

tripos: a L^AT_EX class for typesetting exam papers

Markus G. Kuhn
Computer Laboratory, University of Cambridge
<https://www.cl.cam.ac.uk/~mgk25/>

2024/02/02

The `tripos` L^AT_EX class contains macros and style settings for typesetting University of Cambridge exam papers. It has been used to typeset *Computer Science Tripos* papers at the *Computer Laboratory* since 2012. The layout applied follows very closely an earlier set of plainT_EX macros by Frank King, used during 1993–2011. Basic format requirements can be found in the *Guidance Notes for Examination Question Papers*.¹

This document class can be used by

- *question setters*, to draft exam questions and solution notes;
- *examiners*, to typeset and proofread entire question papers;
- *supervisors* and *directors of studies*, to typeset practice papers that combine selected questions from past papers into a format that closely resembles an actual exam paper;
- *lecturers* of Part III and MPhil modules, to prepare test papers.

A *Tripos paper* is structured into *questions* (typically 8–14 per paper), each prepared by a *question setter*, and each normally counting 20 *marks*. Questions may be grouped into *sections* to impose constraints on which subset of questions a student can choose. Questions can also be subdivided into *parts* for which the number of marks is then indicated individually.²

Installation

The `tripos.cls` file, associated documentation, and examples are available for download from

<https://www.cl.cam.ac.uk/local/typography/tripos/>

This class uses several L^AT_EX packages commonly required to typeset Computer Science exam questions. If any of those (e.g., the *St. Mary Road symbol font*) are not yet on your computer, then try installing the following additional packages: *Ubuntu Linux 16.04* – `pgf`, `texlive-latex-extra`, `texlive-math-extra`; *Ubuntu Linux 18.04* – `texlive-latex-extra`, `texlive-science`.

¹<http://www.admin.cam.ac.uk/students/studentregistry/staff/exams/examiners/>

²The dates and structure of *Computer Science Tripos* papers are announced at <https://www.cl.cam.ac.uk/teaching/exams/>, where there is also an archive of past papers.

```

\documentclass{tripos}      % Do not add any commands here
\begin{document}          % outside the "question" environment!
\begin{question}[CSTpartIB,year=2038,paper=3,question=4,author=mgk25]{Exam Tools}

Consider the design of the \texttt{tripos} document class.
\begin{enumerate}

\item \label{easy}\topic{usability} Is it easy to use? \fullmarks{5}
\begin{answer}
Yes, very easy.
\end{answer}

\item Prove the correctness of your answer to part~\ref{easy}. \fullmarks{15}
\end{enumerate}
\begin{answer}
\includegraphics{2038-p03-q04-fig.pdf}
\end{answer}

\end{question}
\end{document}

```

Figure 1: Source file `2038-p03-q04.tex` for a simple example question. This file includes text for solution notes (`answer` environment), which will not be typeset by default.

```

\documentclass{tripos}
\begin{document}
\begin{solutionnotes}
\input{2038-p03-q04}
\end{solutionnotes}
\end{document}

```

Figure 2: Source file `2038-p03-q04-solutions.tex` is a simple wrapper for typesetting the solution-notes version of the question file `2038-p03-q04.tex` (fig. 1).

Use by Tripos question setters

Tripos examiners usually ask question setters to provide them with a separate `*.tex` source file for each question. A simple example of such a question file is shown in figure 1. If you typeset such a question file with `latex` or `pdflatex`, the question will be typeset almost exactly like in the exam paper, however additional metadata that you provide as parameters to the `question` environment will be added to the headings, to help with reviewing questions.

document Never add anything of your own directly before or after the `\begin{document}` line in such a question file. Anything found in the preamble before `\begin{document}` will be discarded by the method that the examiners use to integrate your file into the whole paper.

In particular do not try to use the `\usepackage` command to load additional packages. You can only use the packages and associated options that are always loaded for you by the `tripos` class:

```

\usepackage[utf8]{inputenc}
\usepackage{color}
\usepackage{graphicx}
\DeclareGraphicsExtensions{}
\DeclareGraphicsRule{.pdftex}{pdf}{*}{}
\usepackage{amsmath}

```

```

\usepackage{amssymb}
\usepackage{stmaryrd}
\usepackage{proof}
\usepackage{latexsym}
\usepackage{upgreek}
\usepackage{upquote}
\usepackage{alltt}

```

If you really would like to use another package, please discuss this with the author of the `trijos` class, who might be able to extend the above list.

Likewise, do not change the state of L^AT_EX outside the `question` environment, e.g. by (re)defining macros. Keep any macros that you want to define inside the `question` environment.

Both of these restrictions are in place to make it easy for the examiners to combine questions into a single paper.

question Anything related to a question must be contained within a `question` environment. This begins with a line of the form

```
\begin{question}[\langle key \rangle, \langle key \rangle = \langle value \rangle, \dots] \{ \langle heading \rangle \}
```

The parameter `\{ \langle heading \rangle \}` is (in a *Computer Science Tripos* exam) the name of the lecture course to which the question relates, and should be as it was specified in the paper structure document.

Additional metadata related to the question should be specified in the optional argument as a comma-separated list of `\langle key \rangle = \langle value \rangle` pairs:

```

year=\langle int \rangle      the 4-digit year in which the exam takes place
paper=\langle int \rangle    the number of the paper
question=\langle int \rangle the number of the question
author=\langle str \rangle    the question setter (usually the lowercase CRSId)

```

You can also specify the category of students that will face the question, by adding as `\langle key \rangle` one of the predefined values `CSTpartIA/NST/PBS`, `CSTpartIA`, `CSTpartIB`, `CSTpartII`.

Specifying these parameters ensures that if you process the question file on its own with L^AT_EX for proofreading, all this metadata will be included in the printout. (Less metadata will appear for each question when the examiners typeset the entire paper.)

The same `\label` definition can appear in different questions and it is not possible to reference a `\label` definition in some other question. Equation numbers will restart from (1) in each question.

enumerate Use the normal `enumerate` environment and `\item` to divide a question into parts (a), (b), ... and subparts (i), (ii), ... if desired.

resumeenumerate A variant of the `enumerate` environment that does not reset the item counter.

`\label` In order to refer to such a part (like “(b)(ii)”), use `\label{\langle name \rangle}` after the relevant
`\ref` `\item` to define a name for that part, and then `\ref{\langle name \rangle}` to refer to that label. This ensures consistent typography of such references and makes it easier to reorder or delete parts later.

compact By default the vertical space between paragraphs and list items is equivalent to an entire empty line. The `compact` environment can be used to reduce that, where appropriate, for example around lists of very short items. (Where this results in unequal space above and below the list, you may have to include the following paragraph as well.)

- `quote` The `quote` environment increases the left and right margins to make a block of text stand out (and `quotation` does exactly the same thing). When using the `verbatim` environment to typeset a few lines of a computer file, wrap it into the `quote` environment: `\begin{quote}\begin{verbatim} ... \end{verbatim}\end{quote}`.
- `\hint` Use `\hint{<text>}` to add guidance in a question, which will appear as “[*Hint: <text>*]”.
- `\note` The macro `\note[<prefix>]{<text>}` does the same, but has an optional argument to replace the prefix “Hint” (default: “Note”). Example: `\hint{proof by induction}`
- `\fullmarks` After every part or subpart of a question, or at the end of a question not divided into parts, indicate with `\fullmarks{<n>}` how many marks can be achieved by answering correctly. This will be typeset at the end of the line as “[<n> marks]” (for $n \neq 1$) or “[1 mark]”. All the values $\langle n \rangle$ within one question must add up to the total number of marks that can be achieved per question, which is 20 by default. If your marks do not add up correctly, you will get a warning message “expected 20 marks total, but found ...”, both in L^AT_EX’s diagnostic output, as well as typeset in bold at the end of the question.
- If you have been asked to provide a question with, for example, just 15 marks total, then you can set this non-default marks target by adding “`totalmarks=15`” to the key/value list after `\begin{question}`. You can also specify “`totalmarks=`” to disable the automatic checking of the total number of marks per question. (There is a similar parameter `totalmarkspaper` to set a total marks target for an entire paper.)
- If you want to award up to $\langle n \rangle$ marks for $\langle m \rangle$ aspects of a (part of a) question, you can also write `\fullmarks[<m>]{<n>}`. This will be typeset as “[<n> marks each]” and will add $\langle m \rangle \times \langle n \rangle$ marks to the count.³
- `\fullmarks*` There is also a `\fullmarks*{<n>}{<text>}` variant that typesets just “[<text>]” at the end of the line and adds $\langle n \rangle$ to the count of marks. This lower-level macro gives you more control over the content of the square brackets, but leaves you with the responsibility to ensure that $\langle text \rangle$ and $\langle n \rangle$ actually represent the same number of marks.
- `answer` You can (and should) also provide solution notes in the same file, usually after each `\fullmarks`, using the `answer` environment. These solution notes will not be typeset by default. To proofread them, create a second file that reads the question file inside the `solutionnotes` environment, as show in fig. 2. There, these notes will then appear right after each corresponding question, using a smaller font, between two horizontal black lines, and prefixed with “*Answer:*”.
- `\topic` Examiners may request that the solution notes indicate, which part of the course syllabus a question (or part) relates to. This can also be useful for students and supervisors. Use the `\topic{<syllabus-keywords>}` macro to annotate the solution-notes margin with keywords, at the start of the question, or after any `\item`.
Example: `\topic{proof by induction, recursion}`.

