BACK

AN INTEGRATED SYSTEM FOR WEB-BASED ASSESSMENT IN MATHEMATICS

Michael McCABE, Brian DAUGHERTY
School of Computer Science and Maths, University of Portsmouth, England PO1 2EG
michael.mccabe@port.ac.uk, brian.daugherty@port.ac.uk

Abstract
On-line assessment is used in the School of Computer Science and Mathematics for both self-assessment and formal examinations. The key to its successful introduction, over two years ago, has been the exploitation and extension of a sophisticated new suite of programs, Question Mark Perception (http://www.qmark.com/perception) which supports rapid authoring, flexible delivery, secure management and results analysis of tests. Basic mathematics test questions may be MCQ, MRQ, numeric, text, match items, sequence, matrix, single or multiple hotspot. Random numeric or variable parameters have been added as an extra feature to enable greater question variety. Some test questions use additional software in support of on-line tests, e.g. problem solving with Maple/Matlab are formally assessed at http://meat.csm.port.ac.uk/cmp108/assess.htm.

Introduction

In the School of Computer Science and Mathematics at the University of Portsmouth, students are introduced to both Maple and Matlab computer software at an early stage. The first year course unit, "Computer Packages in Mathematical Studies", enables students to acquire the necessary skills for effective use of the software and to solve a range of interesting problems. The unit is studied in parallel with a calculus unit based on an Anton textbook and an algebra unit based on a Larson and Edwards textbook. Both books include technology exercises, the former suitable for Maple and the latter for Matlab. Students are expected to tackle a selection of these exercises, as well longer problems such as those found in Etchells (1997). The assessment of all three of these units is now conducted by means of regular computer-marked tests, typically every two or three weeks.

Computer Assisted Assessment on Local Networks

Since 1994 Question Mark Designer for Windows has been adopted as the standard software package for computer assisted assessment on local networks. The main question types available in this software are multiple choice, multiple response, text, numeric, selection (match/rank) and hotspot. Questions are authored, delivered and results analysed by the package. Figure 1 below shows a recent Designer example of an objective question, which uses a selection "match items" question.

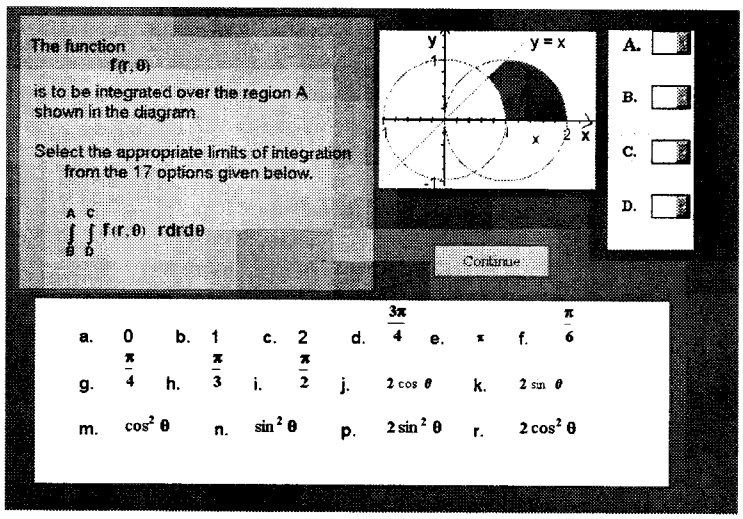

Figure 1 Use of Question Mark Designer for Local Computer Assisted Assessment

For some questions, access to further software, ranging from a simple calculator to a computer algebra system, is made available via a button on the screen. For a course unit in which it is already a requirement for students to use Maple and Matlab, computer assisted assessment is a logical choice. Immediate feedback on practice questions encourages learning, instant marking of exams saves time and analysis of results helps to pinpoint common student errors.

Web Hosted Assessment of Mathematics (WHAM!)

Local assessment with mathematical software support has been extended to take advantage of a comprehensive, new system for delivery of assessment on the World Wide Web. The application suite adopted is Question Mark Perception (http://www.qmark.com/perception/), which has been found to be much more powerful and easier to use than other available systems, including those for local assessment delivery. Perception provides comprehensive facilities for question authoring, test assembly, delivery and feedback, results reporting and analysis, as well as test management and security. The four modules within QM Perception are:

- the Question Manager for authoring and organising question banks
- the Session Manager for selecting questions for use within tests
- the Perception Server for on-line administration of secure test delivery
- the Reporter for on-line analysis of test results

A wide variety of standard question types are available, including MCQ, MRQ, text, numeric, match up items, place in sequence, matrix, single or multiple hotspot. Figure 2 shows the delivery of a typical on-line question requiring multiple numeric input.

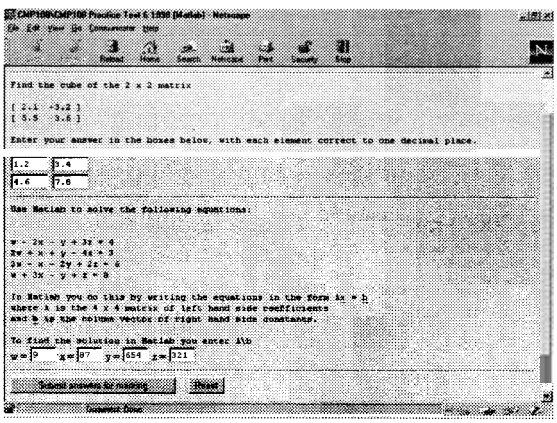

Figure 2: On-Line Delivery of Questions with Multiple Numeric Answers

Random numeric or variable parameters have been added as an extra feature to enable greater question variety (McCabe et al., 2000).

In some questions, students are expected to use additional software to answer questions. Figure 3 shows a Maple graph being plotted to help identify a location where no derivative exists.

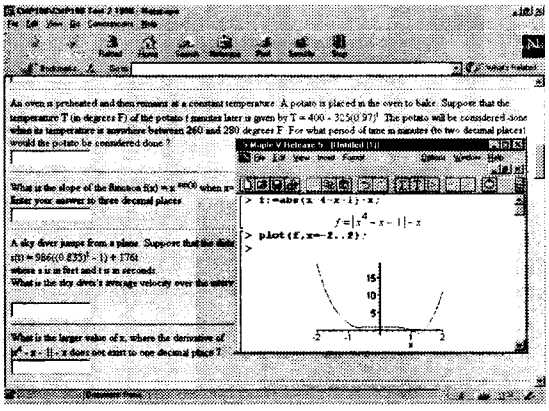

Figure 3 Numeric Questions with Maple Support

Similar tests can be tried at http://meat.csm.port.ac.uk/cmp108/assess.htm. and http://L62.csm.port.ac.uk/mathletics.html

Future Proofing

Question banks with a wide variety of question types have been used to deliver on-line assessment. The release of an international standard for question and test interoperability (Smythe and Shepherd, 2000) is an important recent development in the "future-proofing" of questions.

References

- McCabe, E.M.. et al.(2000) http://meat.csm.port.ac.uk/caa4paper.doc and http://meat.csm.port.ac.uk/ictmt4p.doc Smythe, C. and Shepherd, E. (2000) , http://www.imsproject.com
- Etchells,T.(1997) *Math. Activities with Computer Algebra*, Chartwell-Bratt