MPs
	N–S	E–W		N–S	E–W	
1.						
2.						
et cetera						

- Bridge pair match scheme, with special 'first' element

Spel / Ronde	1–3	4–6	7–9	10–12	13–15	16–18	19–21
1.	1: 1–2			2: 3–4		3: 5–6	4: 7–8
2.	4: 8–3	1: 1–6			2: 5–7		3: 2–4
. . .							

[3] How many rows does the header have? Descriptive 1, visual 2, and for plain TEX formatting 3? See Mark up of Bridge Form subsection.

- Alignment at decimal points. Generally this is done by introducing an extra column for the dot, and flushing right the digits left and flushing left the digits right of it. It comes from the wishes not to print non-significant leading zeroes, and to suppress zeroes behind the point for exact numbers. 3.5 means exactly $3\frac{1}{2}$. 3.500 means accurate to three digits. I would mark up the numbers separately and insert Knuth's '?', TEXbook, p.240–241, for non-signicant zeroes, automatically. The latter can also be done by programming the editor by a template consisting of sufficient ?-s followed by the decimal point. The required numbers can be brought in by overtyping the template. Related to alignment at the decimal point is alignment at number signs,[4] see the AAP table.
- Fill-in forms, especially the registration forms for the various TEX conferences, are captivating. Sometimes I ponder about the e-mail equivalents of the traditional snail forms, especially what and how they should be filled in. Redefine a list of empty definitions?
- Time-tables (railway, bus, . . .), and the use of rotated fonts.
- Nested, and interrupted[5] table with updating of memory, [14]

Puzzle	♠ KQ76 ♡ J98 ♢ J942 ♣ 65	6NT, by East
♠ AJ3 ♡ K653 ♢ AK3 ♣ AQT	W N E S	♠ T9 ♡ A2 ♢ T5 ♣ KJ9xxxx
	♠ 8542 ♡ QT74 ♢ Q876 ♣ 2	

Trick					NS	EW
1	♡ 4!	♡ K	♡ 8	♡ 2	–	1
2	♣ A	♣ 5	♣ x	♣ 2	–	2
3	♣ Q	♣ 6	♣ x	♠ 2	–	3
4	♣ T	♡ 9	♣ K	♠ 4	–	4
5	♣ J	♠ 5	♠ 3	♠ 6	–	5
6	♣ 9	♠ 8	♡ 5	♠ 7	–	6
7	♣ x	♢ 6	♠ J	♢ 2	–	7

Puzzle	♠ KQ ♡ J ♢ J94 ♣ –	NS squeezed on ♣ continuation?
♠ A ♡ 63 ♢ AK3 ♣ –	W N E S	♠ T9 ♡ A ♢ T5 ♣ ⓧ
	♠ – ♡ QT7 ♢ Q87 ♣ –	

8	♣ x	♡ 7	♡ 6	♡ J	–	8

et cetera

Tables which also require updating of memory occur with typesetting of chess, for example [24], or GO, [11].

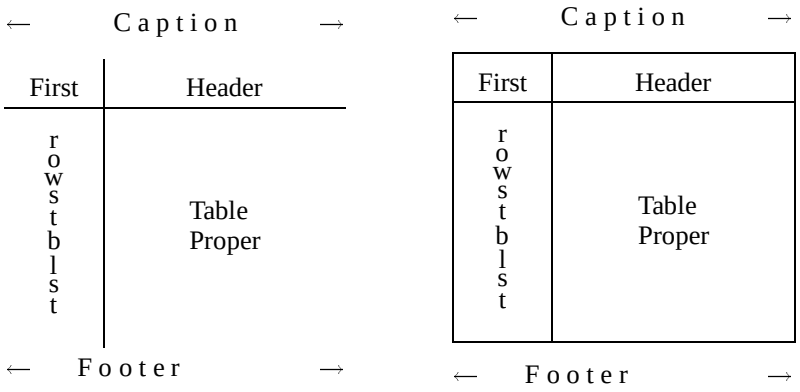
[4] Another column for the signs offends the structure. At a lower level one could think of `\scs`, a Sign Column Separator, but that is not nice either.

[5] From the user level one would say: aligned material connected by text, where the latter in the case at hand is the status of the play.

