

autoQs

A program for releasing individualised sequences of problems or examples

autoQs has been written by Dr Karen Ayres at the University of Reading. It is free to use for educational purposes, and can be updated if required for educational purposes, provided reference is made to the following paper

Ayres, KL and Glaister, P (2012) A technique for delivering individualised formative problems and examples. *To appear, Proceedings of the 1st HEA STEM Conference*.

and to the original author (KL Ayres), and that the updated version makes it clear what the changes are. License is not granted for commercial use whatsoever.

The author makes no guarantee that the program will run as expected and with no errors. The program is run entirely at the risk of the user, and the author accepts no responsibility for any problems arising from the use of this program.

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1. Introduction to autoQs

Students benefit from the chance to tackle problems, or see examples, which are tailored to their current level of understanding. Providing problems that are too challenging too soon may be demoralising, and providing problems which are insufficiently challenging for too long may simply lead to a lack of interest and engagement. autoQs has been developed to automatically choose a sequence of problems that is tailored to the student's current level of understanding (as self-assessed). It makes use of simple statistical methodology underlying clinical trials, namely the "3+3" design. Full details can be found in the paper

Ayres, KL and Glaister, P (2012) A technique for delivering individualised formative problems and examples. *To appear, Proceedings of the 1st HEA STEM Conference*

and so are not repeated here. This document instead sets out how one can use autoQs in delivery of a course to students.

The program autoQs has been written using Visual Basic in Microsoft Excel – it has been designed to work with Excel 2003, 2007 and 2010. To this end, only 25 'dose' levels are permitted, to keep the number of required worksheet columns within that which Excel 2003 has available.

Figure 1 shows a typical screenshot of autoQs as students see it (this is delivered as an Excel UserForm). The main features of the program are

- Current level and question number are shown top right
- Current question is shown in the left panel
- Up to five supporting files can be accessed from the grey buttons on the right
- Students declare their level of understanding for the question (in blocks of 25%) with the arrows
- A (blank in the screenshot) small grey button will allow for a sequential release of the supporting files if the lecturer chooses
- The large light blue button is used to move to the next question
- The small red button quits at the current point, returning to the main Excel page
- The title of the UserForm window, the heading of the page and the other headings and labels are all customisable by the lecturer

Figure 2 shows the appearance of the autoQs.xls file upon opening – clicking the main "Start autoQs ..." button opens the UserForm that is shown in Figure 1. The "New to autoQs button?" links to the file autoQs.pdf (see Section 2.3), which should include some information provided by the lecturer with respect to file extensions and their association with relevant programs.

Note: the version that you download will have DEMO or DEMONSTRATION in place of the module code and title, and will have three buttons enabled instead of four. These are only cosmetic differences made to limit the size of the download package (only six questions are provided with the download package, whereas the examples shown in this document are for use of the program with 80).

AS2B1 Stats and Epi for the Life Sciences

Chi-Squared Test problems

Level 1 Question 1

The problem ... (download the data file to accompany this)

Residents on an island (island A) where nuclear testing took place are concerned at the number of deaths from cancers of various types. Data collected from this island and a similar one (island B) where there was no such test are given in the data file. Expected counts under an assumption of no association between nuclear testing on an island and cancer are also given in the data file.

Using the test statistic $X^2 = \sum \frac{(O-E)^2}{E}$, carry out an appropriate test on the observed and expected counts (the critical value from the chi-squared distribution for a 5% significance level for 1 degree of freedom is 3.84).

Further files and explaining the solution ...

[View the data file \(.docx\) for this problem](#)

[View the Powerpoint annotated lecture notes](#)

[View the chi-squared distribution statistical tables](#)

[View a worked solution \(.pdf\) for this problem](#)

How much do you feel you understand this problem?

0%

[Move on to the next problem](#) [Quit](#)

Figure 1. Screenshot of autoQs – main student view (UserForm)

autoQs.xls [Compatibility Mode] - Microsoft Excel non-commercial use

Home Insert Page Layout Formulas Data Review View Developer

A1

autoQs

automatic delivery of questions, problems and examples

Topic: The Chi-Squared Test

Resume from level reached previously (Level 1)

Start autoQs for AS2B1

New to autoQs?
Click here to find out what you need to know

(c) Karen Ayres, University of Reading, 2011

WELCOME

Ready 100%

Figure 2. Screenshot of autoQs.xls upon opening

2. Preparation of files

2.1 Image files of problems or examples

The questions that are displayed on the left of the main autoQs window are image files (.jpg should suffice, but other formats should also be suitable). When using autoQs, one of the first steps is to create the image files of the problems. This can be achieved in various ways, for example using specialist image software. One possibility that we have found to be simple and effective is to first enter the text into a text box in a Microsoft Word document, then copy the text box into Microsoft Paint, as shown in Figures 3 and 4. The image can then be saved as a .jpg file. Depending on the screen resolution of the machine that autoQs is to be used on, it may take a few attempts to ensure that the displayed image fits into the autoQs image box correctly, with large enough font (experiment with different sized fonts to find the one that gives the desired result ... to allow for different resolutions, it would be appropriate to leave some space to the right of the image when creating it, so that if it appears larger on another machine all text is still viewable).

