Bangor University Computer Science Department Exam Document Class

Cameron Gray <c.gray@bangor.ac.uk>

March 14, 2017

Abstract

Starting with the 2016/17 academic year, the Computer Science department at Bangor University have moved to LaTeX for preparation of examination papers for all taught courses. This was done for multiple reasons, including the reduction of burden on support staff.

This package is the embodiment of that effort. It includes all of the elements needed to produce an examination paper, including examiner's copies with solutions included.

1 Usage - Class Options

The document class is activated (or loaded) using the usual LaTeX command `\documentclass{bangorexam}`. The class requires one of the following options to control which 'style' of exam paper is produced.

[⟨*ab*⟩] - produces a compulsory Section A and a 'two from three' Section B exam.

[⟨*aonly*⟩] - produces a single section, all questions compulsory exam.

[⟨*twofour*⟩] - produces a single part 'two from four' exam.

The 'answers' option controls the inclusion of solutions as part of the output.

`\documentclass[ab]{bangorexam}` - produces the student form of a Section A/B exam paper.

`\documentclass[aonly]{bangorexam}` - produces the student form of an exam paper where all questions are compulsory.

`\documentclass[ab,answers]{bangorexam}` - produces the examiner form of the paper.

2 Usage - Preamble Macros

The class includes several macros that must be added to the document's preamble. These set important aspects such as the module code and title.

`\school{⟨English name⟩}{⟨Welsh name⟩}`	The name of the school setting this exam, provided in both English and Welsh.
`\module{⟨code⟩}{⟨full name⟩}`	The code (including the 3-letter prefix) and full name of the module.
`\examperiod{⟨resit|s1|s2⟩}`	Specifies the period of the exam, s1 for January/End of Semester 1, s2 for May/End of Semester 2, or resit for Supplementary exams (August Resits).
`\timeallowed{⟨hours⟩}`	The amount of time allowed in hours. This should be the numerical part only, e.g. `\timeallowed{1\half}` or `\timeallowed{3}`.

3   Usage - Body Macros

Various macros exist to typeset the questions within the exam paper. The macros listed here are provided to comply with Bangor University's style and formatting requirements. Users should not adjust any formatting, font, header, footer, margin other other display parameters. Please use `\emph{}` for italic text and `\textbf{}` for boldface fonts only. The document class has been designed to support amsmath and amssymb mathematics typesetting with the conventional font.

`\sectiona`

Only applies when class option ab is active.

Begins the compulsory Section A.

`\sectionb`

Only applies when class option ab is active.

Begins the student-choice Section B.

`\pointsdesc{⟨description⟩}` Sets the suffix/descriptive text following a points value. This defaults to an empty string, so 5 points would be rendered as `[5]`. Setting `\pointsdesc{%}` would result in `[5%]`.

`\guidance{⟨guidance text⟩}` Sets a 'guidance' paragraph at the beginning of all question sections (at the start for two of four or both of section A and B if ab).

`\guidancea{⟨guidance text⟩}` Sets a 'guidance' paragraph at the start of section A only.

`\guidanceb{⟨guidance text⟩}` Sets a 'guidance' paragraph at the start of section B only.

4   Usage - Environments

There are three key environments `questions`, `parts`, and `solution`. These represent a numbered sequence of questions, parts and sub-parts of one question, and a solution/answer for a question respectively.

4.1   Questions Environment

All questions must be set within a questions environment. You may add other items, such as explanations, images, scenarios etc., in this environment too. The most simple questions environment is as follows:

```
\begin{questions}
\end{questions}
```

However, this will not actually produce any output.
Questions must be added with use of the `\question` macro.

`\question[⟨points⟩]`
`Question Text` This macro can only be used within the Questions environment and is used to typeset a question. The optional argument sets the number of points/marks/percentage awarded for correct answers. See the `\pointsdesc` macro for customisation options.
Whenever a new block is started (with `\begin{questions}`), the numbering begins at 1. (Questions, at present, can only be labelled with Arabic numerals.)