4 Bordered table

A bordered table consists of a caption, a header, row stubs, a table proper and a footer, all with appropriate separators. Special cases occur when some of the elements are absent. Abstraction from ruled and non-ruled is realized at the user level. Ruled can be specified either as horizontal, vertical or both. Dotted rules, also the partial ones, can be specified.[6] No variation in the line thicknesss has been encoded.[7] Framing is treated just as if a general document element has to be framed. I chose to leave the caption and the footer outside the frame. The positioning of the elements can be specified as centered, flushed left, respectively flushed right. A user may supply his own template. Caption, border (first, header, row stubs), and footer can be specified; all mutual orthogonal and independent from `\data`.

- Bordered table model



via

```
\def\caption{$\leftarrow$\hfill C a p t i o n\hfill$\rightarrow$}
\def\first{\hbox to6ex{\hss First\hss}}
\def\header{\hbox to18ex{\hss Header\hss}}
\def\rowstblst{{\hfil$\vcenter to20ex{\vss\offinterlineskip
              \fifo rowstblst\ofif\vss}$}}
\def\data{$\vcenter{\offinterlineskip\hbox{Table}\kern1ex\hbox{Proper}}$}
\def\footer{\hbox to\thsize
{$\leftarrow$\hss{\small F o o t e r}\hss\hss\hss$\rightarrow$}}
$$\vcenter{\btable\data}\qquad\qquad
  \vcenter{\framed\btable\data}$$
```

with, [17], [19]

```
\def\fifo#1{\ifx\ofif#1\ofif\fi\process{#1}\fifo}\def\ofif#1\fifo{\fi}
\def\process#1{\hbox to0pt{\hss#1\hss}\kern.5ex}
```

Rules can be specified via for example `\ruled`, `\hruled`, `\vruled`, `\nonruled`, respectively `\dotruled`.[8] The rules that separate the border can be eliminated, by redefinition of the macros `\headersep` and `\rowstbsep`. Furthermore, there are `\ctr`, `\fll`, and `\flr`, for controlling the positioning of the elements of the table. The framing can be controlled by `\framed`, `\dotframed`, or `\nonframed`.

4.1 Encoding

```
%btable.tex version 1, 17/7/92                          author: cgl@rug.nl
\newbox\tbl\let\ea=\expandafter
%Cell vertical size, row height and depth (separation implicit),
\newdimen\cvsize\newdimen\tsht\newdimen\tsdp\newdimen\tvsize\newdimen\thsize
%Parameter setting macros:   Rules
\def\hruled{\def\lineglue{\hrulefill}\def\colsep{}      \def\rowsep{\hrule}
   \let\rowstbsep=\colsep\let\headersep=\rowsep}
\def\vruled{\def\lineglue{\hfil}     \def\colsep{\vrule}\def\rowsep{}
   \let\rowstbsep=\colsep\let\headersep=\hrule}
\def\ruled {\def\lineglue{\hrulefill}\def\colsep{\vrule}\def\rowsep{\hrule}
   \let\rowstbsep=\colsep\let\headersep=\rowsep}
\def\nonruled{\def\lineglue{\hfil}   \def\colsep{}      \def\rowsep{}
   \def\rowstbsep{\vrule}\def\headersep{\hrule}}
\def\dotruled{\def\lineglue{\dotfill}\def\rowsep{\hbox to\thsize{\dotfill}}
```

[6] The chameleon sized `\hrule` and `\vrule`, don't have dotted analogues, however.

[7] It is not difficult to introduce a parameter `\linethickness`.