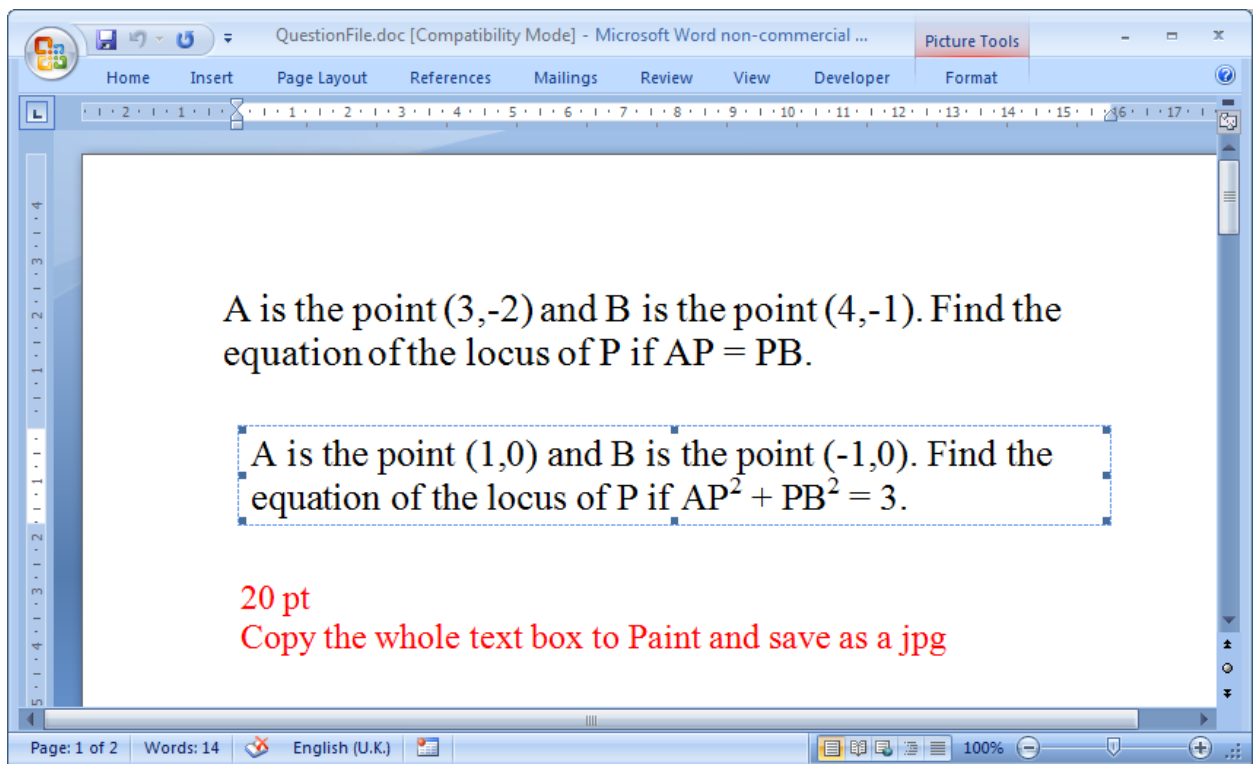


Figure 3. Screenshot of a text box in Microsoft Word, to create question image file

