

Bangor University Computer Science Department

Exam Document Class

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

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Abstract

Starting with the 2016/17 academic year, the Computer Science department at Bangor University have moved to L^AT_EX 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 L^AT_EX command `\documentclass{bangorexam}`. The class requires one of the following options to control which 'style' of exam paper is produced.

[`\langle ab \rangle`] - produces a compulsory Section A and a 'n-from' Section B exam. This type defaults to 2 required to match previous behaviour.

[`\langle aonly \rangle`] - produces a single section, all questions compulsory exam.

[`\langle nfrom \rangle`] - produces a single part 'n-from' 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[nfrom]{bangorexam}` - produces the student form of an exam paper with a single section but n-from the total questions.

`\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{\langle English name \rangle}{\langle Welsh name \rangle}` The name of the school setting this exam, provided in both English and Welsh.

`\module{\langle code \rangle}{\langle full name \rangle}` The code (including the 3-letter prefix) and full name of the module.

`\examperiod{\langle resit|s1|s2 \rangle}` 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 (Summer Resits).

`\timeallowed{\langle hours \rangle}` The amount of time allowed in hours. This should be the numerical part only, e.g. `\timeallowed{1\half}` or `\timeallowed{3}`.

`\nfrom{number}` The number of compulsory questions from the selection available in the options part of the exam.

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 `\pointdesc` 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 `\pointdesc` 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.

<code>\choice</code> 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 <code>correctchoice</code> macro.
<code>\correctchoice</code> Choice Text	Typeset the correct choice based on where the macro is placed. When <code>answers</code> 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{1.3.0 }
2
3 \NeedsTeXFormat{LaTeX2e}
4
5 \ProvidesClass{bangorexam}[2017/10/06 \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{forloop}
20 \RequirePackage{graphicx}
21 \RequirePackage{letltxmacro}
22 \RequirePackage{newpxtext,newpxmath}
23 \RequirePackage{totcount}
24 \RequirePackage{xstring}
25
26 \RequirePackage{courier}
27
28 % *****
29 % Strings
30 % *****
31
32 \newcommand{\engATypeText}{Answer {\bf Section A} (compulsory) and {\bf any \arabic}
33 \newcommand{\welATypeText}{Atebwch {\bf Adran A} (gorfodol) ac {\bf unrhyw \arabic}
34 \newcommand{\engBTypeText}{Answer any \textbf{\arabic{qN}} questions.}%
35 \newcommand{\welBTypeText}{Atebwch unrhyw \textbf{\arabic{qN}} o'r pedwar cwestiwn}
36 \newcommand{\engCTypeText}{Answer all questions.}%
37 \newcommand{\welCTypeText}{Atebwch bob cwestiwn.}%
38 \newcommand{\sectionAHeader}{\textbf{SECTION A} --- Answer \textbf{ALL} questions}
39 \newcommand{\sectionBHeader}{\textbf{SECTION B} --- Answer any \textbf{\arabic{qN}}
40 \newcommand{\sectionAOnlyHeader}{Answer \textbf{ALL} questions (Total marks \total
41
42 % *****
43 % Class Level Options
44 % *****
45
46 % Enable Welsh headings, etc. Does not affect the cover sheet.
47 % -----
48 \DeclareOption{welsh}{%

```