4.2 Parts Environment

Within a question, examiners may wish to have multiple sub-questions (a.k.a parts). This is provided for by the \begin{parts}...\end{parts} environment. Each sub-question or part is handled with the part macro.

\part[⟨*points*⟩] Part Text

This macro can only be used within the parts environment and is used to typeset a sub-question. The optional parameter sets the number of points/marks/percentage awarded for correct answers. See the \pointsdesc macro for customisation options.

The parts environment may only be used within the questions environment, as in the example below:

```
\begin{questions}
  \question Use the graph in Figure 1 to answer the following:
  \begin{parts}
\part Sub-question 1
\part[10] Sub-question 2
  \end{parts}
\end{questions}
```

Whenever a new block is started (with \begin{parts}), the sub-question numbering begins with a). (Sub-questions, at present, can only be labelled with English letters).

4.3 Solution Environment

Following either a \question or \part, the examiner should include a solution block. This block/environment will only be included if the answers class option is in effect. (See Class Options for more details). Any standard LaTeX content can be placed in a solution block. A minimal example is below:

```
\begin{questions}
  \question A really hard question.
  \begin{solution}
The answer is placed here.
  \end{solution}
\end{questions}
```

5 Usage - Multiple Choice Questions

There are four environments that will allow typesetting of multiple choice selections depending on the desired layout. All must be used within a Questions or Parts environment. The first pair present a list of possible responses labelled with letters. The choices environment presents one choice per line, whereas the horizontalchoices environment lays out choices in a single paragraph, wrapping lines wherever necessary.
The second pair present tick or check boxes instead of labelled choices. A checkboxes environment will again typeset options one to a line, and the horizontalcheckboxes environment will present all options in one paragraph.
Within any of the four environments each choice is typeset using the choice macro. Please note; there is no points argument for individual choices, this should be handled at the question or part level.

\choice Choice Text

Typesets a single choice according to which environment it is placed in.
Solutions to multiple choice questions are handled somewhat differently. Instead of a solutions environment, typeset the correct option using the correctchoice macro.

\correctchoice Choice Text   Typeset the correct choice based on where the macro is placed. When answers is in effect, the output of this macro will either highlight the option in boldface, or replace the checkbox with a tick.