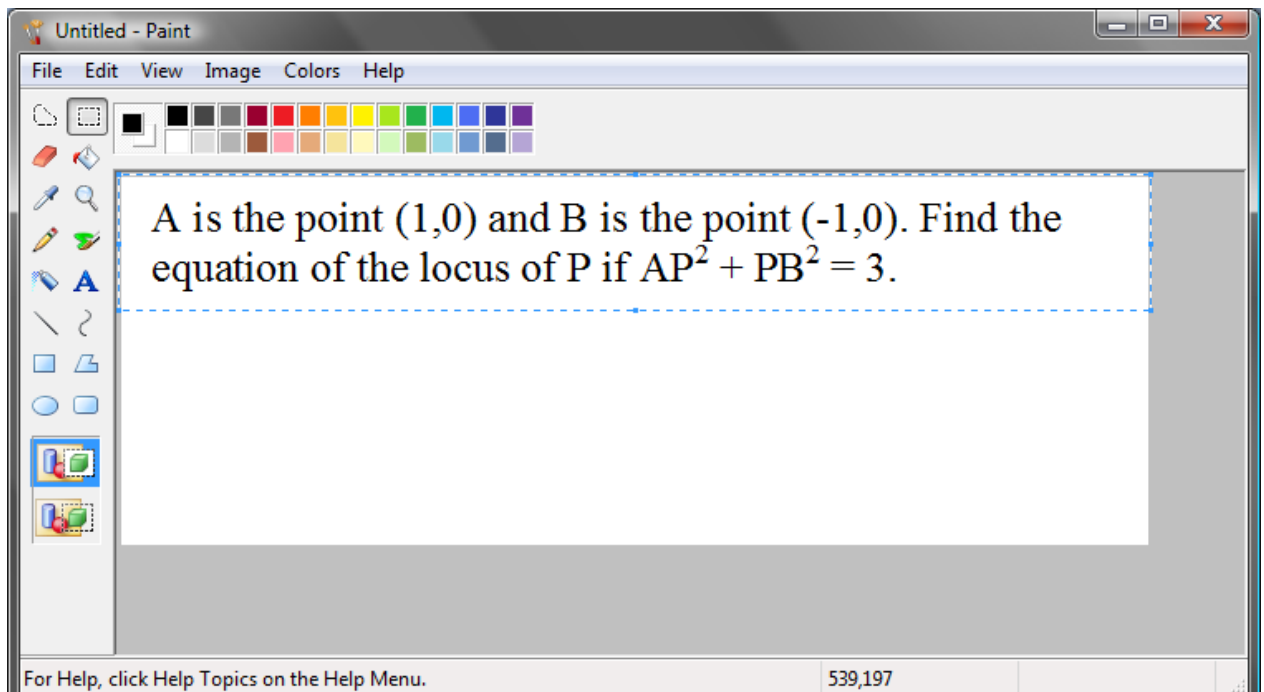


Figure 4. Screenshot of Microsoft Paint with question text pasted in, ready to be saved as an image file

2.2 Supporting files

Up to five supporting files can be made available for each problem/example, and they should be prepared in the usual way. Any files can be made available, provided the user's PC is set up to associate the file extension with a program (and so if this is not automatic, then guidance should be given in the autoQs.pdf file, see Section 2.3, to do this before starting to work through the questions).

Examples of supporting files are full solutions, partial solutions, illustrative material to explain the problem in more detail, screencasts to demonstrate the use of software, audio files to explain concepts, and so on. Depending on the purpose of the use of autoQs, and on the subject, the files can be very different in nature. There is no restriction placed on them by autoQs, except that there can only be at most five, and that they need to be associated with a program for opening them on the user's PC.

The supporting files should be placed in the same folder with autoQs.xls.

2.3 autoQs.pdf

For students who are new to autoQs, there should be some initial guidance placed in a file named autoQs.pdf, which should also be included in the same folder as autoQs.xls. At a minimum, we recommend that the autoQs.pdf file (which can be produced from Microsoft Word) contain information about which programs need to be associated with which file extensions.

3. The lecturer interface

3.1 Introduction

autoQs is a generic program and suitable for use by anyone without knowledge of Visual Basic programming. There is no need to change the code in the program, though there is a need to change the labels on the UserForm, and also to provide various details as well as the filenames for the information to be displayed and accessed. Full details are given below.

3.2 Specifying mode

Figure 5 shows a screenshot of part of the main lecturer interface – essentially the parameters of the program are set in the rows and columns of the main WELCOME sheet outside of the area that the student sees when it is made available to the class. The entries in columns A-C should not be modified, as these are changed by the program when it needs to change them, and the “Hide Rows/Cols” button can be used to quickly hide all rows and columns outside of the A1:L20 region. Entries in Column H and column K need to be specified by the lecturer.