```

49 \newcommand{\welsh}{true}%
50 \renewcommand{\sectionAHeader}{\textbf{ADRAN A} --- Atebwch BOB cwestiwn (Cyfanswm
51 \renewcommand{\sectionBHeader}{\textbf{ADRAN B} --- Atebwch unrhyw \textbf{\arabic
52 \renewcommand{\sectionAOnlyHeader}{Atebwch \textbf{BOB} cwestiwn (Cyfanswm marciau
53 }%
54 % Exam Type
55 % -----
56 \newcounter{qN}
57 \newcommand{\nfrom}[1]{\setcounter{qN}{#1}}
58 \newcommand{\engTypeText}{}
59 \newcommand{\welTypeText}{}
60 \DeclareOption{ab}{%
61 \newcommand{\examtype}{ab}%
62 \renewcommand{\engTypeText}{\engATypeText}%
63 \renewcommand{\welTypeText}{\welATypeText}%
64 \nfrom{2}%
65 }%
66 \DeclareOption{aonly}{%
67 \newcommand{\examtype}{aonly}%
68 \renewcommand{\engTypeText}{\engCTypeText}%
69 \renewcommand{\welTypeText}{\welCTypeText}%
70 \renewcommand{\sectionAHeader}{\sectionAOnlyHeader}%
71 }%
72 \DeclareOption{twofour}{%
73 \newcommand{\examtype}{nfrom}%
74 \renewcommand{\engTypeText}{\engBTypeText}%
75 \renewcommand{\welTypeText}{\welBTypeText}%
76 \nfrom{2}%
77 }%
78 \DeclareOption{nfrom}{%
79 \newcommand{\examtype}{nfrom}%
80 \renewcommand{\engTypeText}{\engBTypeText}%
81 \renewcommand{\welTypeText}{\welBTypeText}%
82 }%
83 \DeclareOption{answers}{\PassOptionsToClass{\CurrentOption}{exam}}%
84 \DeclareOption{draft}{\PassOptionsToClass{\CurrentOption}{exam}}%
85 \ProcessOptions\relax%
86
87 \ifx\examtype\undefined%
88 \ClassError{bangorexam}{An exam type option has not been defined; use ab, aonly, o
89 \fi%
90
91 \LoadClass[a4paper,twoside,11pt,addpoints]{exam}%
92
93 % *****
94 % Layout
95 % *****
96 % Page layout
97 \setlength{\parindent}{0mm}%
98 \setlength{\parskip}{1ex plus 0.5ex minus 0.2ex}%
99
100 % Footer
101 \pagestyle{headandfoot}%
102 \coverfooter{}{\iflastpage{}{/ troi drosodd\\ / turn over}{}%
103 \footer{}{\thepage}{\oddeven{\iflastpage{}{/ troi drosodd\\ / turn over}{}%
104
105 % Cover Column Definition
106 \newcolumntype{C}[1]{>{\centering\arraybackslash}p{#1}}
107
108 \SolutionEmphasis{\color{red}}
109 \CorrectChoiceEmphasis{\bfseries\color{red}}
110
111 % *****
112 % Configuration Macros
113 % *****
114 \newcounter{tmp}

```

```

115 \newtotcounter{all}
116 \newtotcounter{tf}
117 \newtotcounter{sectiona}
118 \newtotcounter{sectionb}
119 \newcounter{lq}
120 \newcounter{lqp}
121 \setcounter{lq}{-1}
122 \newcounter{loopnu}
123
124
125 \newcommand{\school}[2] {%
126 \def \engSchool {\expandafter\MakeUppercase\expandafter{#1}}%
127 \def \welSchool {\expandafter\MakeUppercase\expandafter{#2}}%
128 }%
129 \newcommand{\module}[2]{%
130 \StrSubstitute{#1}{-}{\mTmp}%
131 \def \moduleCode {\expandafter\MakeUppercase\expandafter{\mTmp}}%
132 \def \moduleName {#2}%
133 }%
134 \newcommand{\examperiod}[1]{%
135 \setcounter{tmp}{\the\year}%
136 \ifnum \the\month>8%
137 \stepcounter{tmp}%
138 \newcommand{\examYear}{\arabic{tmp}}%
139 \else%
140 \newcommand{\examYear}{\arabic{tmp}}%
141 \fi%
142 \newcommand{\welSemesterText}{Arholiadau Diwedd Semester\ \welSemester}%
143 \newcommand{\engSemesterText}{End of Semester \engSemester\ Examinations}%
144 \ifthenelse{\equal{#1}{s1}}{%
145 \def \welSemester {Un}%
146 \def \engSemester {One}%
147 \def \welExamMonth {IONAWR}%
148 \def \engExamMonth {JANUARY}%
149 }{%
150 \ifthenelse{\equal{#1}{s2}}{%
151 \def \welSemester {Dau}%
152 \def \engSemester {Two}%
153 \def \welExamMonth {MAI}%
154 \def \engExamMonth {MAY}%
155 }{%
156 \ifthenelse{\equal{#1}{resit}}{%
157 \renewcommand{\welSemesterText}{Arholiadau Atodol}%
158 \renewcommand{\engSemesterText}{Supplementary Examination}%
159 \def \welExamMonth {HAF}%
160 \def \engExamMonth {SUMMER}%
161 }{%
162 }
163
164 \newcommand{\timeallowed}[1]{%
165 \def \timeAllowed {#1}%
166 }
167
168 \newcommand{\guidance}[1]{%
169 \def \guidance@a {#1}%
170 \def \guidance@b {#1}%
171 }
172
173 \newcommand{\guidancea}[1]{%
174 \def \guidance@a {#1}%
175 }
176
177 \newcommand{\guidanceb}[1]{%
178 \def \guidance@b {#1}%
179 }
180

```

