Individualised summative assignments [that can be scaled sustainably]

FYi Maths workshop — 2018

Dr. Ant Edwards

Department of Mathematics, Swinburne University of Technology

28 June, 2018

Table of contents

The problem:

How do we decide how to assess understanding in first year mathematics?

The problem:

How do we decide how to assess understanding in first year mathematics?

Quality of assessment

The problem:

How do we decide how to assess understanding in first year mathematics?

Quality of assessment

- Authenticity of assessment

The problem:

How do we decide how to assess understanding in first year mathematics?

Quality of assessment

- Authenticity of assessment

- "real-world"

A form of assessment in which students are asked to perform real-world tasks that demonstrate meaningful application of essential knowledge and skills (Mueller, 2005, p. 1).

The problem:

How do we decide how to assess understanding in first year mathematics?

Quality of assessment

- Authenticity of assessment

- "real-world"
- "testing understanding"

Performance assessments call upon the examinee to demonstrate specific skills and competencies, that is, to apply the skills and knowledge they have mastered (Stiggins, 1987, p. 34).

The problem:

How do we decide how to assess understanding in first year mathematics?

Quality of assessment

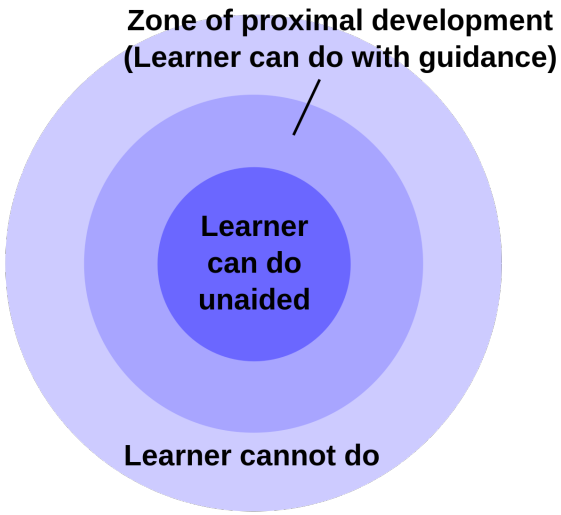
- Academic challenge

The problem:

How do we decide how to assess understanding in first year mathematics?

Quality of assessment

- Academic challenge



The distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem-solving under adult guidance, or in collaboration with more capable peers (Vygotsky, 1978, p. 86).

The problem:

How do we decide how to assess understanding in first year mathematics?

Quality of assessment

- Identity verification

The problem:

How do we decide how to assess understanding in first year mathematics?

Quality of assessment

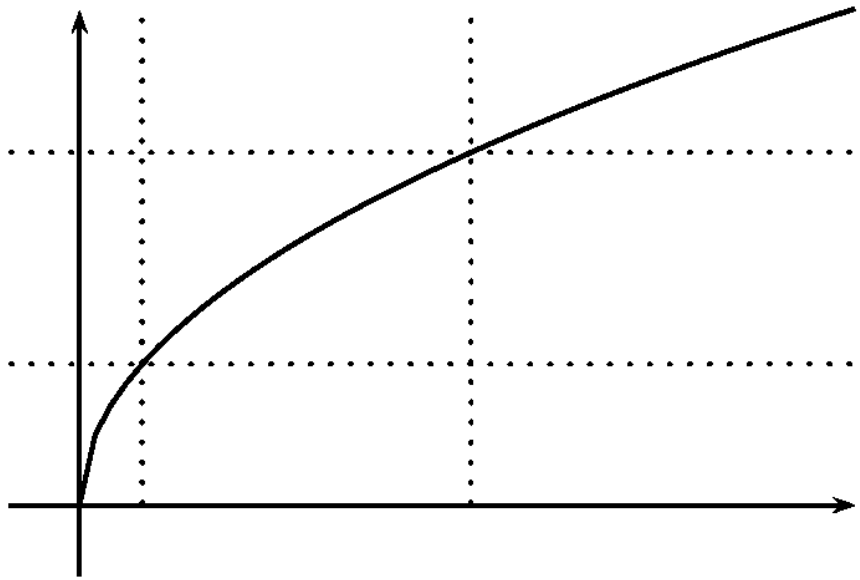
- Replicability

The problem:

How do we decide how to assess understanding in first year mathematics?