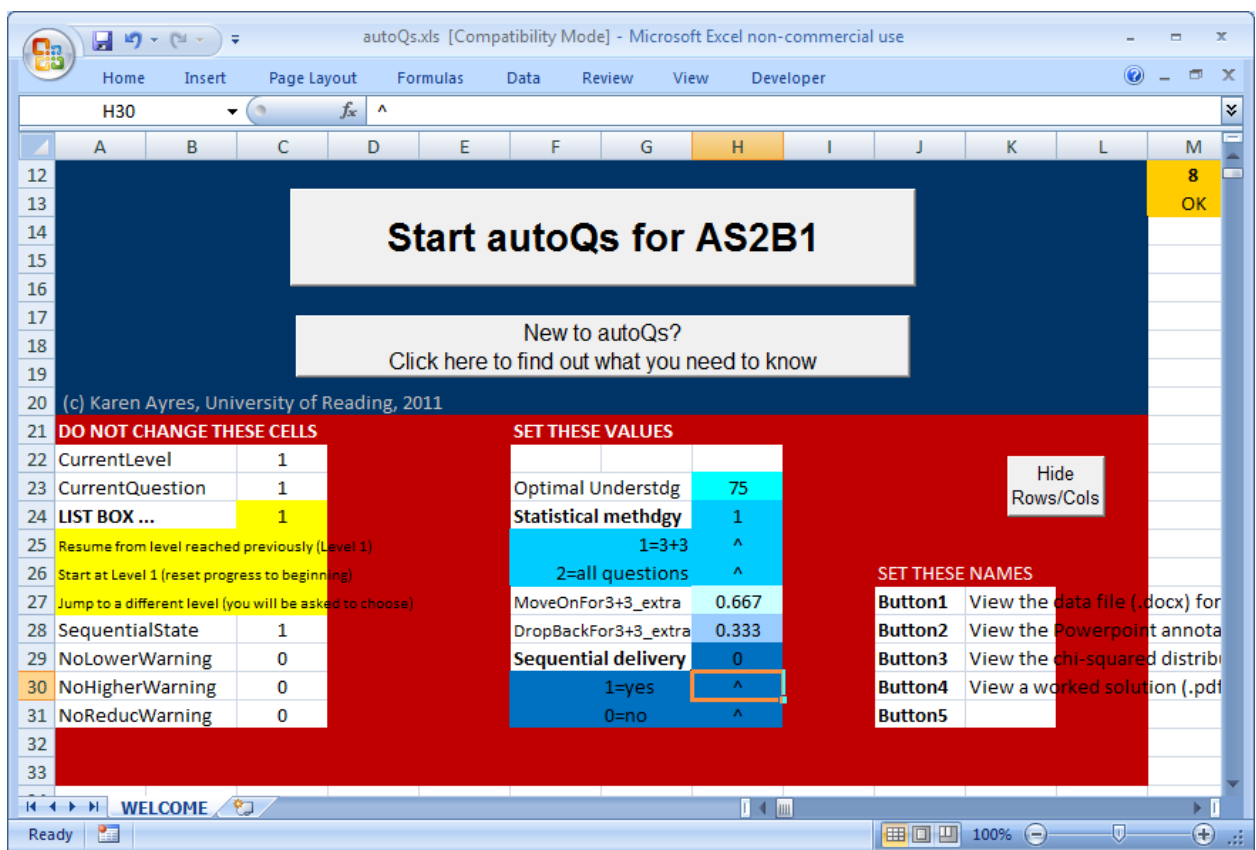


Figure 5. Screenshot of the “lecturer interface” of autoQs (rows 21-33)

Column K (rows 27-31) allow for specification of the main button names that will appear on the right of the UserForm when it is loaded. Leave an entry blank if there are no files whatsoever for that button, else enter some text here (do not just enter a number, ensure that there is some text for a non-blank entry). In Figure 5 (and compare to Figure 1 for the result), there is no entry for Button5, and the text for Button4 reads “View a worked

solution (.pdf) for this problem”. It is best to aim for no more than about 55 characters, to be sure of the name fitting onto the button.

The main parameters determining how the program will operate are specified in column H.

Cell H23	Optimal Understdg	This is the percentage which will count as “sufficiently understood” for a problem if a student declares this to be their level of understanding. A “sufficiently understood” problem is not repeated at any point, whereas one that is not yet “sufficiently understood” will be shown again later when all problems have been seen at least once, and will continue to be shown until it has been declared to be “sufficiently understood”. Because students can only declare their understanding in blocks of 25%, this value should only be set at 100 or 75.
Cell H24	Statistical methdgy	This is an indicator for which type of methodology the program will run under. Enter 1 to use the “3+3+1×k” design, outlined in the Ayres & Glaister (2012) paper, where the dose de/escalation approach is used, and enter 2 if the program is to be used merely to step through each problem one by one with no de/escalation.
Cell H27	MoveOnFor3+3_extra	For the “3+3+1×k” design, this is the proportion of “sufficiently understood” problems that needs to be met when in the “1×k” phase before escalation to the next difficulty level is attempted. To be consistent with the “3+3” phase, by default this is set at 2/3, but can be changed.
Cell H28	DropBackFor3+3_extra	For the “3+3+1×k” design, this is the proportion of “sufficiently understood” problems when in the “1×k” phase to trigger an attempt to de-escalate to the difficulty level below. To be consistent with the “3+3” phase, by default this is set at 1/3, but can be changed. Note that if the student’s current proportion of “sufficiently understood” problems lies between the MoveOn and DropBack proportions, then another problem at the same difficulty level is presented (when in the “1×k” phase).
Cell H29	Sequential Delivery	This is an indicator for a staggered release of the support material (the Hint button is enabled in this mode, with all grey buttons initially blanked out, and their labels only revealed upon each click of the Hint button, which enables the next grey button in turn). This button release mode may be particularly useful when the program is used in the Methodology=2 mode and all questions are cycled through.

