



UNIVERSITY OF
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Electronic submission and marking of handwritten solutions

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Background

How it's done now:

- Substantial part of assessment in Mathematics focuses on solving problems.
- Since solutions usually contain many equations, writing them in a word processor is impractical.
- So, students write solutions by hand on sheets of paper, staple them (hopefully), write name, module number, etc. (hopefully), and submit them by dropping in a corresponding box by a specified deadline.
- Solutions are picked up by markers, marked by writing the marks and feedback with a red pen on the solutions, as well as entering marks in a spreadsheet (e.g. Grade Centre on Bb).
- The marked solutions are then distributed to students in a lecture, problem class, seminar, etc.

Background

Drawbacks:

- Students have physically to bring in the solutions to drop them in a box
- Solution may be dropped in a wrong box and eventually lost (no way to verify whether it was actually submitted)
- If not well stapled, the solutions pages may get separated and lost
- If students forgot to write their name or student ID, it may be hard to identify whose work it is
- Returning marked solutions to students is time consuming (especially in big classes)
- Students who happen to be absent in class do not get their marked solutions on time.
- Not 'green'

DIP Project Aims and Team

1. Investigate options, determine best practices, and prepare written guidance for students on how to submit their solutions in an electronic form, for example via Blackboard
2. Investigate options, determine best practices, and prepare written guidance for markers on how to mark the electronic solutions and return marks and feedback to students in an electronic form

Project team:

Digital Advocate: **RD**

Digital Associates: **Matthew Norris** (2nd year BSc Mathematics)

Digital Innovator: **Andy Tonks** (teaches Calculus and Analysis – 1st year core module)

Digital Associate: **Octavia Hailes** (3rd year BSc Mathematics)

Digital Innovator: **Ed Hall** (teaches Probability and Introduction to Stats – 1st year core modules and Introduction to Computing – 2nd year core module)

Analysis of options

Part 1: Submission

Option 1		Option 2		Option 3		Option 4	
Scanning handwritten work with mobile phone scanning apps (Microsoft Lens, Evernote, Adobe Scan)		Scanning handwritten work on Uni scanners		Math based software to type solutions (STACK, Wiley Plus, Latex)		Writing tablets (WACOM, iQbe, UGEE Graphics Tablet)	
Pros	Cons	Pros	Cons	Pros	Cons	Pros	Cons
Can do it anywhere (e.g. ill / home)	Must scan multiple documents (time consuming)	Fast, scans all pages in one go	Must be in Uni	Looks good/ professional	Students must get used to typing in a mathematical format	Quick and easy	Expensive (£20 - £100 roughly per student)
Sufficiently legible	May not compress to one file	Emailed directly to Uni account	Quality can be poor on different types of paper.	I know students at Loughborough using STACK	Time consuming	Converts text written on tablet straight to PDF file (no 'middle man'/ scanning)	Requires software on mobile/laptop
Lots of variety of apps (same output file needed)	May not be available for all mobile OS	Scans all files in one go	Economics students say they sometimes have to rewrite to get a better scan.	Could use LaTeXiT just for equations and import into Word, etc.	Not much known about it		Charging required
	Not all students have access to mobile.	Already done in Economics and students have to use the scanner. Students are fine with this.	Things in margins sometimes not picked up.				Variable quality of writing experience

Analysis of options

Part 1: Submission

Submission via Blackboard	
Pros	Cons
Submission code as proof	File size limit (2MB per page)
Easy to upload one/multiple files	No integration with a scanning app so work cannot be directly scanned into blackboard
Can restrict file type submission (e.g. Only PDFs allowed – making it easier for markers)	Students maybe less inclined to come into Uni at all
Midnight deadlines as no college house restrictions	
No losing marked work	

Analysis of options

Part 2: Marking and Feedback

Option 1		Option 2		Option 3	
Tablet with compatible digital pen		General feedback sheet (similar given for exams where feedback is given for how the overall cohort did on each question)		Longer/more detailed feedback sessions (smaller groups)	
Pros	Cons	Pros	Cons	Pros	Cons
<p>Directly annotate and note on PDFs (Easy to do with built in Drawboard PDF app for Windows 10)</p> <p>Don't have to carry lots of work about</p> <p>No chance of losing work (unless files corrupt but can always reupload)</p>	<p>Expensive (Cheaper to provide staff with tablets and let students scan work)</p> <p>Tedious to mark for whole class and inputting marks into blackboard could be time consuming (Split work between markers – 20 students each?)</p> <p>Systems could be slow or unresponsive at times</p> <p>File sizes would be large for large cohort</p> <p>Marked files would have to be reuploaded to specific accounts</p>	<p>Quicker to do than writing feedback on all work</p>	<p>No specific feedback to students except marks</p> <p>May get lots of questions from students (Students generally want personal/detailed feedback). Is this evidence based?</p> <p>One submission file to upload to blackboard with marks given with grade centre</p>	<p>Quick marking; just follow mark scheme and provide marks via Grade Centre</p> <p>Students get more personal and detailed feedback</p> <p>Students may be more inclined to come to Uni if this is the only way they get personal feedback</p>	<p>More time consuming for students and feedback leaders</p> <p>We don't see that it is more time consuming for students. Although timetabling may be an issue.</p>