6   The Code

```
1 \def\version{1.2.0 }
2
3 \NeedsTeXFormat{LaTeX2e}
4
5 \ProvidesClass{bangorexam}[2017/03/14 \version C. Gray]
6
7 % Based on the Exam document class by Philip S. Hirschhorn
8 % Developed/Adapted for Bangor University by C. Gray
9
10 \RequirePackage[dvipsnames]{xcolor}
11 \RequirePackage[T1]{fontenc}
12 \RequirePackage[UKenglish]{babel}
13 \RequirePackage[UKenglish]{isodate}
14 \RequirePackage[utf8]{inputenc}
15
16 \RequirePackage{array}
17 \RequirePackage{color}
18 \RequirePackage{etoolbox}
19 \RequirePackage{graphicx}
20 \RequirePackage{letltxmacro}
21 \RequirePackage{newpxtext,newpxmath}
22 \RequirePackage{totcount}
23 \RequirePackage{xstring}
24
25 \RequirePackage{courier}
26
27 % ***********************************************************************
28 % Strings
29 % ***********************************************************************
30
31 \newcommand{\engATypeText}{Answer {\bf Section A} (compulsory) and {\bf any two} q
32 \newcommand{\welATypeText}{Atebwch {\bf Adran A} (gorfodol) ac {\bf unrhyw ddau} g
33 \newcommand{\engBTypeText}{Answer \textbf{two} out of four questions.}%
34 \newcommand{\welBTypeText}{Atebwch \textbf{ddau} o'r pedwar cwestiwn.}%
35 \newcommand{\engCTypeText}{Answer all questions.}%
36 \newcommand{\welCTypeText}{Atebwch bob cwestiwn.}%
37 \newcommand{\sectionAHeader}{\textbf{SECTION A} --- Answer \textbf{ALL} questions
38 \newcommand{\sectionBHeader}{\textbf{SECTION B} --- Answer any \textbf{TWO} questi
39 \newcommand{\sectionAOnlyHeader}{Answer \textbf{ALL} questions (Total marks \total
40
41 % ***********************************************************************
42 % Class Level Options
43 % ***********************************************************************
44
45 % Enable Welsh headings, etc.  Does not affect the cover sheet.
46 % ------------------------------------------------------------------
47 \DeclareOption{welsh}{%
48 \newcommand{\welsh}{true}%
49 \renewcommand{\sectionAHeader}{\textbf{ADRAN A} --- Atebwch BOB cwestiwn (Cyfanswm
50 \renewcommand{\sectionBHeader}{\textbf{ADRAN B} --- Atebwch unrhyw DDAU chwestiwn
51 \renewcommand{\sectionAOnlyHeader}{Atebwch \textbf{BOB} cwestiwn (Cyfanswm marciau
52 }%
53 % Exam Type
54 % ------------------------------------------------------------------
55 \newcommand{\engTypeText}{}
56 \newcommand{\welTypeText}{}
57 \DeclareOption{ab}{%
```

```
58 \newcommand{\examtype}{ab}%
59 \renewcommand{\engTypeText}{\engATypeText}%
60 \renewcommand{\welTypeText}{\welATypeText}%
61 }%
62 \DeclareOption{aonly}{%
63 \newcommand{\examtype}{aonly}%
64 \renewcommand{\engTypeText}{\engCTypeText}%
65 \renewcommand{\welTypeText}{\welCTypeText}%
66 \renewcommand{\sectionAHeader}{\sectionAOnlyHeader}
67 }%
68 \DeclareOption{twofour}{%
69 \newcommand{\examtype}{twofour}%
70 \renewcommand{\engTypeText}{\engBTypeText}%
71 \renewcommand{\welTypeText}{\welBTypeText}%
72 }%
73 \DeclareOption{answers}{\PassOptionsToClass{\CurrentOption}{exam}}%
74 \DeclareOption{draft}{\PassOptionsToClass{\CurrentOption}{exam}}%
75 \ProcessOptions\relax%
76
77 \ifx\examtype\undefined%
78 \ClassError{bangorexam}{An exam type option has not been defined; use ab, aonly, o
79 \fi%
80
81 \LoadClass[a4paper,twoside,11pt,addpoints]{exam}%
82
83 % ********************************************************************
84 % Layout
85 % ********************************************************************