3.3 Specifying filenames

Figure 6 shows a screenshot of the lecturer interface (the WELCOME sheet) as you scroll along to the right. It is here that the filenames are entered into the system. Recall from Section 2 that the files need to consist of image files, one for each problem, and of up to five supporting files for each problem (some files can be missing for a problem, there is no need to have a file for every problem for every type, though there does need to be an image file for every problem).

	M	N	O	P	Q	R	S	T	U	V	W	X
1		SUMMARY INFO										
2		Level	1	2	3	4	5	6	7	8	9	10
3		PassThrough	1	0	0	0	0	0	0	0	0	0
4		Number of Qs	10	10	10	10	10	10	10	10	0	0
5		NumComplete	0	0	0	0	0	0	0	0	0	0
6		Num>=75%	0	0	0	0	0	0	0	0	0	0
7												
8												
9												
10		AVAILABLE PROBLEMS										
11	MAX	Level	1	2	3	4	5	6	7	8	9	10
12	8	Number	10	10	10	10	10	10	10	10	0	0
13	OK	Files ...	Level1Q1	Level2Q1	Level3Q1	Level4Q1	Level5Q1	Level6Q1	Level7Q1	Level8Q1.jpg		
14			Level1Q2	Level2Q2	Level3Q2	Level4Q2	Level5Q2	Level6Q2	Level7Q2	Level8Q2.jpg		
15			Level1Q3	Level2Q3	Level3Q3	Level4Q3	Level5Q3	Level6Q3	Level7Q3	Level8Q3.jpg		
16			Level1Q4	Level2Q4	Level3Q4	Level4Q4	Level5Q4	Level6Q4	Level7Q4	Level8Q4.jpg		
17			Level1Q5	Level2Q5	Level3Q5	Level4Q5	Level5Q5	Level6Q5	Level7Q5	Level8Q5.jpg		
18			Level1Q6	Level2Q6	Level3Q6	Level4Q6	Level5Q6	Level6Q6	Level7Q6	Level8Q6.jpg		
19			Level1Q7	Level2Q7	Level3Q7	Level4Q7	Level5Q7	Level6Q7	Level7Q7	Level8Q7.jpg		
20			Level1Q8	Level2Q8	Level3Q8	Level4Q8	Level5Q8	Level6Q8	Level7Q8	Level8Q8.jpg		
21			Level1Q9	Level2Q9	Level3Q9	Level4Q9	Level5Q9	Level6Q9	Level7Q9	Level8Q9.jpg		
22			Level1Q10	Level2Q10	Level3Q10	Level4Q10	Level5Q10	Level6Q10	Level7Q10	Level8Q10.jpg		

Figure 6. Screenshot of the “lecturer interface” of autoQs (columns M-X)

No changes should be made to the table at the top headed SUMMARY INFO – this is written to automatically, given the entries in other cells. This summary table shows progress for each level, including the number of times the system has passed through a set of questions (for the Methodology = 2 mode where multiple pass-throughs are expected), the number of questions available for each level, the number of problems that have been completed by the student (irrespective of their understanding) and the number of problems that have been completed to a level deemed “sufficiently understood” (note that in Figure 6, the cutoff of 75% has been picked up from cell H23). It is this row which determines if there are still problems to present again to a student where they are struggling on a particular level and cannot move up or down.

Under the heading AVAILABLE PROBLEMS there is the space to enter the filename of the image files that have been created for the problems. Any cells which are highlighted in colour should not be modified, as their entries will be completed automatically if necessary. Row 12 for example automatically lists the number of entries in the columns, from row 13 onwards, to record the number of problems available for that level.

There is no requirement to give the image files any particular name, but in order to keep track of them then a Level*Q*.jpg naming convention may be useful, as shown in Figure 6. However, the names are not used beyond just loading in the correct image when required,

Note the message in cells M11:M13. The “3+3” design requires at least six questions per level in order to work. Cell M12 displays the number of levels that are in use in the program currently (picking up the number of cells in row 12 of the table with values greater than 0). This value should not be changed as it is used elsewhere in the program, but here it also accompanied by a check that there are at least six problems for each of these levels. If any level has fewer than six, then the OK message which can be seen in cell M13 in Figure 6 will change to ERROR, and the program will not run under the “3+3” Methodology = 1 mode (it will, however, still run normally if the Methodology = 2 mode is selected in cell H24).