[8] The latter requires some extra work: table measurement via 2 passes.

```
\def\colsep{\lower1.5\tsdp\vbox to\cvsize{%
\leaders\hbox to0pt{\vrule height2pt depth2pt width0pt\hss.\hss}\vfil}}
\let\rowstbsep=\colsep\let\headersep=\rowsep}
%Parameter setting macros:   Controling positioning
\def\ctr{\def\lft{\hfil}\def\rgt{\hfil}}%Centered
\def\fll{\def\lft{}     \def\rgt{\hfil}}%Flushed left
\def\flr{\def\lft{\hfil}\def\rgt{}}     %Flushed right
%Parameter setting macros:   Framing
\def\framed{\let\frameit=\boxit}
\def\nonframed{\def\frameit##1{##1}}
\def\dotframed{\let\frameit=\dotboxit}
%
\def\btable#1{\vbox{\let\rsl=\rowstblst%Copy
\ifx\empty\template\ifx\empty\rowstblst
    \def\template{\colsepsurround\lft####\rgt&&\lft####\rgt\cr}
    \else\def\template{\colsepsurround####\hfil&&\lft####\rgt\cr}\fi
   \fi
\tsht=.775\cvsize\tsdp=.225\cvsize
\def\tstrut{\vrule height\tsht depth\tsdp width0pt}
%Logical mark up of column and row separators, via use of
\def\cs{&\colsepsurround\colsep\colsepsurround&}
\def\prs{&\colsepsurround\lineglue&}   \def\srp{&\lineglue\colsepsurround&}
\def\rs{\colsepsurround\tstrut\cr
        \ifx\empty\rowsep\else\noalign{\rowsep}\fi
        \ifx\empty\rowstblst\else\ea\nxtrs\fi}
\def\grs{\colsepsurround\tstrut\cr\ghostrow}
\def\rss{&\colsepsurround\rowstbsep\colsepsurround&}
\def\hs{\colsepsurround\tstrut\cr
       \ifx\empty\headersep\else\noalign{\headersep}\fi
       \ifx\empty\rowstblst\else\ea\nxtrs\fi}
\preinsert                                              %User action
\setbox\tbl=\vbox{\tabskip=0pt\relax\offinterlineskip
\halign{\span\template\ifx\empty\first\ifx\empty\rowstblst\else
\ifx\empty\header\else\ea\rss\fi\fi\else\first\ea\rss\fi
\ifx\empty\header\ifx\empty\first\if\empty\rsl\else\ea\nxtrs\fi
                \else\ea\hs\fi
\else\header\ea\hs\fi
#1\colsepsurround\tstrut\crcr}    }                              %end \setbox
\postinsert%Pick up what is needed, \thsize,...
\ifx\caption\empty\else\hbox to\thsize{\strut\hfil\caption\hss}\captionsep\fi
\frameit{\copy\tbl}
\ifx\footer\empty\else\footersep\hbox{\vtop{\noindent\hsize=\thsize%
\footer}}\fi                     }}                             %end \btable
%Defaults
\cvsize=4ex\tsht=.775\cvsize\tsdp=.225\cvsize\def\colsepsurround{\kern.5em}
\def\caption{}\def\first{}\def\header{}\def\rowstblst{}\def\footer{}\def\data{}
\def\captionsep{\medskip}    \def\headersep{\hrule}
\def\footersep{\smallskip}   \def\rowstbsep{\vrule}
\def\preinsert{}
\def\postinsert{\global\thsize=\wd\tbl
               \global\tvsize=\ht\tbl\global\advance\tvsize by\dp\tbl}
\ctr\nonruled\nonframed\def\template{}\def\ghostrow{}            %end Defaults
%Auxiliaries
\def\boxit#1{\vbox{\hrule\hbox{\vrule\vbox{#1}\vrule}\hrule}}
\def\dotboxit#1{\vbox{\offinterlineskip\hbox to\thsize{\dotfill}%
\hbox{\lower\tsdp\vbox to\tvsize{%
\leaders\hbox to0pt{\hss\vrule height2pt depth2pt width0pt.\hss}\vfil}%
\vbox{#1}\lower\tsdp\vbox to\tvsize{%
\leaders\hbox to0pt{\hss\vrule height2pt depth2pt width0pt.\hss}\vfil}}%
\hbox to\thsize{\dotfill}}}
%And to account for logical columns with \logmsp
\def\spicspan{\span\omit}
\def\logmsp#1{\omit\mscount=#1\multiply\mscount by2 \advance\mscount by-1
\loop\ifnum\mscount>1 \spicspan\advance\mscount by-1 \repeat}
```

```
%To handle the row stub list: \rsl
\def\nxtrs{\ifx\empty\rsl\else\def\nxtel{\ea\nrs\rsl\srn}\ea\nxtel\fi}
\def\nrs#1#2\srn{\gdef\rsl{#2}#1\rss}                          %end btable.tex
```

`\btable` Implements the bordered table model. Note that the table is measured in order to set the width of the header and the footer. The measurement is also useful for dotted horizontal lines. When no template is provided, then a default will be created, automatically.

`\`$\langle X \rangle$`sep` Parameters which govern the kind of separators.

`\nxtrs` Yields the next element of the row stub list. *The last element of the list has to be enclosed by an extra pair of braces.* I could have introduced an explicit list terminator instead, but that would have created incompatibilities with the termination in other defs. Weird?

`\cvsize, \tsht, \tsdp, \thsize, \tvsize` These dimension variables stand for vertical cell size, table strut height, table strut depth, table horizontal size, and table vertical size.

`\preinsert, \postinsert` For flexibility. Default `\preinsert` is empty. `\postinsert` delivers by default the table sizes globally into `\thsize`, and `\tvsize`.

