

# 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<sup>A</sup>T<sub>E</sub>X 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<sup>A</sup>T<sub>E</sub>X 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.

[`<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[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.

<code>\part[⟨points⟩]</code>	Part	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 <code>\pointdesc</code> macro for customisation options.
	Text	

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	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.
	Text	

`\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{1.1.3 }
2
3 \NeedsTeXFormat{LaTeX2e}
4
5 \ProvidesClass{bangorexam}[2016/10/29 \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{\sectionAHeader}{\textbf{SECTION A} --- Answer \textbf{ALL} questions
36 \newcommand{\sectionBHeader}{\textbf{SECTION B} --- Answer any \textbf{TWO} questi
37
38 % *****
39 % Class Level Options
40 % *****
41
42 % Enable Welsh headings, etc. Does not affect the cover sheet.
43 % -----
44 \DeclareOption{welsh}{%
45 \newcommand{\welsh}{true}%
46 \renewcommand{\sectionAHeader}{\textbf{ADRAN A} --- Atebwch BOB cwestiwn (Cyfanswm
47 \renewcommand{\sectionBHeader}{\textbf{ADRAN B} --- Atebwch unrhyw DDAU chwestiwn
48 }%
49 % Exam Type
50 % -----
51 \newcommand{\engTypeText}{}
52 \newcommand{\welTypeText}{}
53 \DeclareOption{ab}{%
54 \newcommand{\examtype}{ab}%
55 \renewcommand{\engTypeText}{\engATypeText}
56 \renewcommand{\welTypeText}{\welATypeText}
57 }%

```

```

58 \DeclareOption{twofour}{%
59 \newcommand{\examtype}{twofour}%
60 \renewcommand{\engTypeText}{\engBTypeText}
61 \renewcommand{\welTypeText}{\welBTypeText}
62 }%
63 \DeclareOption{answers}{\PassOptionsToClass{\CurrentOption}{exam}}%
64 \DeclareOption{draft}{\PassOptionsToClass{\CurrentOption}{exam}}%
65 \ProcessOptions\relax%
66
67 \ifx\examtype\undefined%
68 \ClassError{bangorexam}{An exam type option has not been defined; use ab or twofour}
69 \fi%
70
71 \LoadClass[a4paper,twoside,11pt,addpoints]{exam}%
72
73 % *****
74 % Layout
75 % *****
76 % Page layout
77 \setlength{\parindent}{0mm}%
78 \setlength{\parskip}{1ex plus 0.5ex minus 0.2ex}%
79
80 % Footer
81 \pagestyle{headandfoot}%
82 \coverfooter{}{}{\iflastpage{}{/ troi drosodd\\ / turn over}{} }%
83 \footer{}{\thepage}{\oddeven{}{\iflastpage{}{/ troi drosodd\\ / turn over}{} }%
84
85 % Cover Column Definition
86 \newcolumnntype{C}[1]{>\centering\arraybackslash}p{#1}}
87
88 \SolutionEmphasis{\color{red}}
89 \CorrectChoiceEmphasis{\bfseries\color{red}}
90
91 % *****
92 % Configuration Macros
93 % *****
94 \newcounter{tmp}
95 \newtotcounter{all}
96 \newtotcounter{tf}
97 \newtotcounter{sectiona}
98 \newtotcounter{sectionb}
99 \newcounter{lq}
100 \newcounter{lqp}
101 \setcounter{lq}{-1}
102
103 \newcommand{\school}[2]{%
104 \def \engSchool {\expandafter\MakeUppercase\expandafter{#1}}%
105 \def \welSchool {\expandafter\MakeUppercase\expandafter{#2}}%
106 }%
107 \newcommand{\module}[2]{%
108 \StrSubstitute{#1}{-}{}[\mTmp]%
109 \def \moduleCode {\expandafter\MakeUppercase\expandafter{\mTmp}}%
110 \def \moduleName {#2}%
111 }%
112 \newcommand{\examperiod}[1]{%
113 \setcounter{tmp}{\the\year}%
114 \ifnum \the\month>8%
115 \stepcounter{tmp}%
116 \newcommand{\examYear}{\arabic{tmp}}%
117 \else%
118 \newcommand{\examYear}{\arabic{tmp}}%
119 \fi%
120 \newcommand{\welSemesterText}{Arholiadau Diwedd Semester\ \welSemester}%
121 \newcommand{\engSemesterText}{End of Semester \engSemester\ Examinations}%
122 \ifthenelse{\equal{#1}{sl}}{}%
123 \def \welSemester {Un}%

```

