

## Multiple choice test creation and marking - the future is barcodes

Warren Harrop

wharrop@swin.edu.au

CAIA lightning talk  
Swinburne University of Technology



### Outline

---



- Space age technology, that is to say, technology from the 1960s:
- Barcodes!

# Motivation

---



- Make some painstaking parts of teaching easier
  - Attendance
    - No calling names
    - No paper based attendance
      - Reduce possibility of any forgeries
      - No need to transcribe to spreadsheet
  - Marking multiple choice tests...

# Literature / other options:

---



- OCR
  - [1] Scribble over the incorrect letters on answer sheet
    - OCR only works on what is left
  - [2] More advanced OCR, answers are in-line
    - Advantage with many tests – the scanner can be a photocopier
- Survey or test web sites? (many out there)
  - Didn't want to go external for privacy reasons.
  - Didn't want to develop from scratch.

[1] <http://jeroendoggen.wordpress.com/2011/06/06/automated-multiple-choice-exam-grading/>

[2] <http://home.gna.org/auto-qcm/>

## Literature / other options: (2)

---



- Wanted to stay with paper
  - Paper trail
  - Student: "I swear I answered `B`!"
  
- Punch cards?
  - Could, but there might be problems with hanging chads...

## Barcodes

---



- Had a good idea it would work
- Keeps me in the loop when marking
- Allows students to correct answers without too much worry about how an OCR scanner will react
- Barcode readers are cheap
  - <http://s.dealextreme.com/search/barcode>
- (Was already using for attendance)

## pst-barcode for latex [1]

---



- Can produce many varieties of barcodes
  - Including 2D ones
- I went with Code-39 (same as our ID cards)

Example code:

```
\begin{pspicture}(5,1in)
\psbarcode{BARCODE1234}{includecheck
includetext}{code39}
\end{pspicture}
```

## BASH scripts

---



- Generate randomised tests:
  - Take a question file (my own tags to indicate what is what)
  - Loop for number of tests to make
    - Write out a header (instructions for taking test, etc...) to the latex file
    - Randomise questions, randomise possible answers - write into the file
    - Write out a footer to the file
  - Build the latex into pdf
  
- Print all the pdfs, take test

# BASH scripts (2)



## •Mark:

- Scan all the barcodes
- Generates a results file for the student
- (Analysis of test results at this point)

## •email results:

- emails results text file, and a copy of the original pdf to the student

# Demo



# Success!

---



- With 40 tests the only error discovered so far was me scanning two barcodes
  - A few queries, but they were all students misremembering their answers
  - If I had more time, I would have scanned in each test using the photocopier, emailed, and got students to check (but no time!)
    - For now, that that on a per-request basis

# Problems

---



- I did record the question randomisation order, but not the answer order
  - I can tell what students had issues with what questions
  - But can't work out what wrong answer they were marking down - and if there was correlation there
- Some students don't seem to like the randomisation of questions
  - I did instruct students to consider what order they should do questions in, but some still did not
  - I'm not going to fix this

## Known bugs / future work

---



- Hardcoded to 4 options per question
- Can't 'lock' the order of a set of questions, or answers.  
Random or nothing.
  - ...So don't say "none of the above" -  
say "none of the other answers"
- Scanning two codes - just marks a question wrong
  - Could add in some more error checking

## Known bugs / future work (2)

---



- My particular scanner seems to have very occasional issues in transmission
  - The error is a missing char - so easily checked for
  - Could implement the use of the checksum
- Could make barcodes smaller if I had a better scanner...
  - Ordered a laser diode based one last night (\$35)

## Long term future work

---



- CCD based handheld barcode reading (eg. iPad)
- Cards also contain an RFID chip\*
  - Does not contain student ID number though
  - Loose easy ability to cite ID card picture
- API for uploading marks to ESP (ICT Electronic Submission Processor web site)
  - Takes care of recording and releasing marks to students