4.2 Examples of use

Before the invocation of `\btable\data` do:
Redefine `\data` with column and row separators, `\cs`, respectively `\rs`.
Choose from the 'attributes'
– `\ruled`, `\hruled`, `\vruled`, `\dotruled` Default: `\nonruled`
– `\framed`, `\dotframed` Default:`\nonframed`
– `\fll`, `\flr` Default: `\ctr`
Supply the caption, header, first element, row stubs, or footer via redefinitions of the corresponding macros.

- Just data, [14]

2	7	6
9	5	1
4	3	8

16	3	2	13
5	10	11	8
9	6	7	12
4	**15**	**14**	1

via

```
$$\def\data{2\cs7\cs6\rs 9\cs5\cs1\rs  4\cs3\cs8}
  \vcenter{\framed\ruled\btable\data}\qquad\qquad\qquad
  \def\data{16\cs    3\cs    2\cs13\rs
            5\cs   10\cs   11\cs 8\rs
            9\cs    6\cs    7\cs12\rs
            4\cs\bf15\cs\bf14\cs 1}
\ruled\framed\setbox0=\btable\data%for measuring sizes
\vcenter{\dotruled\dotframed\btable\data}\qquad$$
```

- Data plus header, TEXbook p.246

Year	World Population
8000 B.C.	5,000,000
50 A.D.	200,000,000

Year	World Population
8000 B.C.	5,000,000
50 A.D.	200,000,000

via the simpler nearly descriptive mark up

```
\def\header{\hfill Year\hfill\cs\hfill World Population\hfill}
\def\data{8000 B.C.\cs  5,000,000\rs 50 A.D.\cs200,000,000}
$$\flr\vruled\vcenter{\btable\data}\qquad
\ruled\framed\vcenter{\btable\data}$$
```

- Data with row stubs, TEXbook p.232

Horizontal lists	Chapter 14	
Vertical lists	Chapter 15	via
Math lists	Chapter 17	

```
\def\rowstblst{{Horizontal lists}
  {Vertical lists}{{Math lists}}}
\def\rowstbsep{}%Default a \vrule
\def\data{Chapter 14\rs
Chapter 15\rs Chapter 17}
$$\btable\data$$
```

- Data, row stubs, header, caption and footer

11	12
21	22

	Header	
1^{st} row	11	12
2^{nd} row	21	22

Caption

	Header	
1^{st} row	11	12
2^{nd} row	21	22

Footer

Caption

	Header	
1^{st} row	11	12
2^{nd} row	21	22

Footer

after data definition, `\def\data{11\cs12\rs21\cs22}`, via[9]

```
$$\vcenter{\framed\btable\data}      \qquad
  \def\header{\logmsp2\hfill Header\hfill}
  \def\rowstblst{{$1^{st}$ row}{{$2^{nd}$ row}}}
  \vcenter{\btable\data}             \qquad
  \def\caption{Caption}\def\footer{Footer}
  \vcenter{\dotruled\btable\data}    \qquad
  \vcenter{\ruled\framed\btable\data}$$
```

- Walter's spreadsheet, TEXbook, p.244. No preamble has to be defined. It makes ex22.10 superfluous. How about that?

1	Adjusted gross income	$4,000
2	Zero bracket amount for	
	a single individual	$2,300
3	Earned income	1,500
4	Substract line 3 from line 2	800
5	Add lines 1 and 4. Enter here	
	and on Form 1040, line 35	$4,800

The above is encoded, as a 4-column table, via

```
\def\data{1\cs\logmsp2Adjusted gross income     \dotfill\cs\$4,000\rs
          2\cs Zero bracket amount for                          \rs
           \cs a single individual \dotfill\cs\hfill\$2,300\cs  \rs
          3\cs Earned income       \dotfill\cs
                                    \hfill\underbar{ 1,500}\cs  \rs
          4\cs\logmsp2Substract line 3 from line 2
                                  \dotfill\cs\hfill\underbar{ 800}\rs
          5\cs Add lines 1 and 4. Enter here                    \rs
           \cs\logmsp2and on Form 1040, line 35 \dotfill\cs\$4,800}
\def\colsepsurround{\kern.5ex}\cvsize=3ex
$$\fll\btable\data$$
```

[9] Note the invariance of the `\data` specification.