Scrolling along further will reveal spaces to enter the filenames of the supporting files (see Figure 7 for an example where the .docx filenames have been specified). Again, do not change the highlighted cells, but only enter the name of the file that is relevant for the button for each problem.: columns AP – BN relate to files for the first button, columns BQ – CO for the second button, CR – DP for the third button, DS – EQ for the fourth button and columns ET – FR for the fifth button. The two tables to the right of this are automatically filled in by the program when necessary (recording when students have worked through a problem and how much they have said they understand it) and should not be altered manually.

	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													

Figure 7. Screenshot of the “lecturer interface” of autoQs (columns AN-AZ)

3.4 Editing button text and headers

3.4.1 Main WELCOME sheet

The first entry to change on the main WELCOME sheet is in cell B8 (which is actually a cell spreading across columns B – K). This is where you can enter text to indicate the nature of the problems being presented. In the example in Figure 8, the text says “Topic: The Chi-Squared Test”. Selecting this cell you can type in whatever you wish here.

The drop-down box should not be changed, and usually should be left on the “Resume from level reached previously” option by default. Only under the Methodology = 2 mode, where all problems are cycled through, will the option to jump to a requested level be allowed at the time the program is running (in which case a small UserForm will pop up to allow the choice, drawing from the maximum number of levels given in cell M12). It is always possible to select a reset to level 1 when the program is running under either mode. However, usually students will want to resume from their previous state.

Therefore, the only remaining change to make to the WELCOME sheet is to change the text on the main launch button. In Figure 8 this currently says “Start autoQs for AS2B1”, referring to the module for which the program in its current state has been designed. In order to change the text, right-click on the button and select Edit Text (as shown in Figure 8). The cursor will appear at the start of the text, which can then be deleted and alternative text written. Click anywhere on the worksheet to exit editing the text.