Use by examiners

Examiners collect the individual per-question `*.tex` files from the question setters into a directory and then simply add a wrapper file for the entire paper, such as the one shown in figure 3. It should not be necessary to edit any of the collected per-question files, unless editorial changes are desired. In any included files, the `\documentclass` line, `\begin{document}`, and any preamble lines between these two, as well as `\end{document}`

³Shall we change this to typeset “[$\langle m \rangle \times \langle n \rangle$ marks each]” in future? This would help proofreaders to spot more easily if the multiplier $\langle m \rangle$ is out of date, e.g. because part of a question was deleted.

```

\documentclass{tripos}
\begin{document}
\begin{paper}[CSTpartIB,year=2011,paper=3,day=Wednesday 8 June]

\maketitle
\section
\input{2038-p03-q01}
\input{2038-p03-q02}
\section
\input{2038-p03-q03}
\input{2038-p03-q04}

\end{paper}
\end{document}

```

Figure 3: Source file for a simple example paper.

and any lines after it, are suppressed, using the `docmute` package. This way, the same question file can both be included as part of a paper or be typeset on its own.

paper The `paper` environment, similar to the `question` environment, accepts a comma-separated list of $\langle key \rangle = \langle value \rangle$ pairs as an optional argument, which are handled using the `pgfkeys` package. Any $\langle key \rangle = \langle value \rangle$ pairs set in the optional argument of `\begin{paper}` or `\begin{question}` are only effective within that environment and do not affect anything after the corresponding `\end` statement.

These $\langle key \rangle$ values share the same name space, meaning that parameters that affect the `question` environment can also be changed in the `paper` environment. In addition, there is the `\triposset{\langle key \rangle = \langle value \rangle, \dots}` command, which can also be used to set the same parameters.

Parameters that should be set at the start of the `paper` environment for a Tripos paper include

<code>year = \langle int \rangle</code>	the 4-digit year in which the exam takes place
<code>paper = \langle int \rangle</code>	the number of the paper
<code>day = \langle string \rangle</code>	the date of the paper, e.g. “Monday 1 June” (no year!)

as well as the student-category keys (see `question` environment above).

The `paper` environment sets `metadata=false`, such that questions are printed without per-question metadata. It also configures the page headlines to show a short dot-separated string that includes a tripos identifier (key: `code`), the year, the paper number and the page number, to assist with printing. In the footline, it provides a page number as well as a “(TURN OVER)” indicator on all odd-numbered pages, except for the first and last one.

Since any keys specified in individual questions override those specified for the paper (without warning), it is a good idea to check the metadata in all question files for consistency. This can easily be done with `“fgrep -H '\begin{question}’ *.tex”`.

\maketitle The `\maketitle` macro is used inside the `paper` environment to output the title page of an exam paper, using the metadata previously provided in the form of $\langle key \rangle = \langle value \rangle$ pairs. The detailed content of the title page can be customized using many other keys, in addition to those listed above; see the implementation appendix for details.

If the graphics file `uc-logo.pdf` (University of Cambridge logo) exists, it will be added to the top-left of the title page, scaled to 30 mm width.

- `\section` Use `\section` to start a new section of questions. Sections are numbered automatically with A, B, ...
- `\blankpage` Use `\blankpage` to insert an empty page that only says “*This page is intentionally left blank.*” This can be used to achieve a particular page alignment of questions in double-sided papers. Has no effect inside the `solutionnotes` environment.
- `signoff` Near the end of the exam-paper editing process, examiners usually collect a signature from each question setter on a printout of the final version of their respective question. To print such signoff sheets for each question in a paper, simply replace the `paper` environment with the `signoff` environment, or wrap the the `signoff` environment around the `paper` environment. The latter alternative is supported to allow using a Unix shell command line such as
- ```
pdflatex -jobname 'signoff' \
 '\documentclass{tripos}\begin{document}'\
 '\begin{signoff}\input{paper}\end{signoff}\end{document}'
```
- to generate `signoff.pdf` printouts, without having to modify the `paper.tex` file.
- The `signoff` environment changes some formatting parameters such that each question is prefixed with metadata and a “cover letter” sentence, followed by a signature statement, and printed on its own page (`newpage=true`). It also suppresses the actions of the `\section` and `\maketitle` commands.
- The option `newsheet=true` ensures that each question starts on a new sheet of paper when using a duplex printer.
- `solutionnotes` After the examination, administrators usually release the solution notes. To print solution notes for entire papers, simply change the `paper` environment to the `solutionnotes` environment, or wrap the the `solutionnotes` environment around the `paper` environment (i.e., the commandline trick shown above for `signoff` also works here).
- The `solutionnotes` environment changes some formatting parameters to prominently write “— *Solution notes* —” in the headline of each page, and activates the output of the text provided in the `answers` environment and `\topics` command. It also suppresses the actions of the `\section`, `\maketitle` and `\blankpage` commands.

## Use in practice papers

Some Directors of Studies prepare practice papers for their students, which may combine questions of real papers from different years. Such practice papers can be assembled in the same way as a real paper (see previous section). However, this would cause the questions to appear numbered with their original question number. To avoid this, specify the `renumberquestions=true` option for the `paper` environment. The questions will then just be numbered in their order of appearance, not with their original question number. This way, practice papers can be compiled easily without having to edit the original question files. The following example also shows how you can use parameters like `subtitle` and `time` to identify the paper properly as a practice paper. Example:

```
\documentclass{tripos}
\begin{document}
\begin{paper}[CSTpartIB,year=2015,paper=3,renumberquestions=true,
 day=Wednesday 13 May,time=4.30,endtime=6.00,
 subtitle={Practice paper for John Doe}]
\maketitle
\input{2012-p03-q05-djg}
\input{2013-p03-q03-am}
```

```

\input{2014-p03-q08-acr}
\input{2014-p03-q01-fms}
\input{2012-p03-q02-fms}
\input{2013-p03-q04-tgg}
\input{2014-p03-q04-tgg}
\input{2012-p03-q08-de}
\input{2013-p03-q09-rja}
\end{paper}
\end{document}

```

For the Computer Science Tripos, a L<sup>A</sup>T<sub>E</sub>X source archive of past papers is available as a set of Subversion repositories on the departmental filer:

```
file:///usr/groups/wwwsvn/repositories/tripos-papers/all
```

Example usage of this archive:

```

$ svn checkout file:///usr/groups/wwwsvn/repositories/tripos-papers/all ~/exams
$ TEXINPUTS=$TEXINPUTS:$HOME/exams// pdflatex practicepaper.tex

```

## Use in Part III and MPhil tests

While the `tripos` class was primarily written for typesetting Tripos papers, it has a few additional features that allow it also to be adapted for typesetting, in a similar format, test questions for assessing modular courses (e.g., CST Part III, MPhil ACS):

- The class option `ownpackages` allows users to load their own packages:

```

\documentclass[ownpackages]{tripos}
\usepackage{...}

```

- The key `CSTpartIII/ACS` adjusts the text on the title page, which can be configured further:

```

\begin{paper}[
 CSTpartIII/ACS,
 code=L99,
 year=1314,
 modulename=Experimental Astrosemantics,
 date=Tuesday 22 April 2014,
 time=11:00,
 endtime=12:30,
 rubrics={Candidates should attempt \textbf{three} questions.},
 rubrics2={Submit the answers on the paper provided.},
 titlewarning={You may not start to read the questions printed on the
 subsequent pages of this question paper until instructed that you may
 do so by the Invigilator},
 stationery requirements={Script paper},
 special requirements={Approved calculator permitted},
]

```

For a take-home test, also specify `enddate`.