Quality of assessment

- Scalability

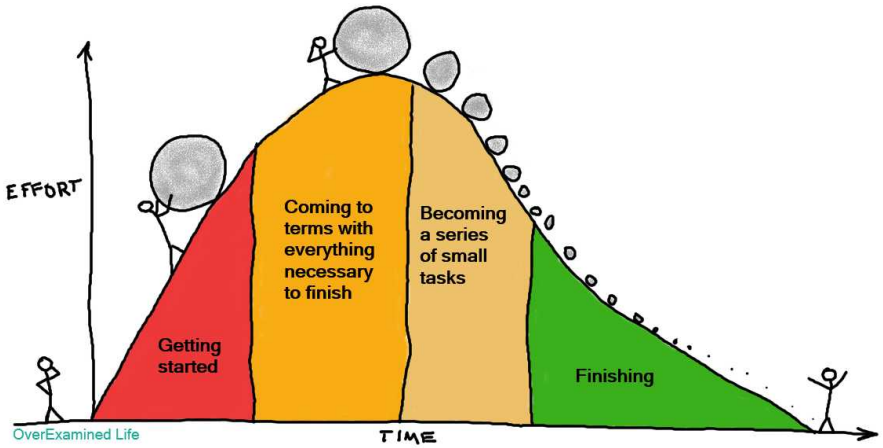


The problem:

How do we decide how to assess understanding in first year mathematics?

Quality of assessment

- Sustainability



The problem:

How do we decide how to assess understanding in first year mathematics?

Quality of assessment

- Authenticity of assessment
- Academic challenge
- Identity verification
- Replicability
- Scalability
- Sustainability

The problem:

How do we decide how to assess understanding in first year mathematics?

Time & Resourcing

- student time
- marking staff time
- teaching staff time
- support staff time
- convening staff time

The problem:

How do we decide how to assess understanding in first year mathematics?

Time & Resourcing

- student time
- marking staff time
- teaching staff time
- support staff time
- convening staff time

These are related to scaleability and sustainability.