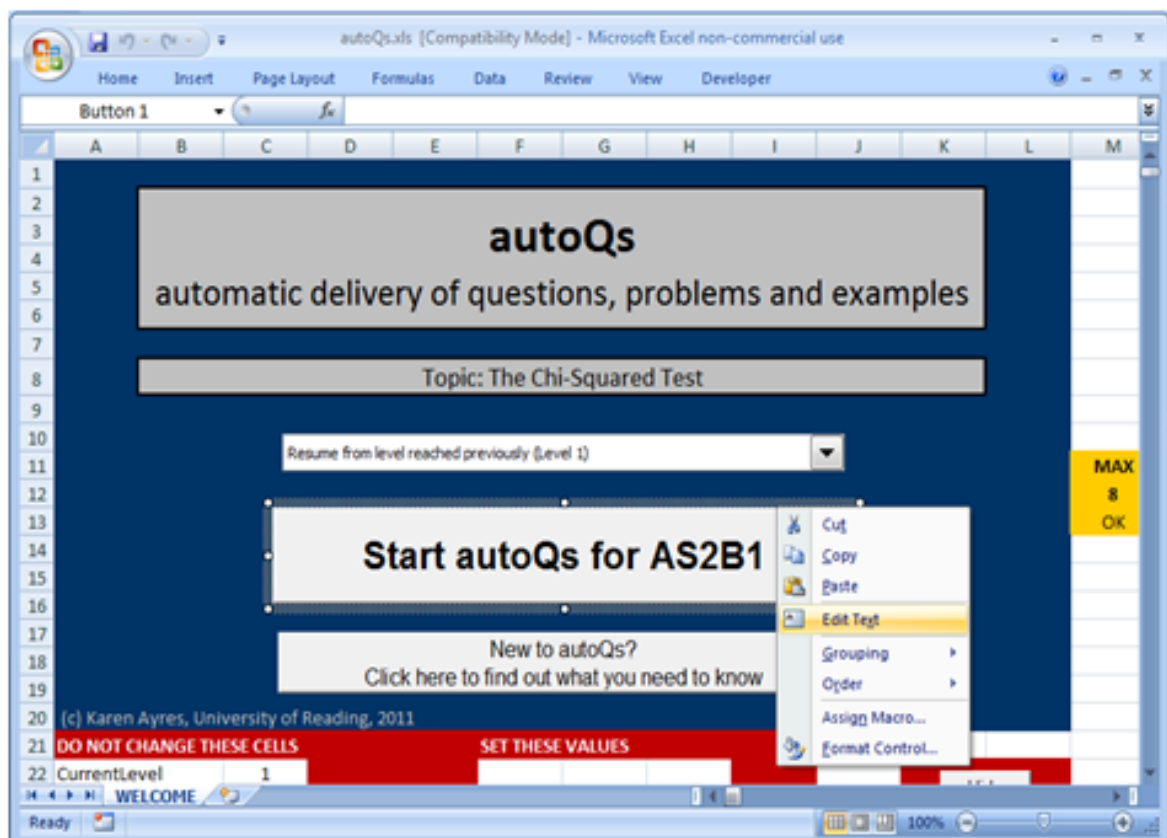


Figure 8. Screenshot of the main WELCOME sheet being modified

3.4.2 Headings on the UserForm

The final changes to make to customise the program to your own needs is to change the headings on the UserForm. In order to access the UserForm, in Excel 2007 or 2010 first select the Developer tab (if you cannot see this, you will need to select Excel Options from the main Office button, then Add-Ins, then select to activate the Analysis Toolpak – VBA). From the Developer tab, click Visual Basic. In the top window on the left, headed Project – VBAProject, scroll down to Forms and double-click on autoQs. The UserForm should appear, as shown in Figure 9.

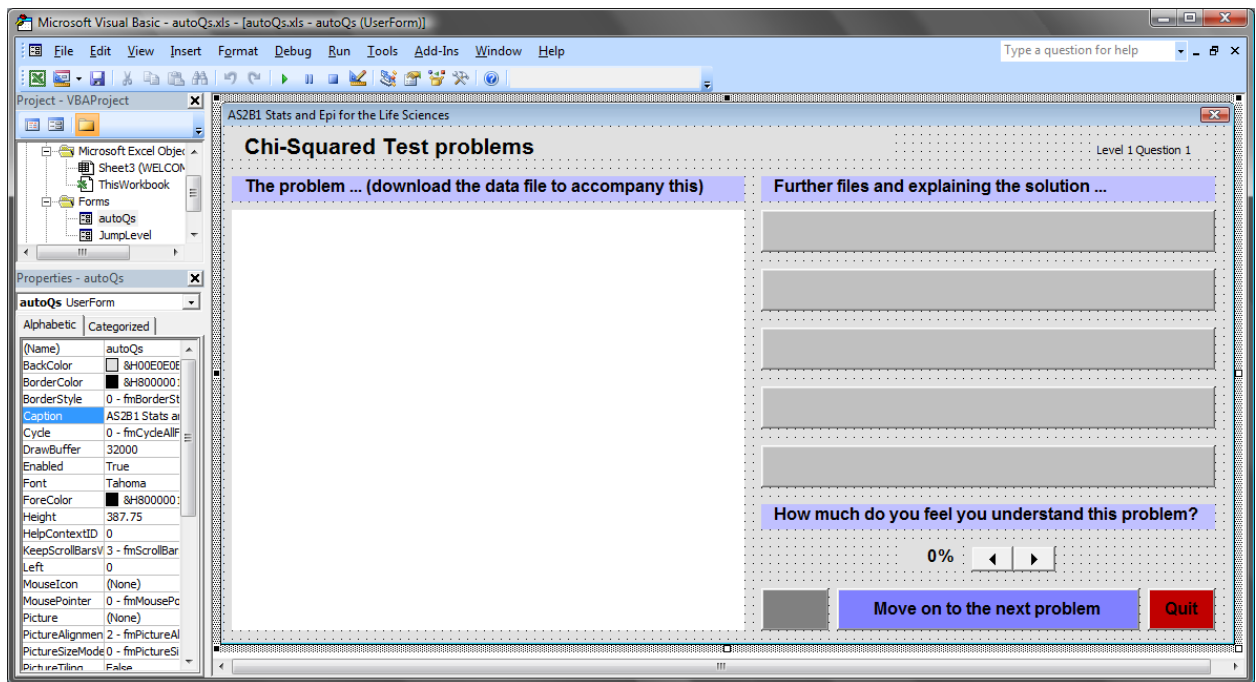


Figure 9. Screenshot of the autoQs UserForm

The following headings and labels can be changed if wished

- Main window name (“AS2B1 Stats and Epi for the Life Sciences” in Figure 9)
- Main heading (“Chi-Squared Test problems” in Figure 9)
- Image heading (“ The problem ... (download the data file to accompany this)” in Figure 9)
- Button heading (“ Further files and explaining the solution ...” in Figure 9)
- Understanding heading (“ How much do you feel you understand this problem?” in Figure 9)

Note that the grey buttons have no labels, because these will be added at the time the program runs.