Analysis of options

Part 2: Marking and Feedback

Marking and Feedback via Blackboard	
Pros	Cons
Can download all work as a zip file instead of separately	No integration with PDF editors; must download all files then mark individually and reupload. Would be easier if you could click a name, the students work appears, can then be marked/annotated and then reuploaded with one click when finished.
Lecturers already comfortable with Blackboard platform	
Integrated comments and marks section	Technical errors may cause submissions to fail or get corrupted (back ups needed?)

Resources and examples

Best scanning apps

Product	Abbyy FineScanner	Dropbox Business	Evernote Scannable (for iPhone)	Genius Scan Plus	Adobe Scan (for iPhone)	Intsig CamScanner	Microsoft Office Lens (for Android)	ScanBot	Shoeboxed	TurboScan
Lowest Price										
Editors' Rating										
Captures Business Cards	✓	—	✓	—	—	✓	✓	✓	✓	—
Captures Text	✓	✓	✓	✓	✓	✓	✓	✓	—	—
Captures Multi-Page Docs	✓	✓	—	✓	✓	✓	—	✓	—	✓
Captures Photos	—	✓	✓	✓	✓	—	✓	✓	—	✓
Fax Capability	—	—	—	✓	—	✓	—	—	—	—
Prints from App	✓	—	✓	✓	—	✓	—	✓	✓	✓
Includes OCR	✓	—	✓	—	✓	✓	✓	✓	✓	—
Annotates Images	—	✓	—	✓	✓	✓	—	✓	✓	—
Read Review	Abbyy FineScanner Review	Dropbox Business Review	Evernote Scannable (for iPhone) Review	Genius Scan Plus Review	Adobe Scan (for iPhone) Review	Intsig CamScanner Review	Microsoft Office Lens (for Android) Review	ScanBot Review	Shoeboxed Review	TurboScan Review

Resources and examples

Example of University scanner

3.1 Q2 Analytic Solution (2).pdf - Drawboard PDF

Tabs

View & Layout

3.1 Q2 Analytic Solution (2).pdf

1/2

42%

Close all

3.1 - Question 2

$$\frac{dy}{dx} = 1 - y^2, \quad y(0) = 0$$
$$\Rightarrow \int_{y_0}^y \frac{dy}{1-y^2} = \int_{x_0}^x dx$$
$$\frac{1}{1-y^2} = \frac{1}{(1+y)(1-y)}$$
$$= \frac{A(1+y)}{(1-y)} + \frac{B(1-y)}{(1+y)}$$
$$\Rightarrow \begin{aligned} A(1+y) &= A + Ay \\ B(1-y) &= B - By \\ \therefore A + Ay + B - By &= 1 \\ \Rightarrow A + B &= 1, \quad Ay - By = 0 \\ A &= \frac{1}{2}, \quad B = \frac{1}{2} \end{aligned}$$
$$\therefore \frac{1}{1-y^2} = \frac{1}{2(1-y)} + \frac{1}{2(1+y)}$$
$$\Rightarrow \int_{y_0}^y \frac{1}{2(1-y)} + \frac{1}{2(1+y)} dy = x - x_0$$
$$\frac{1}{2} \int_{y_0}^y \frac{1}{1-y} + \frac{1}{1+y} dy = x - x_0$$
$$\frac{1}{2} [-\ln(1-y) + \ln(1+y)]_{y_0}^y = x - x_0$$
$$\frac{1}{2} \left[\ln \left(\frac{1+y}{1-y} \right) \right]_{y_0}^y = x - x_0$$
$$\therefore \frac{1}{2} \left[\ln \left(\frac{1+y}{1-y} \right) - \ln \left(\frac{1+y_0}{1-y_0} \right) \right] = x - x_0$$

Next steps

- Discuss and identify best options (before mid-May)
- Draft guidance for submission and marking/feedback, circulate among staff and students, gather feedback (before end of May)
- Finalise the guidance, present project results (June)
- Introduce electronic submission/marking in 2018/19 in Year 1 (compulsory), and Years 2-4 (as an option).

Questions?