Features of an automated solution

We want to maximise quality while keeping within time and resourcing constraints

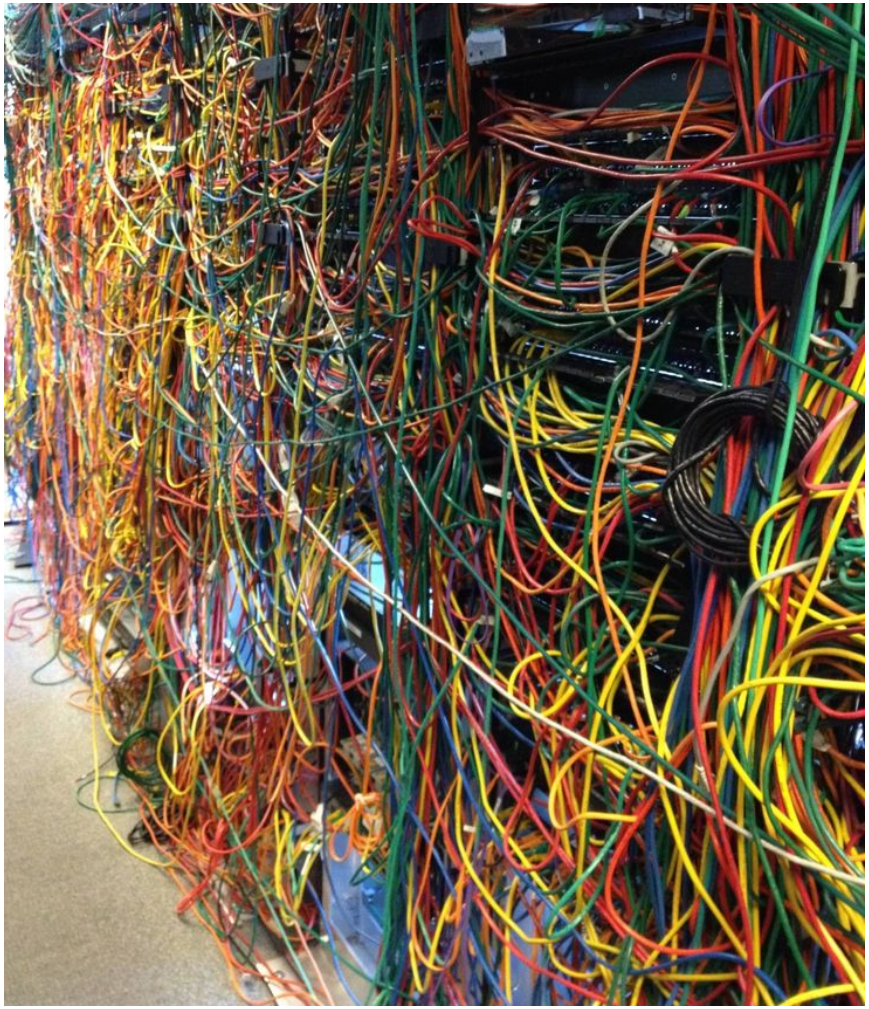
Quality of assessment

- Authenticity of assessment
- Academic challenge
- Identity verification
- Replicability
- Scalability
- Sustainability

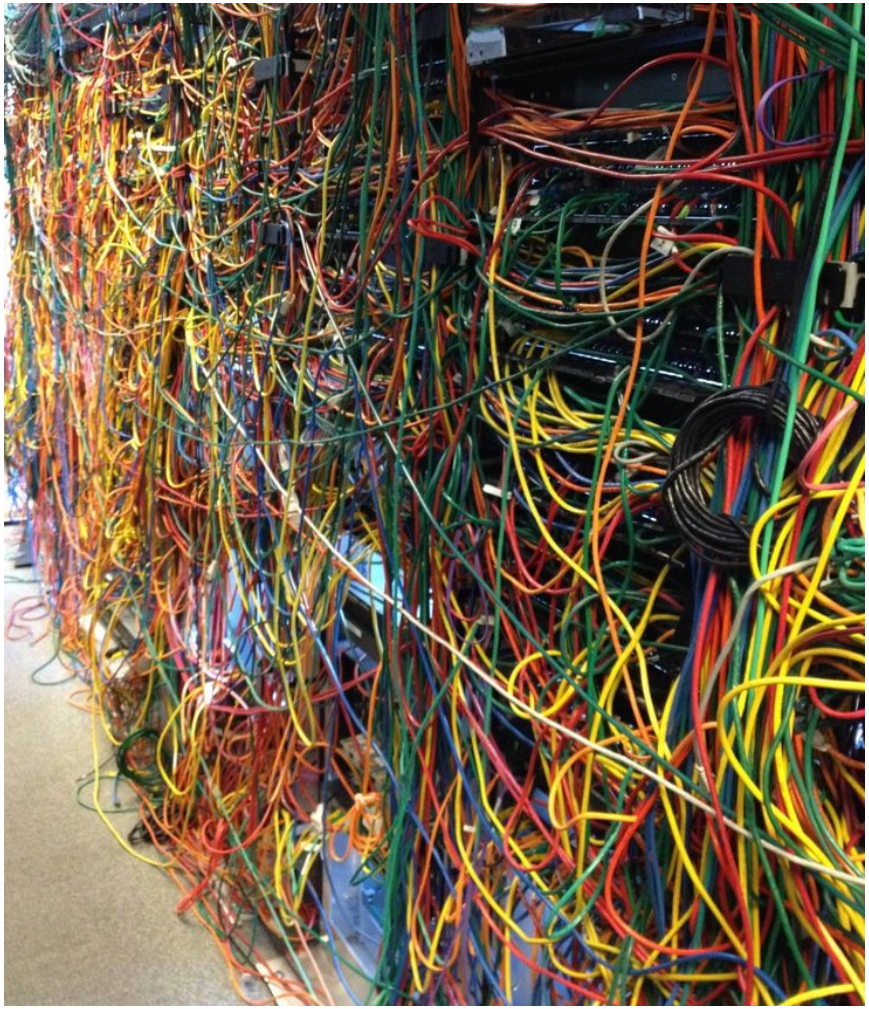
Time & Resourcing

- student time
- marking staff time
- teaching staff time
- support staff time
- convening staff time

Can technology help?

