Electronic Documents

interactiveworkbook: LaTeX-based interactive PDF on the Web

Jonathan Kuhn

Abstract

The package **interactiveworkbook** gives the user the ability to write LaTeX documents which, ultimately, create interactive question-and-answer Portable Document Format (PDF) tutorials meant to be used by Internet distance learning students (Kuhn, 1999).

1   Introduction

Combining interactivity with the display of mathematical notation is important for online distance learning. The interactive PDF (Adobe, 1999a; Adobe, 1999b) tutorials created using **interactiveworkbook** are meant to mimic a classroom discussion situation. The interactive PDF tutorial program responds in either a positive or negative way to an Internet student's answers to a variety of questions, including multiple choice (multiple and single answer), fill-in-the-blank, true/false and matching type problems. The fact that the interactive PDF tutorial is LaTeX-based allows both the program questions and responses to student answers to be very

explanatory and, in particular, to freely use mathematical notation.

Achieving interactivity with the display of mathematical notation is difficult on the Internet. The Internet is presently based on the Hypertext Markup Language (HTML) which essentially does not allow for mathematical notation. Not surprisingly, a fair bit of effort has been devoted in the last few years to finding a solution to this problem. The World Wide Web Consortium, which manages HTML, has prepared a Mathematical Markup Language (MathML) (Sutor and Dooley, 1998; W3C, 2001). The computer company IBM has produced a plug-in for Netscape Navigator and Microsoft Internet Explorer called *techexplorer Hypermedia Browser* (Sutor and Dooley, 1998). The interactive PDF approach used in this paper has been used by others, in particular, D.P. Story (1999) and T. Merz (1998). An initial version of **interactiveworkbook**, called *pdfflash*, was written by A. Montgomery (1998).

2 Creating an interactive PDF question

A simple example of the use of **interactiveworkbook**, to create an interactive PDF multiple choice question with multiple answers using check boxes, is given below.

```
\documentclass[dvips]{article}
\usepackage{interactiveworkbook}

\begin{document}

\questionandresponses{check}
{ques1.pdf}{questionindex.pdf}{ques3.pdf}
{Question 2. $\;$ This is a multiple
check box question where more than one
answer can be correct.\\
\begin{center}
\checkone {\boldmath $0.94$}
    \answercheckone{Off} $\;$
\checktwo {\boldmath $0.95$}
    \answerchecktwo{Off}$\;$
\checkthree {\boldmath $0.96$}
    \answercheckthree{On} $\;$
\checkfour {\boldmath $0.97$}
    \answercheckfour{Off} $\;$
\checkfive {\boldmath $0.98$}
    \answercheckfive{On}
\end{center}
}
{Yes, correct.}
{No, try again.}

\end{document}
```

Using a LaTeX → DVI → PS → PDF process, three PDF pages (which, together, are called an interactive PDF question), are generated by this sample LaTeX file. These three pages include a question (first) page, correct response (second) page and incorrect response (third) page. In addition to the question text and check boxes, there are a number of navigational buttons appearing at the bottom of all of these pages. Depending on the navigational button clicked, the user is passed either between the three pages of this interactive PDF question, or outside of this interactive PDF question, to another interactive PDF question.

2.1 The \questionandresponses command

The command \questionandresponses used in the sample LaTeX file above has seven arguments.

The first argument, "check", tells **interactiveworkbook** that check boxes are used in this particular question. This first argument may take on one of four values: check, popup, field or radio.

The second, third and fourth arguments name the PDF files that a user passes to when clicking on the Previous, Index and Next navigational buttons, respectively. In this case, a user passes back to the first question, ques1.pdf, when clicking on the Previous question, ques3.pdf, when clicking on the Next button.

The question asked is given in the fifth argument. Five check boxes, \checkone, ..., \checkfive, are used, where the five possible choices are 0.94, ..., 0.99. The third and fifth choices, in this case, are correct, because \answercheckthree and \answercheckfive are "On" and the other three are "Off". The correct answers are not displayed to the user on any of the three pages of the interactive PDF question, and are only shown on the two response pages after clicking on an Answer button.

Correct response and incorrect response comments are given in the sixth and seventh arguments, respectively. The correct response comment, in this case, is "Yes, correct.", whereas the incorrect response comment is "No, try again.". These comments appear below the question on the correct response and incorrect response pages, respectively, of the interactive PDF file.

2.2 Interactive index PDF page

In addition to the interactive PDF question, there is one other kind of interactive PDF document generated by **interactiveworkbook**, called an interactive PDF index page. The interactive PDF index page can be used to tie a collection of interactive

PDF questions into an *exercise* of related questions. Consider the following example.

```
\documentclass[dvips]{article}
\usepackage{interactiveworkbook}

\begin{document}

\exerciseintroduction{Index. This is an
index of four interactive PDF questions.}

\vspace{.2in}
\exerquessetupone{ques1.pdf}
\exerquessetuptwo{ques2.pdf}
\exerquessetupthree{ques3.pdf}
\exerquessetupfour{ques4.pdf}

\begin{center}
\begin{tabular}{|lc|} \hline
    Question 1. & \exerquesone   \\ \hline
    Question 2. & \exerquestwo   \\ \hline
    Question 3. & \exerquesthree \\ \hline
    Question 4. & \exerquesfour  \\ \hline
\end{tabular}
\end{center}
\end{document}
```

The introduction to the exercise, beginning "Index. This is an ...", is given as the argument of `\exerciseintroduction`. Also, `\exerquessetupone`, for example, specifies the user passes to the first interactive PDF question, `ques1.pdf`, when clicking on a rectangular button defined by `\exerquesone`.

3 interactiveworkbook

The two sample LATEX files given above were written using the WinEdt editor. They have been executed using the MiKTEX version of LATEX on a Pentium II 32 Meg RAM, 6 Gig hard disk, 266 MHz Aptiva PC. One style file, `interactiveworkbook.sty`, was located in the `/tex/latex/graphics` directory and a number of supporting Encapsulated PostScript (EPS) files (Adobe, 1999c; McGilton and Campione, 1992; Flanagan, 1998) were located in the same directory as the two sample LATEX files.

The package `interactiveworkbook.sty`, EPS files, some sample interactive PDF files, and a readme are contained in the self-extracting zip file, `interactiveworkbookzip.exe`, which can be downloaded from

`http://www.pnc.edu/faculty/jkuhn/research/research.html`

or from CTAN at
`http://www.ctan.org/tex-archive/macros/latex/contrib/interactiveworkbook.`

After making sure Adobe Acrobat 4.0 or later is installed and setting the File | General Preferences | Magnification | Default Zoom preferences to "Fit in Window", click on one of the PDF files, such as `ndex.pdf`, say, to begin the interactive session.

4 Acknowledgements

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◇ Jonathan Kuhn
 Purdue University North Central
 Westville, Indiana 46391–4197
 USA
 `jkuhn@pnc.edu`
 `http://www.pnc.edu/faculty/`
  `jkuhn`