To change the main window name, click on the top band of the autoQs UserForm window. On the left, the Properties – autoQs window should show (name) autoQs at the top, as in Figure 9. Left-click in the Caption box, highlight the current text, and overwrite it to change the name of the window.

To change any of the labels, left-click that label so that it is highlighted. On the left, the Properties window should now be relevant to the label clicked. For example, if you click the label currently entitled “ The problem ...”, i.e. the image heading label, the Properties

window in Figure 10 should be displayed. Again, select the Caption box, delete the text, and overwrite it with new text to change the heading.

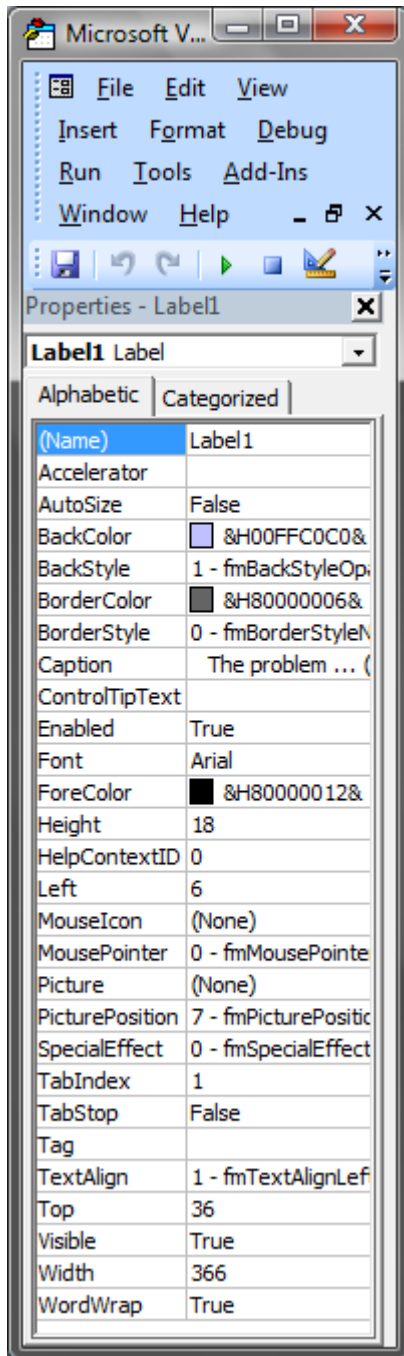


Figure 10. Screenshot of the Properties window for the image heading in the autoQs UserForm

The remaining labels not referred to in the list above should not be changed unless really necessary (i.e. the Level and Question labels in the top right corner, the display of the percentage understanding). It may be preferable to change the text of the blue button to “example” instead of “problem”, and if so, follow the same procedure as above.

4. Making it available to students

4.1 Protecting the file

When the program is ready to be made available to students, click the macro button “Hide Rows/Columns”. This will hide all rows and columns on the WELCOME sheet that are outside of the A1:L20 range (the macro assumes that Excel 2003 is being used, or that the file is open in compatibility mode, and so only hides the relevant number of rows and columns for that version – the code is commented out in the Sub HideCols() and the Sub UnhideCols() functions to hide rows and columns for worksheets under Excel 2007 or 2010, so can be used if necessary).

In order to prevent inadvertent deleting of the macro buttons on the WELCOME sheet, the file should then be Protected before being made available to students. In Excel 2007 or 2010, from the Review tab click Protect Sheet, and ensure that only “Select locked cells” and “Select unlocked cells” are ticked (scroll down to make sure that Edit objects is not ticked). Add a password if desired (but make a note of it!)

To unprotect and regain the full lecturer interface, from the Review tab click Unprotect Sheet, and then from the Developer tab click Macros, and choose to run UnhideCols.

4.2 Availability and purpose

The autoQs.xls file needs to be made available alongside the set of supporting files (the .jpg image files of the questions, and the various additional files). Since the student needs to save their progress, they will need to have a copy of the files on their own PC, or in their university filespace. It is therefore not suitable for making available via a VLE (Virtual Learning Environment), except in terms of a zip file of the whole suite of files together. We have found this to be a suitable distribution method. All files should be within the same folder before zipping.

We advise explaining to students the use of the program before making it available to them. For example, explain the benefit of formative problems, and explain the benefit gained from tackling problems that are most suited to their current level of understanding. It is important that they honestly evaluate their level of understanding for each problem before moving on, and that they save their progress to pick up from that point later on. We would also advise demonstrating the use of the program to the class, to encourage its use and avoid problems.

5. Acknowledgement and contact details

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