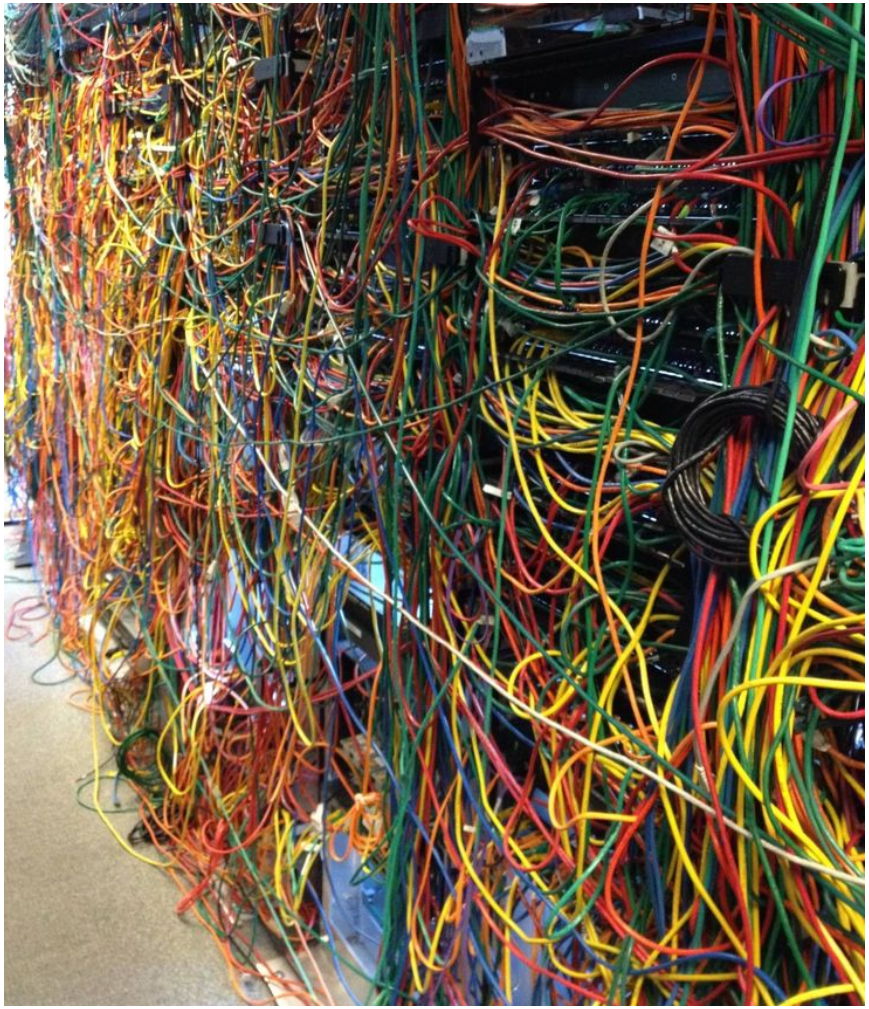


Can technology help?



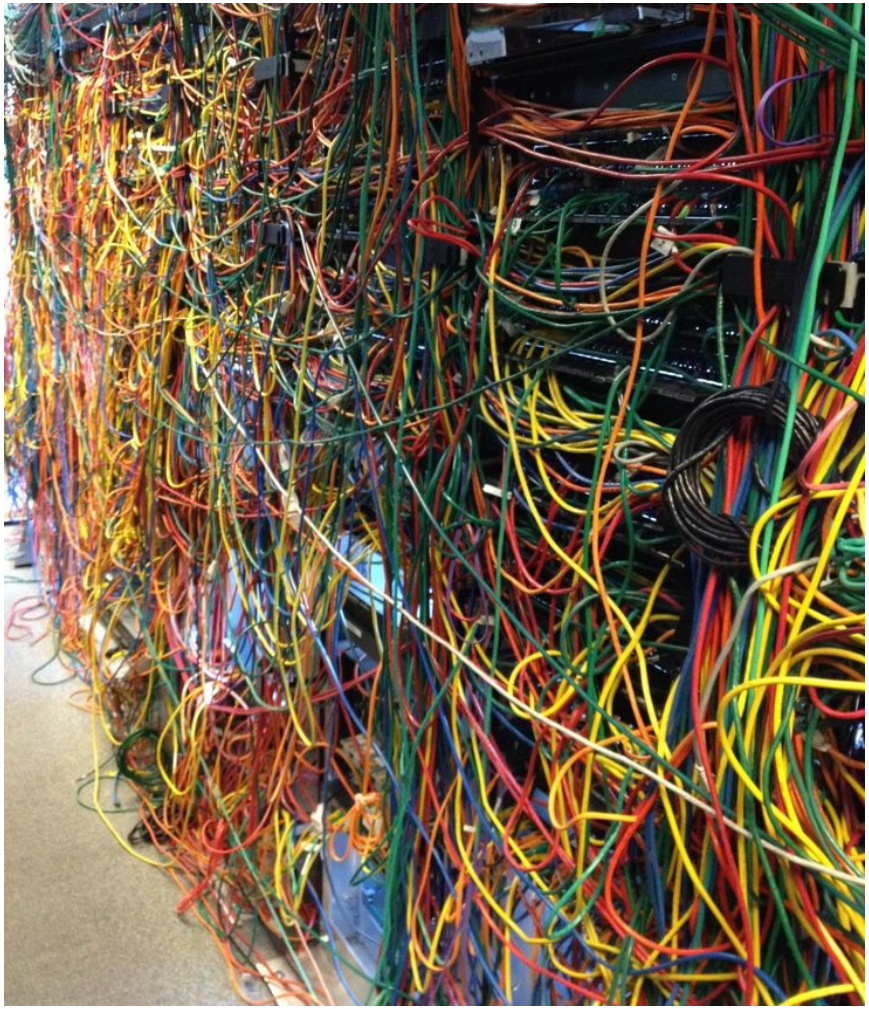
Potentially.