- Part of AAP's table, [1], or [13]

AAP's table: Job Changes 1973–1980

	Gain/Loss of hospitals since 1973	Total No of CEO Job Changes 1973–90	Survival Rate of CEO's
Texas	+20	—	22%
Maryland	+ 5	42	24%

Source: David Kinzer, 'Turnover Of Hospital Chief Executive Officers: A Hospital Association Perspective,' Hospital and health Services Administration May-June 1982.

obtained via

```
\def\caption{AAP's table:\qquad Job Changes 1973--1980\hfill}
\def\rowstblst{{Texas}{Maryland}}}
\def\header{\copy1\cs\copy2\cs\copy3}
\def\data{$+20$\cs---\cs22\%\rs
          $+?5$\cs 42\cs24\%}
\def\footer{Source: David Kinzer, 'Turnover Of Hospital Chief
Executive Officers: A Hospital Association Perspective,'
Hospital and health Services Administration May-June 1982.}
$$\btable\data$$
```

with auxiliaries

```
\def\nl{\hfil\strut\break\strut}\catcode'?=\active \def?{\kern1.1ex}
\setbox1=\vtop{\noindent\hsize14ex
    Gain/Loss of\nl hospitals\nl since 1973}
\setbox2=\vtop{\noindent\hsize13ex
    Total No\nl of CEO Job\nl Changes\nl 1973--90}
\setbox3=\vtop{\noindent\hsize10ex
    Survival\nl Rate of\nl CEO's}
```

- AT&T table diversions, TEXbook p.247, [20]

```
\def\caption{AT\&T Common Stock}
\def\header{Year\cs Price\cs Dividend}
\catcode'?=\active \def?{\kern1.1ex}
\def\data{1971\cs41--54\cs\llap{\$}2.60\rs
             2\cs41--54\cs         2.70\rs
             3\cs46--55\cs         2.87\rs
             4\cs40--53\cs         3.24\rs
             5\cs45--52\cs         3.40\rs
             6\cs51--59\cs         ?.95\rlap*}
\def\footer{* (first quarter only)}
$$\framed\vcenter{\vbox{\small\btable\data}}\qquad\qquad
\def\caption{}\def\header{\logmsp3 \hfil AT\&T Common Stock\hfil\rs
           \hfill Year\hfill\cs\hfill Price\hfill\cs \hfill Dividend\hfill}
\vcenter{\flr\ruled\btable\data}$$
```

yields

AT&T Common Stock

Year	Price	Dividend
1971	41–54	$2.60
2	41–54	2.70
3	46–55	2.87
4	40–53	3.24
5	45–52	3.40
6	51–59	.95*

* (first quarter only)

AT&T Common Stock		
Year	Price	Dividend
1971	41–54	$2.60
2	41–54	2.70
3	46–55	2.87
4	40–53	3.24
5	45–52	3.40
6	51–59	.95*

* (first quarter only)

It remains a matter of choice what should be considered as header and what as caption. A footnote facility, which will append the footnote to a footnote list similar to the row stub list, could have been implemented. I refrained from implementing it, for the moment.

- Pittman's, [22], deterministic multiplication table. Typographically and in other programming languages a trifle. In TEX the encoding matters.

1	2	3
2	4	6

×	1	2	3
1	1	2	3
2	2	4	6

×	1	2	3	4
1	1	2	3	4
2	2	4	6	8
3	3	6	9	12

via

```
\let\nx=\noexpand \let\ea=\expandafter
\newcount\rcnt \newcount\ccnt \newcount\tnum
\newcount\mrow \newcount\mcol
\rcnt1 \ccnt1 \mrow2 \mcol3
\def\rows{\global\ccnt1 \cols \global\advance\rcnt1
   \ifnum\rcnt>\mrow\swor\fi\rs\rows}
\def\swor#1\rows{\fi}
\def\cols{\tnum\rcnt \multiply\tnum\ccnt \the\tnum
   \global\advance\ccnt1 \ifnum\ccnt>\mcol\sloc\fi\cs\cols}
\def\sloc#1\cols{\fi}
\vcenter{\btable\rows}\qquad\qquad
%
\global\ccnt=1 \global\rcnt=1 \mrow2 \mcol3
\def\first{$\times$}  \def\header{\row}
\def\row{\the\ccnt\global\advance\ccnt1
   \ifnum\ccnt>\mcol\wor\fi\cs\row}
\def\wor#1\row{\fi}
\def\rowstblst{\ifnum\rcnt=\mrow\gdef\rowstblst{}\fi}
\def\nxtrs{\the\rcnt\rss}
\vcenter{\btable\rows}\qquad\qquad
%
\global\ccnt=1 \global\rcnt=1 \mrow3 \mcol4
\def\rowstblst{\ifnum\rcnt=\mrow\gdef\rowstblst{}\fi}
\framed\vcenter{\btable\rows}$$
```

4.3 No mark up

For simple tables the data can be specified without `\cs`-s, and `\rs`-s, that is without explicit markers for column and row separators. These can be inserted by TEX, see TEXbook p.249, [17], or [22]. For special cases, for example crosswords, [16], this is handy.