- The question heading can remain empty:

```
\begin{question}{}

```

# Appendix

## Implementation

### Options

Class option `draft` (default) enables a black warning bar for overfull hboxes and `final` switches it off.

```
1 \DeclareOption{draft}{\setlength\overfullrule{5pt}}
2 \DeclareOption{final}{\setlength\overfullrule{0pt}}
3 \ExecuteOptions{draft}
```

Option `commonpackages` (default) includes a number of packages so they can be used by question setters (whom the `docmute` package would normally prevent from including packages themselves if their question files are included by a paper file). Option `nocommonpackages` disables that.

Option `noownpackages` (default) loads `docmute` and prevents users from calling `\usepackage`, as that would not work anyway when a question file is included under `docmute`. Option `ownpackages` disables that, allowing users to load their own packages.

Option `sans` switches to Helvetica as the main font and option `crop` makes pages smaller by removing margins.

Option `twoside` (default) configures L<sup>A</sup>T<sub>E</sub>X for duplex printing and places the “(TURN OVER)” indicator onto odd-numbered pages. Option `oneside` disables that.

```
4 \newif\ifcommonpackages
5 \newif\ifownpackages
6 \newif\ifsans
7 \newif\ifcrop
8 \DeclareOption{ownpackages}{\ownpackagestrue}
9 \DeclareOption{noownpackages}{\ownpackagesfalse}
10 \DeclareOption{commonpackages}{\commonpackagestrue}
11 \DeclareOption{nocommonpackages}{\commonpackagesfalse}
12 \DeclareOption{sans}{\sanstrue}
13 \DeclareOption{crop}{\cropttrue}
14 \DeclareOption{oneside}{\@twosidefalse}
15 \DeclareOption{twoside}{\@twosidetrue}
16 \ExecuteOptions{twoside,commonpackages,noownpackages}
17 \ProcessOptions
```

### Packages used by this class

The following packages are used by this class: `docmute` to suppress preambles in included files, such that they can also be compiled on their own, and `pgfkeys` to handle  $\langle key \rangle = \langle value \rangle$  parameters. Versions of `docmute` before 2012/01/28 contain a bug that triggers a (presumably harmless) warning message.

```
18 \RequirePackage{pgfkeys}
```

(Furthermore, some commonly required packages are loaded at the end.)

### Layout geometry

Set the normal font size to 12pt and the paper format to A4.

```
19 \input{size12.clo}
```



```

20 \setlength\paperwidth {210mm}
21 \setlength\paperheight{297mm}

```

The page layout carefully tries to approximate the historic practice used in Computer Science Tripos papers, as implemented by Frank King back in about 1993 (which you can find on the Computer Laboratory filer in `/home/chn2/tripos/tripos2011/FORMAT.tex`). However, the visual result will still differ slightly in horizontal letter spacing, because we now use proper 12pt fonts here, rather than the previously used 10pt fonts magnified by a factor 1.2.

One official layout requirement is: “The total area must not exceed 6" × 9" [...] otherwise text could be lost during production of the Bound Volumes of Examination Papers.”

We now first specify the vertical dimensions. (If you think the values look a bit odd: they were originally rounder numbers chosen by Frank King, which were then multiplied with 1.2, as he had scaled the entire page by that factor using `\magnification=1200`. As we do not use `\magnification` here, we had to multiply each length here by 1.2.)

We use `\raggedbottom`, because exam paper pages rarely extend to the end of a page, and where they do, there is no need for alignment of the bottom across pages. This choice also prevents excessive vertical stretching on solution notes, where the answer environment currently does not allow page breaks.

```

22 \setlength\voffset{0pt}
23 \setlength\topmargin{-53pt}
24 \setlength\headheight{12pt}
25 \setlength\headsep{67.5pt}
26 \setlength\textheight{664pt}
27 \setlength\parskip{\baselineskip}
28 \setlength\lineskip{1pt}
29 \setlength\normallineskip{1pt}
30 \setlength\footskip{2\parskip}
31 \raggedbottom

```

Next the horizontal dimensions. `\indentation` will be used by our customization of all the list environments (`enumerate`, `itemize`, `quote`, ...).

```

32 \newlength{\indentation}
33 \newlength{\numbergap}
34 \setlength\indentation{25pt}
35 \setlength\numbergap{12pt}
36 \setlength\hoffset{0pt}
37 \setlength\oddsidemargin{27.5pt}
38 \setlength\evensidemargin{\oddsidemargin}
39 \setlength\textwidth{432pt}
40 \setlength\parindent{0pt}

```

Layouts with reduced margins or Helvetica font may help some special-needs readers.

```

41 \ifcrop
42 \setlength\hoffset{-22mm}
43 \setlength\voffset{-32mm}
44 \setlength\paperwidth {170mm}
45 \setlength\paperheight{250mm}
46 \fi
47 \ifsans
48 \RequirePackage{helvet}
49 \RequirePackage[helvet]{sfmath}
50 \renewcommand{\familydefault}{\sfdefault}
51 \fi

```

Hyphenation was originally disabled completely in the interest of readability, but that sometimes leads to overstretched spacing in justified lines. So currently, we only strongly discourage hyphenation here. We might use `\raggedright` or the `ragged2e` package in future.

```
52 \pretolerance=1000
53 \tolerance=2000
54 \hyphenpenalty=2000
55 \exhyphenpenalty=2000
```

`enumerate` We now configure the `enumerate` environment, such that it uses the required item labels  
`itemize` for parts (a), (b), ... and subparts (i), (ii), ... of questions. We also define a third level (A), (B), ... and a fourth level (1), (2), ..., but expect those to be rarely used in practice. The `\a@theenum` plain-text variants are needed for the `.marks` file. The `enumerate` item labels are left aligned, whereas those in `itemize` are centred within the indentation margin. The indentation margin used in all list environments (not just `enumerate` and `itemize`) is set to `\indentation`.

```
56 \newcommand{\@listo}{
57 \setlength\topsep{0pt}
58 \setlength\partopsep{0pt}
59 \setlength\parsep{\parskip}
60 \setlength\itemsep{0pt}
61 \setlength\leftmargin{\indentation}
62 \setlength\labelsep{4pt}
63 \setlength\labelwidth{\leftmargin}
64 \addtolength\labelwidth{-\labelsep}
65 }
66 \renewcommand{\@listi }{\@listo}
67 \renewcommand{\@listI }{\@listo}
68 \renewcommand{\@listii }{\@listo}
69 \renewcommand{\@listiii }{\@listo}
70 \renewcommand{\@listiv }{\@listo}
71 \renewcommand{\@listv }{\@listo}
72 \renewcommand\theenumi {(\textit{\@alph\c@enumi})}
73 \renewcommand\theenumii {(\textit{\@roman\c@enumii})}
74 \renewcommand\theenumiii{(\@Alph\c@enumiii)}
75 \renewcommand\theenumiv {(\the\c@enumiv)}
76 \newcommand\a@theenumi {(\@alph\c@enumi)}
77 \newcommand\a@theenumii {(\@roman\c@enumii)}
78 \newcommand\a@theenumiii{(\@Alph\c@enumiii)}
79 \newcommand\a@theenumiv {(\the\c@enumiv)}
80 \newcommand\labelenumi {\makebox[\labelwidth][l]{\theenumi}}
81 \newcommand\labelenumii {\makebox[\labelwidth][l]{\theenumii}}
82 \newcommand\labelenumiii{\makebox[\labelwidth][l]{\theenumiii}}
83 \newcommand\labelenumiv {\makebox[\labelwidth][l]{\theenumiv}}
84 \renewcommand\p@enumii {\theenumi}
85 \renewcommand\p@enumiii {\theenumi\theenumii}
86 \renewcommand\p@enumiv {\p@enumiii\theenumiii}
87 \newcommand\labelitemi {\makebox[\labelwidth][c]{\textbullet\hspace{-\labelsep}}}
88 \newcommand\labelitemii {\makebox[\labelwidth][c]{\textbf{\textendash}\hspace{-\labelsep}}}
89 \newcommand\labelitemiii{\makebox[\labelwidth][c]{\textasteriskcentered\hspace{-\labelsep}}}
90 \newcommand\labelitemiv {\makebox[\labelwidth][c]{\textperiodcentered\hspace{-\labelsep}}}
91 \newcommand\a@theenum{%
92 \ifnum\@enumdepth>0\a@theenumi
93 \ifnum\@enumdepth>1\a@theenumii
94 \ifnum\@enumdepth>2\a@theenumiii
95 \ifnum\@enumdepth>3\a@theenumiv\fi\fi\fi\fi}
```