86 % Page layout
87 \setlength{\parindent}{0mm}%
88 \setlength{\parskip}{1ex plus 0.5ex minus 0.2ex}%
89
90 % Footer
91 \pagestyle{headandfoot}%
92 \coverfooter{}{}{\iflastpage{}{/ troi drosodd\\/ turn over}{}}%
93 \footer{}{\thepage}{\oddeven{\iflastpage{}{/ troi drosodd\\/ turn over}}}{}%
94
95 % Cover Column Definition
96 \newcolumntype{C}[1]{>{\centering\arraybackslash}p{#1}}
97
98 \SolutionEmphasis{\color{red}}
99 \CorrectChoiceEmphasis{\bfseries\color{red}}
100
101 % ********************************************************************
102 % Configuration Macros
103 % ********************************************************************
104 \newcounter{tmp}
105 \newtotcounter{all}
106 \newtotcounter{tf}
107 \newtotcounter{sectiona}
108 \newtotcounter{sectionb}
109 \newcounter{lq}
110 \newcounter{lqp}
111 \setcounter{lq}{-1}
112
113 \newcommand{\school}[2] {%
114 \def \engSchool {\expandafter\MakeUppercase\expandafter{#1}}%
115 \def \welSchool {\expandafter\MakeUppercase\expandafter{#2}}%
116 }%
117 \newcommand{\module}[2]{%
118 \StrSubstitute{#1}{-}{}[\mTmp]%
119 \def \moduleCode {\expandafter\MakeUppercase\expandafter{\mTmp}}%
120 \def \moduleName {#2}%
121 }%
122 \newcommand{\examperiod}[1]{%
123 \setcounter{tmp}{\the\year}%
```

```
124 \ifnum \the\month>8%
125 \stepcounter{tmp}%
126 \newcommand{\examYear}{\arabic{tmp}}%
127 \else%
128 \newcommand{\examYear}{\arabic{tmp}}%
129 \fi%
130 \newcommand{\welSemesterText}{Arholiadau Diwedd Semester\ \welSemester}%
131 \newcommand{\engSemesterText}{End of Semester \engSemester\ Examinations}%
132 \ifthenelse{\equal{#1}{s1}}{%
133 \def \welSemester {Un}%
134 \def \engSemester {One}%
135 \def \welExamMonth {IONAWR}%
136 \def \engExamMonth {JANUARY}%
137 }{}%
138 \ifthenelse{\equal{#1}{s2}}{%
139 \def \welSemester {Dau}%
140 \def \engSemester {Two}%
141 \def \welExamMonth {MAI}%
142 \def \engExamMonth {MAY}%
143 }{}%
144 \ifthenelse{\equal{#1}{resit}}{%
145 \renewcommand{\welSemesterText}{Arholiadau Atodol}%
146 \renewcommand{\engSemesterText}{Supplementary Examination}%
147 \def \welExamMonth {AWST}%
148 \def \engExamMonth {AUGUST}%
149 }{}%
150 }
151
152 \newcommand{\timeallowed}[1]{%
153 \def \timeAllowed {#1}%
154 }
155
156 \newcommand{\guidance}[1]{%
157 \def \guidance@a {#1}%
158 \def \guidance@b {#1}%
159 }
160
161 \newcommand{\guidancea}[1]{%
162 \def \guidance@a {#1}%
163 }
164
165 \newcommand{\guidanceb}[1]{%
166 \def \guidance@b {#1}%
167 }
168
169 % ********************************************************************
170 % Cover Page
171 % ********************************************************************
172
173 \renewcommand{\maketitle}{%
174 \ifx\timeAllowed\undefined%
175 \ClassError{bangorexam}{The time allowed for this exam has not been defined (missi
176 \fi%
177 \ifx\engExamMonth\undefined%
178 \ClassError{bangorexam}{The exam period for this exam has not been set (missing ex
179 \fi%
180 \ifx\moduleCode\undefined%
181 \ClassError{bangorexam}{The module details for this exam have not been specified (
182 \fi%
183 \ifx\welSchool\undefined%
184 \ClassError{bangorexam}{The academic school setting this exam has not been defined
185 \fi%
186
187 \begin{center}
188 \bfseries
189 \huge
```

```
190 PRIFYSGOL\\
191 \large\mbox{}\\
192 \huge
193 BANGOR\\
194 \large\mbox{}\\
195 \huge
196 UNIVERSITY
197
198 \vfill
199 \Large
200 \welSchool \\