```

181 % *****
182 % Cover Page
183 % *****
184
185 \renewcommand{\maketitle}{%
186 \ifx\timeAllowed\undefined%
187 \ClassError{bangorexam}{The time allowed for this exam has not been defined (missi
188 \fi%
189 \ifx\engExamMonth\undefined%
190 \ClassError{bangorexam}{The exam period for this exam has not been set (missing ex
191 \fi%
192 \ifx\moduleCode\undefined%
193 \ClassError{bangorexam}{The module details for this exam have not been specified (
194 \fi%
195 \ifx\welSchool\undefined%
196 \ClassError{bangorexam}{The academic school setting this exam has not been defined
197 \fi%
198
199 \begin{center}
200 \bfseries
201 \huge
202 PRIFYSGOL\
203 \large\mbox{\}\
204 \huge
205 BANGOR\
206 \large\mbox{\}\
207 \huge
208 UNIVERSITY
209
210 \vfill
211 \Large
212 \welSchool \
213 \engSchool
214 \end{center}
215 \medskip
216 \large
217 \begin{tabular}{C{0.5\textwidth}C{0.5\textwidth}}
218 {\bf \welSemesterText\par\welExamMonth\ \examYear}\par\vspace*{\bigskipamount}
219 Amsr a ganiateir:~\timeAllowed~awr &%
220 {\bf \engSemesterText\par\engExamMonth\ \examYear}\par\vspace*{\bigskipamount}
221 Time allowed:~\timeAllowed~hours
222 \end{tabular}
223
224 \vspace*{20mm}
225 \LARGE
226 \begin{center}
227 {\bf \moduleCode\
228 \mbox{\}\
229 \moduleName}
230
231 \vfill
232 \large
233 {\welTypeText} \
234 {\engTypeText} \
235 \
236
237 \medskip
238 {\bf Cyfanswm Marciau \total{all}\
239 Total marks \total{all}}
240 \vfill
241 \end{center}
242 }
243 \AtBeginDocument{
244 \begin{coverpages}
245 \setlength{\hoffset}{0mm}
246 \setlength{\marginparwidth}{0pt}

```

```

247 \maketitle
248 \end{coverpages}
249 \setcounter{page}{2}
250 \pointsinrightmargin
251 \ifthenelse{\equal{\examtype}{nfrom}}{
252 \clearpage
253 {%
254 \LARGE
255 \textbf{\moduleCode: \quad \moduleName}
256
257 \vspace*{8mm}
258 \large
259 \ifcsdef{guidance@a}{\normalsize\par\guidance@a}{}%
260 }
261 \vspace*{8mm}
262 }{%
263 \ifthenelse{\equal{\examtype}{aonly}}{\sectiona}{}%
264 }
265
266 % *****
267 % Section Commands
268 % *****
269 \newcounter{seca}
270 \newcounter{secb}
271 \newcommand{\inDoc}{none}%
272 \newcommand{\sectiona} {%
273 \ifthenelse{\equal{\examtype}{nfrom}}{\ClassError{bangorexam}{Section A defined in
274 \ifnumcomp{\value{seca}}{>}{0}
275 {
276 \ClassError{bangorexam}{There is already a Section A in this exam.}\relax%
277 }
278 {
279 \stepcounter{seca}\relax%
280 }
281 \renewcommand{\inDoc}{secA}%
282 \clearpage
283 {%
284 \LARGE
285 \textbf{\moduleCode: \quad \moduleName}
286
287 \vspace*{8mm}
288 \large
289 \sectionAHeader
290 \ifcsdef{guidance@a}{\normalsize\par\guidance@a}{}%
291 }
292 \vspace*{8mm}
293 }
294
295 \newcommand{\sectionb}{%
296 \ifthenelse{\equal{\examtype}{nfrom}}{\ClassError{bangorexam}{Section B defined in
297 \ifthenelse{\equal{\examtype}{aonly}}{\ClassError{bangorexam}{Section B defined in
298 \ifnumcomp{\value{secb}}{>}{0}
299 {
300 \ClassError{bangorexam}{There is already a Section B in this exam.}\relax%
301 }
302 {
303 \stepcounter{secb}\relax%
304 }
305 \renewcommand{\inDoc}{secB}
306 \clearpage
307 {%
308 \large
309 \sectionBHeader
310 \ifcsdef{guidance@b}{\normalsize\par\guidance@b}{}%
311 }
312 \vspace*{8mm}

```