`resumeenumerate` The `resumeenumerate` environment calls `enumerate` with a temporarily redefined `\usecounter`

macro, which (unlike the original) does not reset the counter used.

```
96 \newenvironment{resumeenumerate}{\let\tmp@usecounter\usecounter
97 \def\usecounter##1{\@nmblisttrue\def\@listctr{##1}}
98 \enumerate\let\usecounter\tmp@usecounter
99 }{\endenumerate}
```

`compact` The default `\parskip` value inserts an entire empty line between paragraphs and list items. The `compact` environment can be used to reduce that vertical gap where appropriate, for example around lists of very short items.

```
100 \newenvironment{compact}{\setlength{\parskip}{0.5\baselineskip}}{}
```

`quote` We adapt the `quotation` and `quote` environments from `article.cls`. They differ slightly from each other in `article.cls` but behave identically here, because we have `\parindent=0pt`.

```
101 \newenvironment{quote}
102 {\list{}{\rightmargin\leftmargin}%
103 \item\relax}
104 {\endlist}
105 \newenvironment{quotation}
106 {\list{}{\rightmargin\leftmargin}%
107 \item\relax}
108 {\endlist}
```

And now a number of standard settings, largely copied from `article.cls`, mostly regarding table dimensions.

```
109 \pagenumbering{arabic}
110 \setlength\arraycolsep{5\p@}
111 \setlength\tabcolsep{6\p@}
112 \setlength\arrayrulewidth{.4\p@}
113 \setlength\doublerulesep{2\p@}
```

We also declare some old plain $\TeX$  font macros (`\rm`, `\tt`, `\it`, `\bf`, ...), solely for backwards-compatibility with `article.cls`, but only if option `ownpackages` is selected. Some packages might rely on them, but we do not use them otherwise.

```
114 \ifownpackages
115 \DeclareOldFontCommand{\rm}{\normalfont\rmfamily}{\mathrm}
116 \DeclareOldFontCommand{\sf}{\normalfont\sfamily}{\mathsf}
117 \DeclareOldFontCommand{\tt}{\normalfont\ttfamily}{\mathtt}
118 \DeclareOldFontCommand{\bf}{\normalfont\bfseries}{\mathbf}
119 \DeclareOldFontCommand{\it}{\normalfont\itshape}{\mathit}
120 \DeclareOldFontCommand{\sl}{\normalfont\slshape}{\@nomath\sl}
121 \DeclareOldFontCommand{\sc}{\normalfont\scshape}{\@nomath\sc}
122 \DeclareRobustCommand*\cal{\@fontswitch\relax\mathcal}
123 \DeclareRobustCommand*\mit{\@fontswitch\relax\mathnormal}
124 \fi
```

`\absize` The `\absize` macro sets the font size for the letters A and B in “Part IA” and “Part IB”. This should be equivalent to `\relsize{-2}` from `relsize.sty`.

```
125 \newcommand{\absize}{%
126 \ifx\@currsize\normalsize\footnotesize\else % test more likely sizes first
127 \ifx\@currsize\small\scriptsize\else
128 \ifx\@currsize\footnotesize\tiny\else
129 \ifx\@currsize\large\small\else
130 \ifx\@currsize\Large\normalsize\else
```

```

131 \ifx\@currsize\LARGE\large\else
132 \ifx\@currsize\scriptsize\tiny\else
133 \ifx\@currsize\huge\Large\else
134 \ifx\@currsize\Huge\LARGE
135 \fi\fi\fi\fi\fi\fi\fi\fi\fi
136 }

```

## Configuration

We now set up a lot of mechanics for configuring formatting. This starts with declaring counters for the paper, section, and question number, which will automatically increment but which can also be overridden by the user.

```

137 \newcounter{paper}
138 \newcounter{section}
139 \newcounter{question}
140 \newcounter{origquestion}
141 \setcounter{paper}{1}
142 \setcounter{question}{1}

```

Next we need a couple of Boolean variables, to distinguish various formatting modes: whether question-metadata, answers and topics keywords shall be printed, whether questions should start on a new page or even on a new sheet, and whether we are producing signoff sheets (rather than normal papers or solution notes).

```

143 \newif\ifmetadata
144 \newif\ifanswers
145 \newif\iftopics
146 \newif\ifrenumberquestions
147 \newif\ifnewpage
148 \newif\ifnewsheet

```

If the `recordmarks` flag is set, `\fullmarks` writes into a `\jobname.marks` file the maximum number of marks for each subquestion. This optional output file can be useful for automatically configuring marking tools (e.g., spreadsheet templates).

```

149 \newif\ifrecordmarks

```

`\triposset` As mentioned, the  $\langle key \rangle = \langle value \rangle$  parameters that can be provided to configure this class are handled via the `pgfkeys.sty` package described in section V of the *TikZ & PGF Manual*. You may want to read its documentation before trying to understand the following code. To summarize briefly, assigning a value to a key can trigger one of several actions with `pgfkeys`: some L<sup>A</sup>T<sub>E</sub>X command gets executed (where that was earlier associated with the key via a `.code` handler), the value gets stored under the key as a text string (where an `.initial` value was provided earlier), the value gets stored in a Boolean variable (via the `.is` handler), or some other keys get assigned a value (via the `.style` handler).

All the PGF keys used by this class start with the path prefix `/tripos/` to avoid clashes with other packages using the same mechanism. The macros `\triposset` and `\triposget` provide easy write and read access to such keys, and `\triposifempty` is provided as a conditional clause to test whether such a key has a non-empty value.

```

150 \newcommand*\triposset[1]{\pgfkeys{/tripos}#{1}}
151 \newcommand*\triposget[1]{\pgfkeysvalueof{/tripos/1}}
152 \newcommand\triposifempty[3]{\pgfkeysgetvalue{/tripos/1}{\@value}%
153 \ifx\@value\relax#2\else\ifx\@value\@empty#2\else#3\fi\fi}

```

The keys `paper` and `question` are implemented by handler code that simply writes the corresponding values into the counter registers of the same name, where they can easily

be incremented.

```
154 \triposset{paper/.code={\setcounter{paper}{#1}}}
155 \triposset{question/.code={\ifrenumberquestions
156 \setcounter{origquestion}{#1}\else
157 \setcounter{question}{#1}\fi}}
```

Others set a boolean value according to their value.

```
158 \triposset{metadata/.is if=metadata,
159 answers/.is if=answers,
160 topics/.is if=topics,
161 renumberquestions/.is if=renumberquestions,
162 newpage/.is if=newpage,
163 newsheet/.is if=newsheet,
164 metadata=true,answers=false,topics=false,
165 renumberquestions=false,
166 newpage=true,newsheet=false}
```

Some keys use the `pgfkeys` mechanics to store a string, others are style specifications that merely set one or more other keys.

```
167 \triposset{title/.initial={title=???},
168 subtitle/.initial=,
169 code/.initial={code=???},
170 year/.initial={year=???},
171 date/.initial={date=???},
172 day/.style={date=#1 \triposget{year}},
173 time/.initial={time=???},
174 enddate/.initial=,
175 endtime/.initial={endtime=???},
176 subject/.initial={subject=???},
177 rubrics/.initial={rubrics=???},
178 rubrics2/.initial=,
179 author/.initial={author=???},
180 fullmarks/.style={totalmarks=#1}, % for backwards compatibility
181 totalmarks/.initial=,
182 totalmarkspaper/.initial=,
183 recordmarks/.code={\ifrecordmarks\else\newwrite\@marksfile
184 \immediate\openout\@marksfile\jobname.marks\recordmarkstrue\fi},
185 recordmarks/.value forbidden}
```