201 \engSchool
202 \end{center}
203 \medskip
204 \large
205 \begin{tabular}{C{0.5\textwidth}C{0.5\textwidth}}
206 {\bf \welSemesterText\par\welExamMonth\ \examYear}\par\vspace*{\bigskipamount}
207 Amser a ganiateir:~\timeAllowed~awr &%
208 {\bf \engSemesterText\par\engExamMonth\ \examYear}\par\vspace*{\bigskipamount}
209 Time allowed:~\timeAllowed~hours
210 \end{tabular}
211
212 \vspace*{20mm}
213 \LARGE
214 \begin{center}
215 {\bf \moduleCode\\
216 \mbox{}\\
217 \moduleName}
218
219 \vfill
220 \large
221 {\welTypeText} \\
222 {\engTypeText} \\
223 \
224
225 \medskip
226 {\bf Total marks \total{all}\\
227     Cyfanswm Marciau \total{all}}
228 \vfill
229 \end{center}
230 }
231 \AtBeginDocument{
232 \begin{coverpages}
233 \setlength{\hoffset}{0mm}
234 \setlength{\marginparwidth}{0pt}
235 \maketitle
236 \end{coverpages}
237 \setcounter{page}{2}
238 \pointsinrightmargin
239 \ifthenelse{\equal{\examtype}{twofour}}{
240 \clearpage
241 {%
242 \LARGE
243 \textbf{\moduleCode: \quad \moduleName}
244
245 \vspace*{8mm}
246 \large
247 \ifcsdef{guidance@a}{\normalsize\par\guidance@a}{}%
248 }
249 \vspace*{8mm}
250 }{}%
251 \ifthenelse{\equal{\examtype}{aonly}}{\sectiona}{}%
252 }
253
254 % ****************************************************************
255 % Section Commands
```

```
256 % **********************************************************************
257 \newcounter{seca}
258 \newcounter{secb}
259 \newcommand{\inDoc}{none}%
260 \newcommand{\sectiona} {%
261 \ifthenelse{\equal{\examtype}{twofour}}{\ClassError{bangorexam}{Section A defined
262 \ifnumcomp{\value{seca}}{>}{0}
263 {
264 \ClassError{bangorexam}{There is already a Section A in this exam.}\relax%
265 }
266 {
267 \stepcounter{seca}\relax%
268 }
269 \renewcommand{\inDoc}{secA}%
270 \clearpage
271 {%
272 \LARGE
273 \textbf{\moduleCode: \quad \moduleName}
274
275 \vspace*{8mm}
276 \large
277 \sectionAHeader
278 \ifcsdef{guidance@a}{\normalsize\par\guidance@a}{}%
279 }
280 \vspace*{8mm}
281 }
282
283 \newcommand{\sectionb}{%
284 \ifthenelse{\equal{\examtype}{twofour}}{\ClassError{bangorexam}{Section B defined
285 \ifthenelse{\equal{\examtype}{aonly}}{\ClassError{bangorexam}{Section B defined in
286 \ifnumcomp{\value{secb}}{>}{0}
287 {
288 \ClassError{bangorexam}{There is already a Section B in this exam.}\relax%
289 }
290 {
291 \stepcounter{secb}\relax%
292 }
293 \renewcommand{\inDoc}{secB}
294 \clearpage
295 {%
296 \large
297 \sectionBHeader
298 \ifcsdef{guidance@b}{\normalsize\par\guidance@b}{}%
299 }
300 \vspace*{8mm}
301 }
302
303 % **********************************************************************
304 % Patch Questions to make it Section-aware
305 % **********************************************************************
306 \renewcommand{\questionshook}{%
307 \setlength{\itemsep}{14pt}%
308     \edef\mytemp{{\inDoc}}%
309     \expandafter\ifstrequal\mytemp{secB}{\addtocounter{question}{100}}{}%
310 }
311
312 \renewcommand{\thequestion}{%
313     \edef\mytemp{{\inDoc}}%
314     \setcounter{tmp}{0}%
315     \addtocounter{tmp}{\value{question}}%
316     \expandafter\ifstrequal\mytemp{secB}{\addtocounter{tmp}{-100}\arabic{tmp}}{\ar
317 }
318
319 \newcommand{\be@adduppoints}[1]{%
320 \def\temp{#1}\ifx\temp\empty%
321         \def\temp{0}%
```

```
322     \fi%
323     \ifnumcomp{\value{question}}{=}{\value{lq}}
324      {% Same question
325      \addtocounter{lqp}{\temp}%