Pondering about lists, make you realize that the table proper data forms a nested list with `\rs` and `\cs`, respectively first level and second level separators. One could also adopt $\langle cr \rangle$ and ␣ for that, in other words allow natural data provision.

5 Simultaneous row and column spans

When one kind of spans is the issue one can use `\logmsp`—for logical columns, as an extension to `\multispan`—either within `\halign`, for column spans, or within `\valign`, for row spans. Simultaneous row and column spans require more work.
First, we have to account for the blocks proper. This is done via leaving space open, overprinting the left open space, and the use of a *Ghost Row Separator*. For a block of even *row* size, I chose to insert lines of height zero. I call these ghost lines. For a block with an odd number of rows, I chose to modify the middle line.
Next, when we are dealing with *ruled* tables we have to hide the rules that should otherwise traverse the block. This can be done for partial vertical rules via `\logmsp{n}\hfil`, with n an integer. For partial horizontal rules there are two aspects. First, the table-wide rules are not typeset, and second, partial horizontal rules have to be typeset around the blocks. I supplied the macros `\prs`, Partial Rule Separator, and `\srp`, *mirror* Separator Rule Partial, to enclose a partial rule. The kind of partial rule is determined by the replacement text of `\lineglue`.

Row spans in the row stub list can be handled similarly. For even spans define an appropriate `\ghostrow`, with a copy of the block in it. For odd spans provide a copy of the block in the row stub list. Provide suitable empty row stub elements, { }, in both cases.

5.1 Partial rules

For a horizontal rule over one (logical) column use
`...\prs\lineglue\srp...` instead of
`...\cs...\cs...`.
`\lineglue` is defined by the $\langle X \rangle$`ruled` macros.

The `\prs`, Partial Rule Separator, accounts for that part of the rule, which extends into the hidden column for the separator. `\srp` is its mirror terminator. At the line-ends of the table one can simply use `\cr`, as mirror terminator. The respective (symmetric) definitions are

```
\def\prs{&\colsepsurround\lineglue&}   \def\srp{&\lineglue\colsepsurround&}
```

For a horizontal rule over $\langle n \rangle$ (logical) columns use

```
...\prs\logmsp{n}\lineglue\srp...%n logical columns
```

5.2 Mark up bridge form

The header row of the bridge form can be characterized by: one 3-row span, two 2-column spans, and two 2-column partial horizontal rules. Furthermore, the repetition of the number of rows is interesting.

```
\def\header{\cs\logmsp2\hfil Contract\hfil\cs
                        \cs\logmsp2\hfil Scores\hfil\cs\grs
            \cs N--S\cs E--W\cs\cs N--S\cs E--W\cs}
\def\data{\lines}   \framed\ruled\btable\data
```

with auxiliaries

```
\newcount\bcnt
\def\lines{\global\advance\bcnt by 1 \ifnum\bcnt=3 et cetera\hidewidth
   \senil\fi\the\bcnt.\cs\cs\cs\cs\cs\cs\rs\lines}
\def\senil#1\lines{\fi}
%
\def\ghostrow{\omit\colsepsurround%
  \vbox to 0pt{\vss\hbox to 5ex{\hss Pair\hss}\vskip.5ex
          \hbox to 5ex{\hss No\hss}\vss}\prs\logmsp2\lineglue\srp
  \vbox to 0pt{\vss\hbox to 5ex{\hss Re-\hss}\vskip.5ex
        \hbox to5ex{\hss sults\hss}\vss}\prs\logmsp2\lineglue\srp
  \vtop to 0pt{\vss\hbox to 5ex{\hss MP$\,$s\hss}\vss}\colsepsurround\cr}
```