The cover sheets can feature boxes in the centre and in the bottom left and right corner. We define here keys for what goes into those boxes, along with styles that add commonly used headings or a decorative frame. This way, a lot of the cover sheet layout can be tweaked in future merely by changing the values assigned to these keys.

```
186 \triposset{titlecentre/.initial=}
187 \triposset{titlebottomleft/.initial=}
188 \triposset{titlebottomright/.initial=}
189 \triposset{titlewarningwidth/.initial=278pt}
190 \triposset{titlewarning/.style={titlecentre={
191 \fboxrule=3pt\fboxsep=1.8pt
192 \fbox{\fboxrule=1.2pt\fboxsep=13pt
193 \fbox{\parbox{\triposget{titlewarningwidth}}{\centerlastline
194 \large\bfseries #1}}}
195 }}}
196 \triposset{stationery requirements/.style={
197 titlebottomleft={STATIONERY REQUIREMENTS\\\itshape #1}
198 }}
199 \triposset{special requirements/.style={
```

```

200 titlebottomright={SPECIAL REQUIREMENTS\\itshape #1}
201 }}

```

`\centerlastline` The `\centerlastline` macro used above in the style key `titlewarning` reconfigures the typesetting of a paragraph such that all lines are justified, except for the last one, which is centered. (Frank King did this in the old style manually with the warning box on the title page; we provide here a macro to achieve the same automatically.)

```

202 \newcommand\centerlastline{\leftskip=0pt plus .5fil
203 \rightskip=0pt plus -.5fil
204 \parfillskip=0pt plus 1fil}

```

The cover sheets of Tripos papers feature instructions known as “rubrics”. We split the rubrics into a first and a second paragraph, the first being very specific to the structure of a paper, whereas the second is of a more general nature. Rather than repeating the rubrics in each paper file, the `structure` key choices defined here collect options for the first paragraph of the rubrics that have been used in the past, such that they can easily be used again in future.

```

205 \triposset{attempts/.style={rubrics2={Submit the answers in
206 #1 \textbf{separate} bundles, each with its own cover sheet. On each
207 cover sheet, write the numbers of \textbf{all} attempted questions,
208 and circle the number of the question attached.
209 }}}
210 \triposset{structure/.is choice}
211 \triposset{structure/1abc2d/.style={rubrics={Answer \textbf{one} question
212 from each of Sections A, B and C, and \textbf{two} questions
213 from Section D.
214 }}}
215 \triposset{structure/5q/.style={rubrics={
216 Answer \textbf{five} questions.}}}
217 \triposset{structure/aq/.style={rubrics={
218 Answer \textbf{all} questions.
219 }}}
220 \triposset{structure/3a1b40/.style={rubrics={
221 Answer \textbf{three} questions from Section A\\
222 \makebox[0pt][r]{and} \textbf{one} question
223 from Section B.}[2.4pt]
224 Forty per cent of the marks will be allocated to Section B.
225 }}}
226 \triposset{structure/5qmax2ps/.style={rubrics={
227 Answer \textbf{five} questions.}[2.4pt]
228 No more than \textbf{two} questions
229 from any one section are to be answered.
230 }}}
231 \triposset{structure/5qmin1ps/.style={rubrics={
232 Answer \textbf{five} questions.}[2.4pt]
233 At least \textbf{one} question from each section is to be answered.
234 }}}

```

The following styles are invoked at the start of a paper, `solutionnotes` and `signoff` environment, respectively, and have been defined such that they can easily be overridden from `tripos-config.tex`.

```

235 \triposset{paper style/.style={newpage=false}}
236 \triposset{solutionnotes style/.style={}}
237 \triposset{signoff style/.style={newsheet=true}}

```

We now define a number of style keys for the different student groups. Such style keys are merely shorthand for setting the values of several other keys. The `CST` style is a superstyle

collecting settings common among the CSTpartIA, CSTpartIB, and CSTpartII keys. If this package is ever to be used by another department, the main extension needed are further styles along the lines of those.

```

238 \triposset{CST/.style={
239 subject=COMPUTER SCIENCE \ Paper \arabic{paper},
240 code=CST,subtitle=,totalmarks=20,time=1.30,endtime=4.30,attempts=five,
241 titlewarning={You may not start to read the
242 questions printed on the subsequent pages of this question paper
243 until instructed that you may do so by the Invigilator},
244 stationery requirements={Script paper\Blue cover sheets\Tags},
245 special requirements={Approved calculator permitted}
246 }}
247 \triposset{CSTpartIA/.style={
248 CST,code=CST0,
249 structure=1abc2d,title=COMPUTER SCIENCE TRIPOS \ Part I{\absize A}}
250 \triposset{CSTpartIAIB/.style={
251 CST,code=CST0+CST1,
252 structure=1abc2d,title={COMPUTER SCIENCE TRIPOS
253 \ Part I{\absize A}~{\absize 75\%}, Part I{\absize B}~{\absize 50\%}}
254 \triposset{CSTpartIB/.style={
255 CST,code=CST1,
256 structure=5q,title=COMPUTER SCIENCE TRIPOS \ Part I{\absize B}}
257 \triposset{CSTpartIBII/.style={
258 CST,code=CST1+CST2,
259 structure=5q,title={COMPUTER SCIENCE TRIPOS
260 \ Part I{\absize B}~{\absize75\%}, Part II~{\absize 50\%}}
261 \triposset{CSTpartII/.style={
262 CST,code=CST2,
263 structure=5q,title=COMPUTER SCIENCE TRIPOS \ Part II}}
264 \triposset{CSTpartIA/NST/.style={
265 CSTpartIA,
266 subtitle={NATURAL SCIENCES TRIPOS \ Part I{\absize A} \ (Paper CS/1)}
267 }}
268 \triposset{CSTpartIA/NST/PPS/.style={
269 CSTpartIA,
270 subtitle={NATURAL SCIENCES TRIPOS \ Part I{\absize A} \ (Paper CS/1)\
271 POLITICS, PSYCHOLOGY, AND SOCIOLOGY TRIPOS \ Part I \ (Paper 9)}
272 }}
273 \triposset{CSTpartIA/NST/PBS/.style={
274 CSTpartIA,
275 subtitle={NATURAL SCIENCES TRIPOS \ Part I{\absize A} \ (Paper CS/1)\
276 PSYCHOL. AND BEHAVIOURAL SCIENCES TRIPOS \ Part I \ (Paper CS~1)}
277 }}

```

The CSTpartIII/ACS style key configures the cover page for use in CST Part III and MPhil ACS tests. Unlike the above keys for undergraduate papers, it leaves much of the text on the cover page to be set by each paper (via rubics, rubics2, titlewarning, etc.), as the details vary much more in modular courses.

```

278 \triposset{CSTpartIII/ACS/.style={
279 title={COMPUTER SCIENCE TRIPOS \ Part III\
280 MPhil IN ADVANCED COMPUTER SCIENCE},
281 metadata=false,
282 paper=0
283 },
284 modulename/.style={subject={\textbf{\large Module \triposget{code} -- #1}}
285 }

```

The variant of the cover page defined by the following style key was suggested by Alan Mycroft for use in CST Part III and MPhil ACS take-home tests. It also shows a trick

to include several paragraphs in rubrics2: while you cannot use `\par` inside a PGF key, you can fake the start of a new paragraph just as well using `\\[\parskip]`.

```
286 \triposset{takehome/.style={
287 structure=aq,
288 rubrics2={
289 Answers may be either handwritten in the
290 booklet provided, or computer printed.
291 If submitting computer-printed answers,
292 please use the yellow cover sheet provided.
293 \\[\parskip]
294 On the cover page, enter the numbers of all the
295 questions you have answered. Put a circle around the number(s) of the
296 question(s) you have answered in each answer booklet if you have used
297 more than one book.
298 \\[\parskip]
299 All booklets and cover sheets must be returned to
300 Graduate Education Office whether used or not.
301 \\[2\parskip]
302 The completed answers should be submitted to
303 the Graduate Education Office
304 \textbf{no later than \triposget{endtime} on \triposget{enddate}}}.
305 \\[\parskip]
306 Students will be required to sign an undertaking that
307 work submitted will be entirely their own;
308 \textbf{no collaboration is permitted}}.
309 },
310 stationery requirements={Two 20-page answer booklets\\Yellow cover sheet}
311 }}
```

