Computer-aided assessment at J-BJI

Robert Leek
r.leek@bham.ac.uk

暨 南 大 学 伯 明 翰 大 学 联 合 学 院

19th June 2024

Context and history

- Jinan-Birmingham Joint Institute (J-BJI) is a transnational partnership between Jinan University, Guangzhou, China, and University of Birmingham, UK.
- First cohort at J-BJI enrolled in 2017/18.
- 4 programmes offered: Applied Mathematics with …
    - Economics,
    - Information Computing Science,
    - Mathematics[1],
    - Statistics.
- University of Birmingham (UoB) teaches 80 credits per year (4 modules per year) and teaches the same modules to all students.
- UoB employs a fly-in/fly-out model, with most academics teaching there for ≈ 2 months per year.

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[1]"Pure Mathematics"

Context and history

- Continuous assessments initially contributed 20% towards module marks, all delivered using the Möbius[2] CAA system.

- During 2020/21 academic year, this increased to 50% due to resilience plans at UoB during the pandemic.

- Reduced back to 20% and then to 10% from 2022, with 10% contribution from hand-written problem sheets.

- 188 assessments delivered from 2017/18 to 2022/23.

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[2]https://www.digitaled.com/mobius/

Content development

- UoB hired student interns (in Birmingham) to implement questions and assessments in Möbius.

- Flying faculty staff focused on writing specifications for these assessments.

- Training and guidance was provided to interns and staff, led by colleagues Jonathan Watkins (JW) → John Christopher Meyer (JCM) → RL → Daniel Jones.

- Quite different approach to having a dedicated team of content developers: all teaching staff were involved in developing content in Möbius, to varying degrees.

Regrading

- We discouraged penalising students for syntactical mistakes (e.g. inputting "3x+2" instead of "3*x+2").
- JCM & RL implemented a regrading procedure, whereby a regrader would check responses which deserved marks but were not awarded, which could be caused by:
    - syntax issues,
    - alternative valid answers/edge cases not anticipated by module lead,
    - mistakes/bugs in grading code/Möbius.

UoB improvements to Möbius platform:

JW wrote JavaScript bookmarklet to collate student responses in gradebook,

RL designed a grading code template to catch syntax errors (imperfectly) and assign 1% of marks, so they could be identified within gradebook.

Regrading

Count	Question Index	Student Answer	Correct Answer	Raw Response	Mark
1	0	45405360*a^2*b^5*c^8	$135135\ a^2\ b^5\ c^8$		❌ 0 / 1 💾 ✖
1	0	25025*a^8*b^3*c^4	$225225\ a^8\ b^3\ c^4$		❌ 0/1 ✎
1	0	1175720*a^4*b^3*c^12	$1763580\ a^4\ b^3\ c^{12}$		❌ 0/1 ✎
1	0	17325	$225225\ a^8\ b^3\ c^4$		❌ 0/1 ✎
2	0	135135	$135135\ a^2\ b^5\ c^8$		❌ 0.5/1 ✎
1	0	1763580*a*b*c	$1763580\ a^4\ b^3\ c^{12}$		❌ 0.5/1 ✎
6	0	225225*a^8*b^3*c^4	$225225\ a^8\ b^3\ c^4$		✅ 1/1 ✎
3	0	1058148*a^2*b^12*c^5	$1058148\ a^2\ b^{12}\ c^5$		✅ 1/1 ✎
2	0	1763580*a^4*b^3*c^12	$1763580\ a^4\ b^3\ c^{12}$		✅ 1/1 ✎
2	0	1763580*(a^4)*(b^3)*(c^12)	$1763580\ a^4\ b^3\ c^{12}$		✅ 1/1 ✎
1	0	135135*a^2*b^5*c^8	$135135\ a^2\ b^5\ c^8$		✅ 1/1 ✎
1	0	135135*(a^2)*(b^5)*(c^8)	$135135\ a^2\ b^5\ c^8$		✅ 1/1 ✎
1	0	225225*a^8*b^3*c^4*x^8*y^3*z^4	$225225\ a^8\ b^3\ c^4$		✅ 1/1 ✎
1	0	255255*a^8*b^3*c^4	$225225\ a^8\ b^3\ c^4$		✅ 1/1 ✎

Figure: JW's JavaScript bookmarklet collates student responses in gradebook.

Considerations for question/assessment design

Some general advice we provided to staff:

- Design your assessment with the strengths and limitations of CAA in mind.

- Design your mark scheme in detail before the assessment, ideally including partial marks & Error Carried Forward.

- Implement randomisation to make questions reusable/more robust against collusion. But be careful to ensure different instances are of comparable difficulty.

- Try to implement "natural" input for student responses.

Considerations for using CAA

- How will CAA be used? Summatively/formatively?
- Who will be designing assessments?
- Who will be implementing assessments?
- Who will be supporting assessments?
- Does the CAA system have the features you need? You might consider:
    - Linked-answer boxes.
    - Ability to change and rerun marking code.
    - Free-text boxes / file uploads for longer explanations.
- Is the system internationalised? For example, can it parse 【1 , 2 , 3】?
- Ask the wider mathematical community for recommendations and their experiences.

References

[1] DigitalEd. *Custom Content Leads to College-wide Adoption of Möbius*. URL: https://www.digitaled.com/resources/ca sestudies/mobius-assessment-adopted-college-wide.

[2] Robert Leek, John Meyer and Daniel Jones. "Reflections on six years of computer-aided assessment at the Jinan-Birmingham Joint Institute". In preparation.

[3] 2017 intern team. *Maple TA 2017*. URL: https://mapletabham2017.wordpress.com/.

[4] 2018 intern team. *Maple TA 2018*. URL: https://mapletabham2018.wordpress.com/.