```

313 }
314
315 % *****
316 % Patch Questions to make it Section-aware
317 % *****
318 \renewcommand{\questionshook}{%
319 \setlength{\itemsep}{14pt}%
320 \edef\mytemp{\inDoc}%
321 \expandafter\ifstrequal\mytemp{secB}{\addtocounter{question}{100}}{}%
322 }
323
324 \renewcommand{\thequestion}{%
325 \edef\mytemp{\inDoc}%
326 \setcounter{tmp}{0}%
327 \addtocounter{tmp}{\value{question}}%
328 \expandafter\ifstrequal\mytemp{secB}{\addtocounter{tmp}{-100}\arabic{tmp}}{\arabic{tmp}}%
329 }
330
331 \newcommand{\be@adduppoints}[1]{%
332 \def\temp{#1}\ifx\temp\empty%
333 \def\temp{0}%
334 \fi%
335 \ifnumcomp{\value{question}}{=}{\value{lq}}%
336 {% Same question
337 \addtocounter{lq}{\temp}%
338 }
339 {% Moved onto next question
340 \be@addpoints{\value{lq}}%
341 \setcounter{lq}{\value{question}}%
342 \setcounter{lq}{0}%
343 \addtocounter{lq}{\temp}%
344 }%
345 }
346
347 \let\oldendq\endquestions%
348 \renewcommand{\endquestions}{%
349 \addtocounter{question}{-1}%
350 \be@adduppoints{0}%
351 }
352
353 \newcommand{\be@addpoints}[1]{%
354 \edef\mytemp{\inDoc}%
355 \expandafter\ifstrequal\mytemp{secA}%
356 {%
357 \addtocounter{sectiona}{#1}%
358 \addtocounter{all}{#1}%
359 }%
360 {}%
361 \expandafter\ifstrequal\mytemp{secB}%
362 {%
363 \ifnumcomp{\value{sectionb}}{=}{0}%
364 {%
365 \addtocounter{sectionb}{#1}%
366 \forloop{loopnu}{0}{\value{loopnu} < \value{qN}}{%
367 \addtocounter{all}{#1}}%
368 }%
369 \ifnumcomp{\value{sectionb}}{=}{#1}%
370 {}%
371 {%
372 \setcounter{tmp}{0}%
373 \addtocounter{tmp}{\value{question}}%
374 \addtocounter{tmp}{-100}
375 \ClassError{bangorexam}{Section B question \arabic{tmp} does not exist}{%
376 }%
377 }%
378 {}%

```

```

379 \edef\mytemp{\examtype}%
380 \expandafter\ifstrequal\mytemp{nfrom}%
381 {%
382     \ifnumcomp{\value{tf}}{=}{0}%
383     {%
384         \addtocounter{tf}{#1}%
385         \forloop{loopnu}{0}{\value{loopnu} < \value{qN}}{%
386             \addtocounter{all}{#1}}%
387     }%
388     \ifnumcomp{\value{tf}}{=}{#1}%
389     {%
390     {%
391         \ClassError{bangorexam}{Question \arabic{question} does not ha
392     }%
393     }%
394     }%
395 }
396
397 \newcommand{\patchqnumaddpoints}{%
398 \be@addupoints{\@points}%
399 }
400 \pointformat{[\thepoints]}
401 \pointname{\null\patchqnumaddpoints}
402 \newcommand{\pointsdec}[1]{%
403 \pointname{#1}\patchqnumaddpoints
404 }
405
406 % *****
407 % Multiple Choice commands.
408 % *****
409
410 \let\horizontalchoices\oneparchoices
411 \let\endhorizontalchoices\endoneparchoices
412 \let\horizontalcheckboxes\oneparcheckboxes
413 \let\endhorizontalcheckboxes\endoneparcheckboxes
414
415 % *****
416 % End of document validation
417 % *****
418
419 \AfterEndDocument{%
420 \edef\mytemp{\examtype}%
421 \expandafter\ifstrequal\mytemp{nfrom}%
422 {%
423     \edef\mytmp{\numquestions}%
424 \expandafter\ifnum\value{numquestions}>\value{qN}%
425 \relax%
426 \else%
427 \ifnum\value{numquestions}=\value{qN}%
428 \relax%
429 \else%
430 \ClassError{bangorexam}{There is/are only (\numquestions) question(s) defined, the
431 \fi
432 \fi%
433 }{%
434     \ifnumcomp{\value{seca}}{=}{0}%
435     {%
436 \ClassError{bangorexam}{There is no Section A defined in this exam.}\relax%
437 }%
438     {\relax}%
439     \expandafter\ifstrequal\mytemp{ab}
440     {%
441         \ifnumcomp{\value{secb}}{=}{0}%
442         {%
443 \ClassError{bangorexam}{There is no Section B defined in this exam.}\relax%
444 }%

```

```
445          {\relax}%  
446      }{}%  
447  }%  
448 }  
449
```