Modify the following in `tripos-config.tex` to indicate access restrictions or embargo dates for solution notes.

```
312 \triposset{solutionnotes head/.initial={--- Solution notes ---}}
```

The following text will be placed above and below an exam question on a signoff sheet.

```
313 \triposset{
314 signoff request/.initial={
315 An examination question which you set recently is
316 likely to appear as reproduced below. Please check carefully
317 that this is what you intended.
318 },
319 signoff declaration/.initial={
320 I have carefully checked the above and can find no errors.
321 }
322 }
```

There is also a variant signoff sheet for question checkers, which can be produced with the `signoffchecker` environment, and which adds the following text instead.

```
323 \triposset{
324 signoff checker request/.initial={
325 An examination question which you checked recently is
326 likely to appear as reproduced below. Please check carefully
327 that this is what you intended.
328 },
329 signoff checker declaration/.initial={
330 I have carefully checked the above and can find no errors.
331 }
332 }
```



## Sections and questions

`\section` We now come to the mechanics for typesetting section and question headings. This has ended up being rather complex, mostly because of the requirements for managing space between questions and sections. The class tries to avoid pagebreaks within a question. This is achieved by using `\filbreak` at the start of each question. If a question is at the start of a new section, the `\section` macro will already issue this `\filbreak` and then set `\if@sectionstart` to true, to suppress another `\filbreak` at the start of the question environment.

```
333 \newif\if@sectionstart
334 \newcommand\section{
335 \ifpaper
336 \par
337 \addtocounter{section}{1}
338 \@sectionstarttrue
339 \ifnewsheet\cleardoublepage\else\ifnewpage\clearpage\else\filbreak\fi\fi
340 \vspace{3em}
341 \hspace*{-\indentation}\textbf{SECTION~\Alph{section}}
342 \par
343 \fi
344 }
```

`question` The question environment does several things:

- It starts the question with a bold question number, followed by the heading of the question (mandatory parameter #2). We typeset the question number into the left margin using the `list` environment, such that if the following question heading is empty (e.g., if the class is used in Part III tests), any subsequent text or list item will continue immediately on the same line.
- It also sums up the marks awarded with `\fullmarks` and compares them at the end with the target sum.
- When additional metadata has to be displayed, this is typeset with negative `vspace` above the question heading, in a way such that the layout of the paper is not affected by whether the metadata is shown or not. This gets a bit complicated as several cases have to be distinguished, e.g. whether the question is preceded by a section header or not. Metadata will never be displayed if the question heading is empty. (That restriction should be fine in practice, as empty question headings are meant for Part III tests, where displaying question metadata is probably not useful anyway.)
- The `question` environment also calls hooks for outputting an additional prelude and postscriptum, which can be used to add a request and declaration text if the question appears on a signoff sheet.

```
345 \newcounter{marksum}
346 \newcounter{marksumpaper}
347 \newcommand\questionprelude{}
348 \newcommand\questionpostscriptum{}
349 \newlength\questiongap
350 \setlength\questiongap{3em}
351 \newenvironment{question}[2][\triposset{author=#1}%
352 \par
353 \ifrecordmarks\immediate\write\@marksfile{question|\triposget{year}}|%
354 \arabic{paper}|\arabic{question}|\triposget{author}|\#2}\fi%
355 \if@sectionstart
356 \else
357 \ifnewsheet\cleardoublepage\else\ifnewpage\clearpage\else\filbreak\fi\fi
358 \ifmetadata
```

```

359 \vspace{4\baselineskip}% do not (see below) move above question heading
360 \else
361 \vspace{\questiongap}% regular space between questions
362 \fi
363 \fi
364 \global\@sectionstartfalse
365 \beginingroup
366 \setcounter{marksum}{0}%
367 \setcounter{equation}{0}%
368 \setlength\partopsep{0pt}
369 \setlength\topsep{0pt}
370 \let\lonely@item@error\makelabel% preserve default definition
371 \trivlist
372 \item[{\makebox[0pt][r]{\textbf{\strut\arabic{question}}\hspace{\numbergap}}}]
373 \def\makelabel{\lonely@item@error}% restore default
374 \def\question@heading{#2}\ifx\question@heading\@empty\else
375 \questionprelude
376 \ifmetadata
377 \makebox[0pt][l]{\parbox{\linewidth}{%
378 \if@sectionstart
379 \vspace*{-8\baselineskip}% move above section and question heading
380 \else
381 \vspace*{-4\baselineskip}% move above question heading
382 \fi
383 \hspace*{-\indentation}\textbf{\triposget{title} -- \triposget{year}}
384 -- Paper \arabic{paper}
385 \ifrenumberquestions-- Question \arabic{origquestion}\fi}}}%
386 \fi
387 \textbf{\question@heading\ifmetadata\ (\triposget{author})\fi}\par\fi
388 \ignorespaces
389 }{
390 \triposifempty{totalmarks}{%
391 \ifnum\value{marksum}=\triposget{totalmarks}
392 \else
393 \def\markswarning{expected \triposget{totalmarks} marks total,
394 but found \arabic{marksum}}
395 \ClassWarningNoLine{tripos}{Question \arabic{question}: \markswarning}
396 \textbf{[Warning: \markswarning]}\par
397 \fi
398 }
399 \endtrivlist
400 \questionpostscriptum
401 \endgroup
402 \addtocounter{question}{1}
403 }

```

**\fullmarks** Macros for indicating the number of marks that can be achieved. **\fullmarks@text** is the low-level command that outputs the text and sums up the marks, the others are various frontends for generating the displayed text.

```

404 \newcommand{\fullmarks}{\@ifstar\fullmarks@text\fullmarks@integer}
405 \newcount\@marks
406 \newcommand*{\fullmarks@integer}[2][1]{\@marks=#2\multiply\@marks by#1%
407 \fullmarks@text{\the\@marks}{#2 mark\ifnum#2=1 \else s\fi\ifnum#1=1
408 \else\space each\fi}}
409 \newcommand*{\fullmarks@text}[2]{%
410 \ifrecordmarks\immediate\write\@marksfile{fullmarks|\a@theenum|#1|#2}\fi%
411 \addtocounter{marksum}{#1}\addtocounter{marksumpaper}{#1}%
412 {\hspace*{\fill}\nolinebreak[1]}%
413 \hspace{5pt}\hspace*{\fill}\mbox{[#2]}\parfillskip=0pt%

```

414 `\finallyphendemerits=0\par}}`

`\label` Question setters may want to use `\label` and `\ref` to refer to other parts of the same  
`\ref` question. However, to make questions easy to combine into a single paper, we want to allow the use of identical labels in different questions. Therefore, we reimplement `\label` and `\ref` to automatically add a question-specific prefix to each label, thereby creating a per-question namespace for labels.

```
415 \def\question@labelprefix{\triposget{year}-p\arabic{paper}-q\arabic{question}}
416 \let\orig@label=\label
417 \let\orig@ref=\ref
418 \let\orig@pageref=\pageref
419 \renewcommand*\label[1]{\orig@label{\question@labelprefix:#1}}%
420 \renewcommand*\ref[1]{\orig@ref{\question@labelprefix:#1}}%
421 \renewcommand*\pageref[1]{\orig@pageref{\question@labelprefix:#1}}%
```

`\topic` The `\topic` macro uses `\marginpar` to annotate question parts in the margin with corresponding syllabus keywords when printing solution notes. In order to achieve that `\topic` annotates the following paragraph or list item, we do not call `\marginpar` directly. Instead, we just record the topic keywords in `\@topics` and print them out via `\do@topics` only when the next paragraph actually starts.

```
422 \let\@topics\@empty
423 \newcommand*\topic[1]{\iftopics\g@addto@macro\@topics{#{1}\par}\fi}
424 \@mparswitchfalse
425 \setlength\marginparwidth{75pt}
426 \setlength\marginparsep{10pt}
427 \reversemarginpar
428 \def\output@topics{\global\let\@@topics\@topics
429 \global\let\@topics\@empty
430 \ifx\@@topics\@empty\else
431 \marginpar{\sffamily\footnotesize\raggedright\@@topics}\fi}
```