```

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

```

```

190 \welSchool \\
191 \engSchool
192 \end{center}
193 \medskip
194 \large
195 \begin{tabular}{C{0.5\textwidth}C{0.5\textwidth}}
196 {\bf \welSemesterText\par\welExamMonth\ \examYear}\par\vspace*{\bigskipamount}
197 Amser a ganiateir:~\timeAllowed~awr &%
198 {\bf \engSemesterText\par\engExamMonth\ \examYear}\par\vspace*{\bigskipamount}
199 Time allowed:~\timeAllowed~hours
200 \end{tabular}
201
202 \vspace*{20mm}
203 \LARGE
204 \begin{center}
205 {\bf \moduleCode\\
206 \mbox{}\\
207 \moduleName}
208
209 \vfill
210 \large
211 {\welTypeText} \\
212 {\engTypeText} \\
213 \
214
215 \medskip
216 {\bf Total marks \total{all}\\
217 \quad Cyfanswm Marciau \total{all}}
218 \vfill
219 \end{center}
220 }
221 \AtBeginDocument{
222 \begin{coverpages}
223 \setlength{\hoffset}{0mm}
224 \setlength{\marginparwidth}{0pt}
225 \maketitle
226 \end{coverpages}
227 \setcounter{page}{2}
228 \pointsinrightmargin
229 \ifthenelse{\equal{\examtype}{twofour}}{
230 \clearpage
231 {%
232 \LARGE
233 \textbf{\moduleCode: \quad \moduleName}
234
235 \vspace*{8mm}
236 \large
237 \ifcsdef{guidance@a}{\normalsize\par\guidance@a}{}%
238 }
239 \vspace*{8mm}
240 }{}%
241 }
242
243 % *****
244 % Section Commands
245 % *****
246 \newcounter{seca}
247 \newcounter{secb}
248 \newcommand{\inDoc}{none}%
249 \newcommand{\sectiona} {%
250 \ifthenelse{\equal{\examtype}{twofour}}{\ClassError{bangorexam}{Section A defined
251 \ifnumcomp{\value{seca}}{>}{0}
252 {
253 \ClassError{bangorexam}{There is already a Section A in this exam}\relax%
254 }
255 {

```

```

256 \stepcounter{seca}\relax%
257 }
258 \renewcommand{\inDoc}{secA}%
259 \clearpage
260 {%
261 \LARGE
262 \textbf{\moduleCode: \quad \moduleName}
263
264 \vspace*{8mm}
265 \large
266 \sectionAHeader
267 \ifcsdef{guidance@a}{\normalsize\par\guidance@a}{}%
268 }
269 \vspace*{8mm}
270 }
271
272 \newcommand{\sectionb}{%
273 \ifthenelse{\equal{\examtype}{twofour}}{\ClassError{bangorexam}{Section B defined
274 \ifnumcomp{\value{secb}}{>}{0}
275 {
276 \ClassError{bangorexam}{There is already a Section B in this exam}\relax%
277 }
278 {
279 \stepcounter{secb}\relax%
280 }
281 \renewcommand{\inDoc}{secB}
282 \clearpage
283 {%
284 \large
285 \sectionBHeader
286 \ifcsdef{guidance@b}{\normalsize\par\guidance@b}{}%
287 }
288 \vspace*{8mm}
289 }
290
291 % *****
292 % Patch Questions to make it Section-aware
293 % *****
294 \renewcommand{\questionshook}{%
295 \setlength{\itemsep}{14pt}%
296 \edef\mytemp{\inDoc}%
297 \expandafter\ifstrequal\mytemp{secB}{\addtocounter{question}{100}}{ }%
298 }
299
300 \renewcommand{\thequestion}{%
301 \edef\mytemp{\inDoc}%
302 \setcounter{tmp}{0}%
303 \addtocounter{tmp}{\value{question}}%
304 \expandafter\ifstrequal\mytemp{secB}{\addtocounter{tmp}{-100}\arabic{tmp}}{\arabic{tmp}}%
305 }
306
307 \newcommand{\be@adduppoints}[1]{%
308 \def\temp{#1}\ifx\temp\empty%
309 \def\temp{0}%
310 \fi%
311 \ifnumcomp{\value{question}}{=}{\value{lq}}%
312 {% Same question
313 \addtocounter{lq}{\temp}%
314 }
315 {% Moved onto next question
316 \be@addpoints{\value{lq}}%
317 \setcounter{lq}{\value{question}}%
318 \setcounter{lq}{0}%
319 \addtocounter{lq}{\temp}%
320 }%
321 }

```

```

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

```

```

388 \let\horizontalcheckboxes\oneparcheckboxes
389 \let\endhorizontalcheckboxes\endoneparcheckboxes
390
391 % *****
392 % End of document validation
393 % *****
394
395 \AfterEndDocument{%
396 \edef\mytemp{\examtype}%
397 \expandafter\ifstrequal\mytemp{twofour}%
398 {%
399 \edef\mytmp{\numquestions}%
400 \expandafter\ifstrequal\mytmp{4}%
401 {\relax}%
402 }%
403 \ClassError{bangorexam}{There is/are only (\numquestions) question(s) defined, the
404 }%
405 }{%
406 \ifnumcomp{\value{seca}}{=}{0}%
407 {%
408 \ClassError{bangorexam}{There is no Section A defined in this exam}\relax%
409 }%
410 {\relax}%
411 \ifnumcomp{\value{secb}}{=}{0}%
412 {%
413 \ClassError{bangorexam}{There is no Section B defined in this exam}\relax%
414 }%
415 {\relax}%
416 }%
417 }
418

```