Numbering individual lines of equation array’s

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This package defines the subeqnarray and subeqnarray* environments, which behave like the equivalent eqnarray and eqnarray* environments, except that the individual lines are numbered like 1a, 1b, 1c, etc.
To refer to these numbers an extra label command \slabel has been defined. Many of this code was taken from latex.tex and modified for this purpose.

1 Initial Code
\c@subequation
We need to allocate a new counter for the subequation environment. It is reset by the equation counter.
1 (+package)
2 \newcounter{subequation}[equation]
\thesubequation The representation of the counter subequation includes the equation counter
3 \def\thesubequation{\theequation\alph{subequation}}

2 Option Handling
The standard \LaTeX options leqno and fleqn are recognised by this package.
4 % When \Lopt{leqno} is used the equation numbers should appear on
5 % the left side of the equation. The numbers are generated by
6 % \@subeqnnum which needs a different definition to achieve this
7 % effect.
8 % \begin{macrocode}
9 \DeclareOption{leqno}{%
10 \def\@subeqnnum{\hbox to .01\p@{}\rlap{\reset@font\rmfamily
11 \hskip -\displaywidth\thesubequation}}}%
\end{macrocode}
12 \DeclareOption{reqno}{%
13 \def\@subeqnnum{\hbox to .01\p@{}\rlap{\reset@font\rmfamily
14 \hskip -\displaywidth\thesubequation}}}%

The default definition of \@subeqnnum.
When the option \texttt{fleqn} is used, the equations have to be printed flush left, with an indent of $\mathindent$; the equations are separated from the surrounding text by $\topsep$ (plus $\partopsep$ if necessary) and the width of the display is $\linewidth$.

\begin{verbatim}
\DeclareOption{fleqn}{%
  \def\subeqn@start{%
    \tabskip\mathindent
    \abovedisplayskip\topsep
    \ifvmode\advance\abovedisplayskip\partopsep\fi
    \belowdisplayskip\abovedisplayskip
    \belowdisplayshortskip\abovedisplayskip
    \abovedisplayshortskip\abovedisplayskip
    $$\everycr{}\halign to \linewidth}}% $

The default will be to have displayed equations to the width of $\displaywidth$.
\end{verbatim}

\begin{verbatim}
\DeclareOption{deqn}{%
  \def\subeqn@start{%
    \tabskip\@centering
    $$\everycr{}\halign to \displaywidth}}% $

We don't support any other options
\end{verbatim}

3 \textbf{Executing Options}

Make sure the \texttt{@eqnnum} is defined by specifying \texttt{reqno} as a default option. Specifying \texttt{deqn} as a default option defines \texttt{\subeqn@start}.

\ExecuteOptions{reqno,deqn}

Now see if the use specified any options.

4 \textbf{The main code}

\texttt{\slabell} A new label command to refer to subequations. It works like the \texttt{\label} command and was taken from \texttt{latex.tex}.

\begin{verbatim}
\slabell{FOO} writes the following on file \@auxout
\newlabel{FOO}{{\thesubequation}{\thepage}}
\end{verbatim}

\newcommand{\slabell}[1]{%
  \@bsphack
  \if@filesw
    \let\thepage\relax
    \edef\protect\noexpand\noexpand\noexpand\@tempa{%
        \write\@auxout{\string
        \newlabel{#1}{{\thesubequation}{\thepage}}}%}
  \expandafter\@tempa
  \if@nobreak \ifvmode
    \nobreak
  \fi\fi
  \fi\@esphack}

\texttt{\subeqnarray} The \texttt{subeqnarray} environment steps the equation counter, sets the subequation counter equal to 1 and behaves much like the \texttt{eqnarray} environment. Note the \texttt{\@currentlabel} is defined to use the equation counter. This is done so that an
entire array an be referred to using the value of the equation counter. Hence the need for the `\slabell` command.

\begin{subeqnarray}
\end{subeqnarray}

\begin{verbatim}
newenvironment{subeqnarray}
{
\stepcounter{equation}
\def\@currentlabel{\p@equation\theequation}
\global\c@subequation\@ne
\global\@eqnswtrue\m@th
\global\@eqcnt\z@
\let\\@subeqncr\subeqn@start
\bgroup
\hskip\@centering
\$
\begin{array}{##}
\@eqnsel
&\global\@eqcnt\@ne \hskip \tw@\arraycolsep \hfil {##} \hfil
&\global\@eqcnt\tw@
\&\hskip \tw@\arraycolsep
\$
\&\global\@eqcnt\thr@@
\hbox to\z@{##}\egroup
\tabskip\@centering
}
{\@@subeqncr\egroup
$$\global\@ignoretrue}
\end{array}$
\end{subeqnarray}

\subeqnarray* This environment is basically the same as the \texttt{eqnarray} environment, but it is provided just for completeness.

\begin{verbatim}
newenvironment{subeqnarray*}
{\def\@subeqncr{{\ifnum0='\fi\@ifstar{\global\@eqpen\@M
\@ysubeqncr}{\global\@eqpen\interdisplaylinepenalty \@ysubeqncr}}

\@ysubeqncr
This macro is called by \subeqnarray and checks if the user requested any extra vertical space. It calls \xsubeqnarray with the wanted amount of space as its argument.

\@xsubeqnarray
This macro calls \@subeqncr to put in extra \&'s if needed, generating an error if the number of columns is too large. Then the penalty selected earlier and the white space requested are inserted.

\@subeqncr
Check the number of columns, and insert extra \& if needed. If there appear to be more than 3 columns an error is signalled.

\subeqnarray*
This environment is basically the same as the \texttt{eqnarray} environment, but it is provided just for completeness.

\begin{verbatim}
newenvironment{subeqnarray*}
{\def\@subeqncr\{\nonumber\@ssubeqncr\subeqnarray}
{\global\advance\c@equation\m@ne\nonumber\endsubeqnarray}
\end{verbatim}
5 An example of the use of this package

When you run the following document through \LaTeX\ you will see the difference between the \texttt{subeqnarray} and \texttt{eqnarray} environments.

\begin{verbatim}
\documentclass[fleqn]{article}
\usepackage{subeqnarray}
\begin{document}
This document shows an example of the use of the \texttt{subeqnarray} environment. Here is one:
\begin{subeqnarray}
\label{eqw}
\slabel{eq0}
x & = & a \times b \\
\slabel{eq1}
& = & z + t\\
\slabel{eq2}
& = & z + t
\end{subeqnarray}
The first equation is number~\ref{eq0}, the last is~\ref{eq2}. The equation as a whole can be referred to as equation~\ref{eqw}.

To show that equation numbers behave normally, here’s an \texttt{eqnarray} environment.
\begin{eqnarray}
\label{eq10}
x & = & a \times b \\
\label{eq11}
& = & z + t\\
\label{eq12}
& = & z + t
\end{eqnarray}
These are equations~\ref{eq10},~\ref{eq11} and~\ref{eq12}.
\end{document}
\end{verbatim}