We hook a call to `\output@topics` into `\everypar` to get it called at the start of every paragraph. We use a technique proposed by David Kastrup<sup>4</sup> to subvert the `\everypar` token register such that our modification of `\everypar` can coexist with L<sup>A</sup>T<sub>E</sub>X's use of it, for example in lists.

```
432 \let\tripos@@everypar\everypar
433 \newtoks\tripos@everypar
434 \tripos@everypar\expandafter{\the\everypar}
435 \tripos@@everypar{\output@topics\the\tripos@everypar}
436 \let\everypar\tripos@everypar
```

`\hint` The macros `\hint` and `\note` can be used to typeset hints and notes that should be  
`\note` uniformly distinguished from the main text of a question.

```
437 \newcommand*\hint[1]{\note[Hint]{#1}}
438 \newcommand*\note[2][Note]{[\emph{#1:} #2]}
```

`answer` If answers are not being typeset, the entire content of the `answer` environment is fed into an `lrbox` and discarded. If we skip outputting the answer box, that also suppresses writing any `\label` entries from it into the aux file, as T<sub>E</sub>X executes the underlying `\write` command only in the output routine. So to suppress any complaints from `\ref` and `\pageref` commands inside a skipped answer box, we redefine those two commands to be empty. Support for footnotes is implemented only inside the `answer` environment.

---

<sup>4</sup><http://www.tex.ac.uk/cgi-bin/texfaq2html?label=subverttoks>

We also reset `\makelabel` to avoid `\item` working with a list environment opened outside an `answer` environment.

```

439 \newsavebox{\answerbox}
440 \newcommand{\answerheader}{\emph{Answer:}\hspace{0.8em plus 0.2em}}
441 \newenvironment{answer}{\par\pagebreak[1]
442 \ifanswers\else\renewcommand*\ref[1]{\renewcommand*\pageref[1]{} \fi
443 \renewcommand{\fullmarks}{\ClassError{tripos}
444 {\@backslashchar fullmarks not allowed in answer environment}}
445 \def\makelabel##1{%
446 \@latex@error{Lonely \string\item--perhaps a missing
447 list environment}\@ehc}
448 \ifanswers\else\begin{group}\lrbox{\answerbox}\begin{group}\minipage{\linewidth}\fi
449 \parskip=\medskipamount
450 \footnotesize\let\@listi\@listI
451 \renewcommand\footnoterule{%
452 \kern8\p@\hrule\@width.15\columnwidth\kern3\p@}
453 \newcommand\@makefntext[1]{\footnotesize
454 \parindent 1em%
455 \noindent
456 \hb@xt@1.8em{\hss\@makefnmark}##1}%
457 \rule{\linewidth}{1pt}
458 \par\nobreak\nointerlineskip\vspace{-\parskip}\vspace{4pt}
459 \answerheader\nopagebreak\ignorespaces
460 }{%
461 \par\nopagebreak\nointerlineskip\vspace{-\parskip}\vspace{4pt}
462 \rule{\linewidth}{1pt}%
463 \ifanswers\else\endminipage\endgroup\endlrbox\endgroup\fi
464 \par\pagebreak[2]
465 }

```

## Miscellaneous

The macros in this section may be of use during the paper editing process. (Some of them are experimental or obsolete and may be removed from future revisions of this document class.)

`\blankpage` The `\blankpage` macro produces a page that only says “*This page is intentionally left blank.*” It can be used to achieve a particular page alignment of questions in double-sided papers.

```

466 \newcommand\blankpage{
467 \ifpaper
468 \clearpage
469 \vspace*{\fill}
470 \begin{center}
471 \emph{This page is intentionally left blank.}
472 \end{center}
473 \vspace*{\fill}
474 \clearpage
475 \fi
476 }

```

`\awaiting` The `\awaiting` macro can be used as a standard placeholder in questions for which no text has been received yet.

```

477 \newcommand*\awaiting[1]{
478 \emph{\ldots\ awaiting text from #1 (\triposget{author}) \ldots}
479 \triposset{totalmarks=}
480 \typeout{Awaiting question \arabic{question} from \triposget{author}:

```

```
481 \question@heading}
482 }
```

For use inside the question environment:

`\context` The `\context` macro and `subjectareas` environment were used to indicate which parts of the syllabus a question relates to at the start of a question. They are now superseded by `\topic` and should no longer be used.

```
483 \newcommand*\context[1]{\par
484 \iftopics[\textit{Context: #1.}]\par\fi}
485 \newsavebox{\subjectareasbox}
486 \newenvironment{subjectareas}{\par
487 \begin{lrbox}{\subjectareasbox}\begin{minipage}{\linewidth}\textit
488 \bgroup\ignorespaces
489 }{\unskip\egroup}\end{minipage}\end{lrbox}}%
490 \iftopics\usebox{\subjectareasbox}\fi
491 }
```

`\continued` A marked page-break for questions longer than one page.

```
492 \newcommand\continued{\ifanswers\else
493 \vfill\rightline{\textbf{[continued \ldots]}}
494 \newpage\fi
495 }
```

`\spacer` Adds a height indicator for how much space to leave at least at the bottom of a page when drafting a question. The vertical rule generated is as high as a section heading or end-of-paper marker. This is a tool for question setters keen to fill the page as much as possible. Its use is discouraged: a question should always be much shorter than a full page.

```
496 \newcommand\spacer{\par
497 \parbox{\linewidth}{\rule{2pt}{42pt}\qquad
498 \raisebox{10pt}{\parbox[b]{406pt}{\centering
499 Please leave this much space at the bottom of the page,\
500 to allow for a section header or end-of-paper footer.}\par}}
```

## Typesetting papers, solution notes, signoff sheets

`\titlerule` The `\titlerule` command simply outputs the vertical rules that appear on the cover page. They go across the full text width, plus extend by `\indentation` into the left margin.

```
501 \newcommand\titlerule{\par\nointerlineskip
502 \makebox[\textwidth]{\kern-\indentation\leaders\vrule height 0.5pt\hfill
503 \relax}\par\nointerlineskip}
```

`\maketitle` After these preparations, we now can typeset the cover page of a paper:

```
504 \newcommand\maketitle{
505 \ifpaper
506 \thispagestyle{papertitle}
507 \makebox[0pt][l]{\IfFileExists{uc-logo.pdf}{%
508 \kern-\indentation\raisebox{2\baselineskip}[0pt][0pt]{%
509 \includegraphics[width=30mm]{uc-logo.pdf}}}{}}%
510 {\large\textbf{\ifnum\triposget{year}>2020%
511 \triposifempty{code}{}\triposget{code}}\fi%
512 \triposget{title}
513 \triposifempty{subtitle}{}\small\triposget{subtitle}}}\par}
```

```

514 \vskip 6pt
515 \titlerule
516 \trijosifempty{enddate}
517 {\trijosget{date}\quad\trijosget{time} to \trijosget{endtime}}
518 {\trijosget{date}\hspace{1em minus 0.3em}\trijosget{time}%
519 \hspace{2em minus 1em}to\hspace{2em minus 1em}%
520 \trijosget{enddate}\hspace{1em minus 0.3em}\trijosget{endtime}}
521 \vskip -3pt
522 \titlerule
523 \vskip 6pt
524 \trijosget{subject}
525
526 \textit{\ignorespaces\trijosget{rubrics}}
527
528 \textit{\ignorespaces\trijosget{rubrics2}}
529 \vfill
530 \centerline{\trijosget{titlecentre}}
531 \vfill
532 \parbox{432pt}{%
533 \parbox[t]{240pt}{\mbox{}}\trijosget{titlebottomleft}}%
534 \parbox[t]{192pt}{\mbox{}}\trijosget{titlebottomright}}%
535 }
536 \vspace*{\parskip}
537 \newpage
538 \fi
539 }