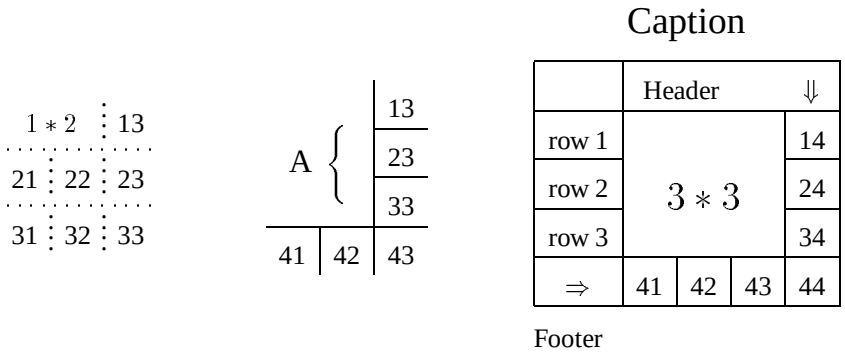
The row span extends implicitly into the first and third row. The last row of the data does not take vertical rules, automatically.[10]

[10] For a real form—24 or more rows—just modify `\lines`.

5.3 Blocks; connected cells

In order to specify spans of *logical* columns, we need an adapted version of `\multispan`, TEXbook p.354, as given in the Encoding subsection.
Spans form a block. Around the blocks partial rules emerge.

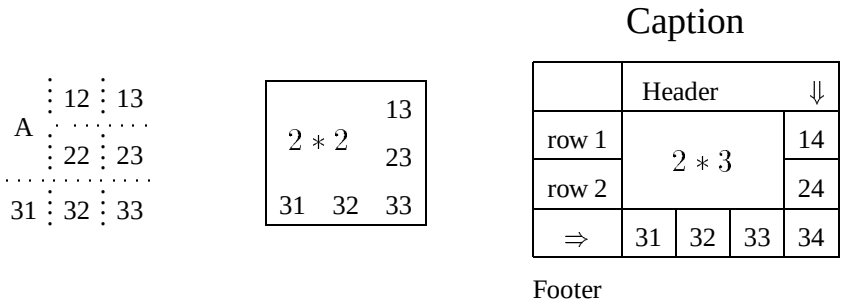
- **Odd blocks**, 1-by-2 etc. Use `\logmsp`, `\srp`, `\lineglue` and the like. Define appropriate -s.



can be obtained via

```
$$\setbox\block=\hbox{$1*2$}
\def\data{\logmsp2\colsepsurround\hfil\copy\block\hfil\cs13\rs
21\cs22\cs23\rs
31\cs32\cs33}                                              %end \data
{\ruled\setbox0=\btable\data}%For measurement
\vcenter{\dotruled\btable\data}\qquad\qquad
%
%3-by-2, and connected cells
\def\data{\logmsp2\hfil\cs13\grs
\logmsp2\colsepsurround\hfil\vbox to0pt{\vss
                                \copy\block\vss}\hfil\cs23\grs
          \logmsp2\hfil\cs33\rs
                   41\cs42\cs43}                           %end \data
\setbox\block=\hbox{{\large A}\enspace%
              $\left\{\vrule height3ex depth3ex width0pt\right.$}
\def\ghostrow{\ifx\empty\rowstblst\else\omit\lineglue\ea\srp\fi
\logmsp2\hfil\prs\lineglue\cr
\ifx\empty\rowstblst\else\ea\nxtrs\fi}
\vcenter{\ruled\btable\data}\qquad\qquad
%
%3-by-3 block and all around
\def\data{\logmsp3\hfil\cs14\grs
\logmsp3\hfil\vbox to 0pt{\vss\copy\block\vss}\hfil\cs24\grs
          \logmsp3\hfil\cs34\rs
              41\cs42\cs43\cs44}                           %end \data
\setbox\block=\hbox{\Large$3*3$}
\def\ghostrow{\ifx\empty\rowstblst\else\omit\lineglue\ea\srp\fi
\logmsp3\hfil\prs\lineglue\cr\ifx\empty\rowstblst\else\ea\nxtrs\fi}
\def\caption{{\Large Caption}}
\def\header{\logmsp4 Header\hfil$\Downarrow$\ }
\def\rowstblst{{row 1}{row 2}{row 3}{{\hfil$\Rightarrow$}}}
\def\footer{Footer}
\vcenter{\ruled\framed\btable\data}$$
```

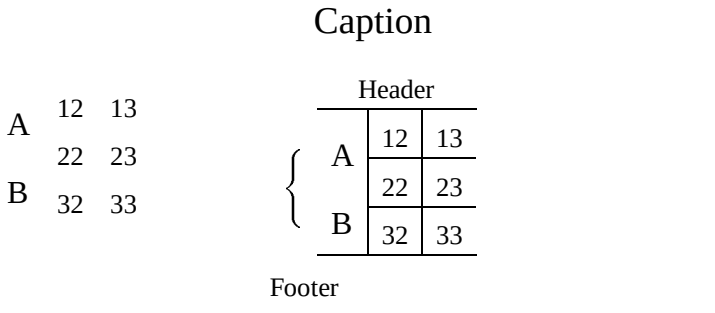
- **Even blocks**, 2-by-1 etc. Leave the cells for the block open in `\data`. Use `\grs`, `\prs`, `\lineglue`, and the like. Define `\ghostrow`.