326      }
327      {% Moved onto next question
328      \be@addpoints{\value{lqp}}%
329      \setcounter{lq}{\value{question}}%
330      \setcounter{lqp}{0}%
331      \addtocounter{lqp}{\temp}%
332      }%
333 }
334
335 \let\oldendq\endquestions%
336 \renewcommand{\endquestions}{%
337     \addtocounter{question}{-1}%
338     \be@adduppoints{0}%
339 }
340
341 \newcommand{\be@addpoints}[1]{%
342 \edef\mytemp{{\inDoc}}%
343 \expandafter\ifstrequal\mytemp{secA}%
344        {%
345             \addtocounter{sectiona}{#1}%
346             \addtocounter{all}{#1}%
347        }%
348        {}%
349     \expandafter\ifstrequal\mytemp{secB}%
350        {%
351             \ifnumcomp{\value{sectionb}}{=}{0}%
352                {%
353                     \addtocounter{sectionb}{#1}%
354                     \addtocounter{all}{#1}%
355                     \addtocounter{all}{#1}}%
356                {}%
357             \ifnumcomp{\value{sectionb}}{=}{#1}%
358                {}%
359                {%
360                 \setcounter{tmp}{0}%
361      \addtocounter{tmp}{\value{question}}%
362      \addtocounter{tmp}{-100}
363                     \ClassError{bangorexam}{Section B question \arabic{tmp} does n
364                }%
365        }%
366        {}%
367     \edef\mytemp{{\examtype}}%
368     \expandafter\ifstrequal\mytemp{twofour}%
369 {%
370             \ifnumcomp{\value{tf}}{=}{0}%
371                {%
372                     \addtocounter{tf}{#1}%
373                     \addtocounter{all}{#1}%
374                     \addtocounter{all}{#1}}%
375                {}%
376             \ifnumcomp{\value{tf}}{=}{#1}%
377                {}%
378                {%
379                     \ClassError{bangorexam}{Question \arabic{question} does not ha
380                }%
381        }%
382        {}%
383 }
384
385 \newcommand{\patchqnumaddpoints}{%
386 \be@adduppoints{\@points}%
387 }
```

```
388 \pointformat{[\thepoints]}
389 \pointname{\null\patchqnumaddpoints}
390 \newcommand{\pointsdec}[1]{%
391 \pointname{#1}\patchqnumaddpoints
392 }
393
394 % ********************************************************************
395 % Multiple Choice commands.
396 % ********************************************************************
397
398 \let\horizontalchoices\oneparchoices
399 \let\endhorizontalchoices\endoneparchoices
400 \let\horizontalcheckboxes\oneparcheckboxes
401 \let\endhorizontalcheckboxes\endoneparcheckboxes
402
403 % ********************************************************************
404 % End of document validation
405 % ********************************************************************
406
407 \AfterEndDocument{%
408 \edef\mytemp{{\examtype}}%
409     \expandafter\ifstrequal\mytemp{twofour}%
410     {%
411        \edef\mytmp{\numquestions}%
412 \expandafter\ifstrequal\mytmp{4}%
413 {\relax}%
414 {%
415 \ClassError{bangorexam}{There is/are only (\numquestions) question(s) defined, the
416 }%
417     }}{%
418        \ifnumcomp{\value{seca}}{=}{0}%
419            {%
420 \ClassError{bangorexam}{There is no Section A defined in this exam.}\relax%
421 }%
422            {\relax}%
423        \expandafter\ifstrequal\mytemp{ab}
424     {%
425        \ifnumcomp{\value{secb}}{=}{0}%
426            {%
427 \ClassError{bangorexam}{There is no Section B defined in this exam.}\relax%
428 }%
429            {\relax}%
430     }{}%
431     }%
432 }
433
```

10