```

`paper` The `paper` environment deactivates the display of metadata in questions and switches to the `paper` pagestyle to arrange for the appropriate display of headline and footline information. It also makes `\parskip` slightly more elastic than it is when question setters typeset their questions, to allow for the addition of a section heading or an end-of-paper marker, without triggering a new pagebreak. At the end we autoincrement the paper number, just for the convenience of anyone who might want to typeset multiple papers from a single file. Using `\paperfalse`, a wrapping environment can disable most of these actions.

```

540 \newif\ifpaper\papertrue
541 \newenvironment{paper}[1][]{
542 \ifpaper
543 \trijosset{metadata=false,answers=false,topics=false,paper style}
544 \fi
545 \setcounter{marksumpaper}{0}
546 \setcounter{section}{0}
547 \setcounter{question}{1}
548 \trijosset{#1}
549 \ifrecordmarks\immediate\write\@marksfile{paper|\trijosget{year}}|%
550 \arabic{paper}|\trijosget{author}}\fi%
551 \ifpaper
552 \cleardoublepage
553 \setcounter{page}{1}
554 \expandafter\@ifundefined{paper@roman{paper}@lastpage}{\gdef\@@lastpage{-1}}
555 {\global\edef\@@lastpage{\csname paper@roman{paper}@lastpage\endcsname}}
556 \pagestyle{paper}
557 \addtolength\parskip{0pt minus 3pt}
558 \fi
559 }{
560 \trijosifempty{totalmarkspaper}{}{
561 \ifnum\value{marksumpaper}=\trijosget{totalmarkspaper}
562 \else
563 \def\markswarning{expected \trijosget{totalmarkspaper} marks total,

```

```

564 but found \arabic{marksumpaper}}
565 \ClassWarningNoLine{tripos}{%
566 \ifnum\value{paper}=0 \else Paper \arabic{paper}: \fi\markswarning}
567 \textbf{[Warning: \markswarning]}\par
568 \fi
569 }
570 \ifpaper\ifnum\value{question}=1\else
571 \nopagebreak
572 \vspace{36pt}
573 \centerline{\textbf{END OF PAPER}\label{l@stp@ge}%
574 \write\@auxout
575 {\string\gdef\string\paper@\roman{paper}@lastpage{\arabic{page}}}%
576 }
577 \newpage
578 \fi\fi
579 \addtocounter{paper}{1}
580 }

```

We also record the last page of paper 1 in `\paper@i@lastpage`, etc., and for the most recent paper in `\@@lastpage`, which is used by the following macro, which later allows us to suppress any “turn over” footer message there. (The additional `l@stp@ge` label merely ensures that we get a rerun warning in case the easier to use `\paper@i@lastpage` macro changes.)

```

581 \def\iflastpage#1#2{\ifnum\value{page}=\@@lastpage\relax#1\else#2\fi}

```

**solutionnotes** The `solutionnotes` environment simply switches on display of metadata, answers and topic keywords in questions, and activates the `solutionnotes` pagestyle. A more elastic `\parskip` helps with neater page breaks around answer boxes.

```

582 \newenvironment{solutionnotes}[1] []{
583 \addtolength\parskip{0pt plus 2pt minus 5pt}
584 \triposset{metadata=true,answers=true,topics=true,solutionnotes style,#1}
585 \pagestyle{solutionnotes}
586 \paperfalse
587 }{
588 \newpage
589 }

```

**signoff** The text of signoff sheets is actually printed by the `question` environment. The `signoff` environment merely has to activate the right flags and switch to the appropriate pagestyle.

```

590 \newenvironment{signoff}[1] []{
591 \triposset{metadata=false,answers=false,topics=false,newpage=true,
592 signoff style,#1}
593 \renewcommand{\questionprelude}{\setcounter{page}{1}%
594 \pagestyle{signoff}%
595 \makebox[0pt][l]{\parbox[b][0pt][b]{\linewidth}{%
596 \triposget{signoff request}
597 \vspace{12pt}
598 \titlerule
599 \vspace*{19.2pt}}}}
600 \renewcommand{\questionpostscriptum}{%
601 \nopagebreak
602 \vspace{-2\parskip}\makebox[0pt][l]{\parbox[t][0pt][t]{\linewidth}{%
603 \vspace{16pt}
604 \titlerule
605 \vspace{12pt}
606 \triposget{signoff declaration}\par
607 \vspace{18pt}

```





```

654 }
655 \newcommand\ps@papertitle{%
656 \ps@paper
657 \renewcommand\@oddfoot{}
658 \renewcommand\@evenfoot{}
659 }

```

Solution notes say so in the headline. There is no footline.

```

660 \newcommand\ps@solutionnotes{%
661 \renewcommand\@oddhead{\hspace*{-\indentation}\hfil\raisebox{-5mm}
662 {\textit{\Large\tripsosget{solutionnotes head}}}\hfil}
663 \let\@evenhead\@oddhead
664 \renewcommand\@oddfoot{\hfil\thepage\hfil}
665 \let\@evenfoot\@oddfoot
666 }

```

The signoff sheets have no footline and the headline prominently states the name of the question setter, along with other metadata.

```

667 \newcommand\ps@signoff{%
668 \renewcommand\@oddhead{\textbf{EXAMINATION QUESTION BY
669 \tripsosget{author}}\quad\hfil\tripsosget{code} \tripsosget{year}
670 P\arabic{paper}~Q\arabic{question}\ifnum\thepage>1~/~/\thepage\fi}
671 \let\@evenhead\@oddhead
672 \renewcommand\@oddfoot{}
673 \let\@evenfoot\@oddfoot
674 }

```

Finally, we leave L<sup>A</sup>T<sub>E</sub>X in plain pagestyle, which is perfectly suitable for proofreading questions that are typeset on their own.

```

675 \pagestyle{plain}

```

## Common packages

The list of packages loaded by the default option `commonpackages` is based on past requirements in the *Computer Science Tripos*. It can be extended by the author of this class if requested, subject to the included package being stable, not requiring excessive resources, and unlikely to conflict with others. We deliberately load these packages last: at least one of them would otherwise undo a redefinition of a macro made in this class (namely `amsmath` redefines `\label` in displayed equations).

```

676 \ifcommonpackages
677 \RequirePackage[utf8]{inputenc}
678 \RequirePackage{color}
679 \RequirePackage{graphicx}
680 \DeclareGraphicsExtensions{}
681 \DeclareGraphicsRule[.pdftex]{pdf}{*}{}
682 \RequirePackage{amsmath}
683 \RequirePackage{amssymb}
684 \RequirePackage{stmaryrd}
685 \RequirePackage{proof}
686 \RequirePackage{latexsym}
687 \RequirePackage{upgreek}
688 \RequirePackage{upquote}[2012/04/19]
689 \RequirePackage{alltt}
690 \fi

```

If the file `tripos-config.tex` exists, we include it here. It allows users to override default settings for multiple documents in one place.

```
691 \InputIfFileExists{tripos-config.tex}{}{}
```

`\usepackage` Finally, load the `docmute` package and disable `\usepackage`, unless option `ownpackages`  
`\newlength` is used. Disabling `\usepackage` discourages Tripos question setters from trying to load their own packages, which would be skipped if questions are loaded under `docmute`, and which would hinder combining question files into paper files). Likewise, disable some other ways of making global declarations, which might cause conflicts. Provide some help text.

```
692 \ifownpackages\else
693 \RequirePackage{docmute}[2012/01/28]
694 \newcommand*\help@ownpackages{If you use this class for something other than
695 submitting a Tripos question:\MessageBreak enabling class option
696 [ownpackages] disables this restriction.}
697 \newcommand*\help@globaldecls{We restrict in Tripos questions the use of
698 global declarations, which could\MessageBreak interfere or collide
699 with other questions, to make sure all questions can be\MessageBreak
700 compiled together into papers.\MessageBreak\MessageBreak\help@ownpackages}
701 \renewcommand*\usepackage[2] []{
702 \ClassError{tripos}{Do not load packages in Tripos questions}{We disable
703 the loading of packages by individual Tripos questions, \MessageBreak
704 to make sure all questions can be compiled together into papers.
705 \MessageBreak\MessageBreak\help@ownpackages}}
706 \renewcommand*{\newlength}[1]{
707 \ClassError{tripos}{Avoid global declarations}{\help@globaldecls}}
708 \fi
```