can be obtained via

```
$$\setbox\block=\hbox{\large A}%2-by-1 block
\def\data{\cs12\cs13\grs
          \cs22\cs23\rs
        31\cs32\cs33}                                          %end \data
\def\ghostrow{\ifx\empty\rowstblst\else\omit\lineglue\ea\srp\fi%
\hfil\vbox to0pt{\vss\copy\block\vss}\hfil\prs
   \logmsp2\lineglue\cr\nxtrs}
{\ruled\framed\setbox0=\btable\data}%for measurement
\vcenter{\dotruled\btable\data} \qquad\qquad
%
\setbox\block=\hbox{\large$2*2$}
\def\data{\logmsp2\hfil\cs13\grs
          \logmsp2\hfil\cs23\rs
                  31\cs32\cs33}                                %end \data
\def\ghostrow{\ifx\empty\rowstblst\else\omit\lineglue\ea\srp\fi%
   \logmsp2\colsepsurround\hfil%
   \vbox to0pt{\copy\block\vss}\hfil\prs\lineglue\cr\nxtrs}
\vcenter{\framed\btable\data}    \qquad\qquad
%
\setbox\block=\hbox{\large$2*3$}
\def\data{\logmsp3\cs14\grs
          \logmsp3\cs24\rs
         31\cs32\cs33\cs34}                                    %end \data
\def\caption{{\Large Caption}}
\def\rowstblst{{row 1}{row 2}{{\hfil$\Rightarrow$}}}
\def\header{\logmsp4 Header\hfil$\Downarrow$\ }
\def\footer{Footer}
\def\ghostrow{\ifx\empty\rowstblst\else\omit\lineglue\ea\srp\fi
\logmsp3\hfil%
\vbox to0pt{\vss\copy\block\vss}\hfil\prs\lineglue\cr\nxtrs}
\vcenter{\framed\ruled\btable\data}$$
```

- **Multiple blocks**: in row stub and table proper



via

```
$$\setbox\block=\vbox{\hbox{\large A}\kern3ex\hbox{\large B}}
\def\data{                              \cs12\cs13\grs
$\vcenter to0pt{\vss\copy\block\vss}$\cs22\cs23\grs
                                        \cs32\cs33\lr}
\vcenter{\btable\data}\qquad\qquad\qquad
```

```
\def\caption{{\Large Caption}}
\def\header{\logmsp3\hfill Header\hfill}
\def\rowstblst{{}{$\vcenter to0pt{\vss\Bigg\{\vss}$}{{}}} $$
\def\footer{Footer}
\vcenter{\ruled\btable\data}
```

with

```
\def\ghostrow{\rss\prs\logmsp2\lineglue\cr\nxtrs}
\def\lr{\tstrut\colsepsurround\cr\prs\logmsp3\lineglue\gobble}
\def\gobble#1#2{}%kludge to undo \tstrut, \colsepsurround
\def\preinsert{\def\rss{&\colsepsurround\hfil\colsepsurround&}
   \def\hs{\colsepsurround\tstrut\cr\prs\logmsp3\lineglue\cr\nxtrs}}
```

Not much is gained in clarity for complicated tables. The logical structure at the top level is there, however.

6 Conclusions

Tables are diverse, and a variety of tools is needed.

Some (deterministic) tables can be generated completely by computer, no detailed user mark up is needed, just the invocation of the macro.

Mark up of bordered scientific tables can be done via the provided bordered table macro `\btable`, in the SGML spirit.

Complex tables need detailed formatting commands and TEXnowledge, in agreement with DEK, TEXbook p.245

> 'People who know how to make ruled tables are generally known as TEX masters. Are you ready?'

Hard things: not to introduce parameters which are already available, and to avoid redundancy. However, I could not get around `\colsepsurround`, because of the impossibility to control the kind of glue inserted by `\tabskip`.
The lack of dotted equivalents of `\hrule`, and `\vrule`, as TEX primitives, is regrettable.

Typesetting tables requires a discipline to be adhered to. What about a discipline of TEXing?

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