Can technology help?



Potentially, depends on context.

Can technology help?

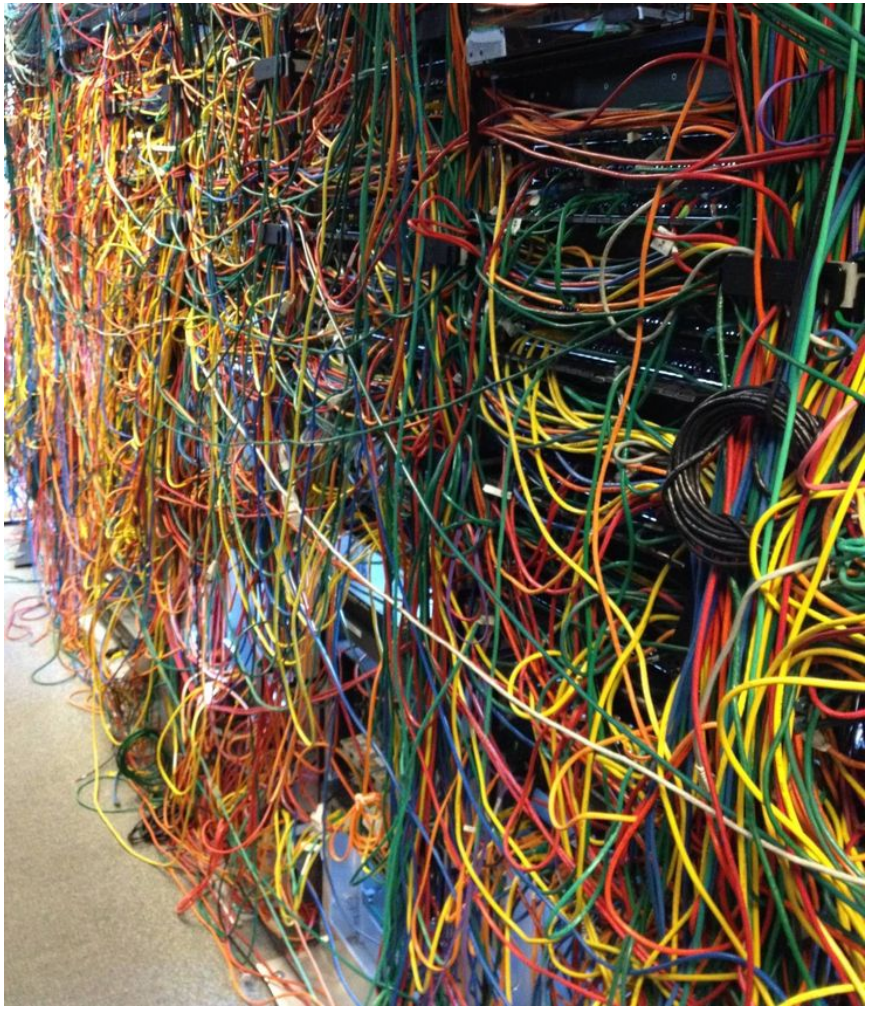


Potentially, depends on context.

Today I am talking about assessments that are:

- Medium-stakes (10-20%)

Can technology help?

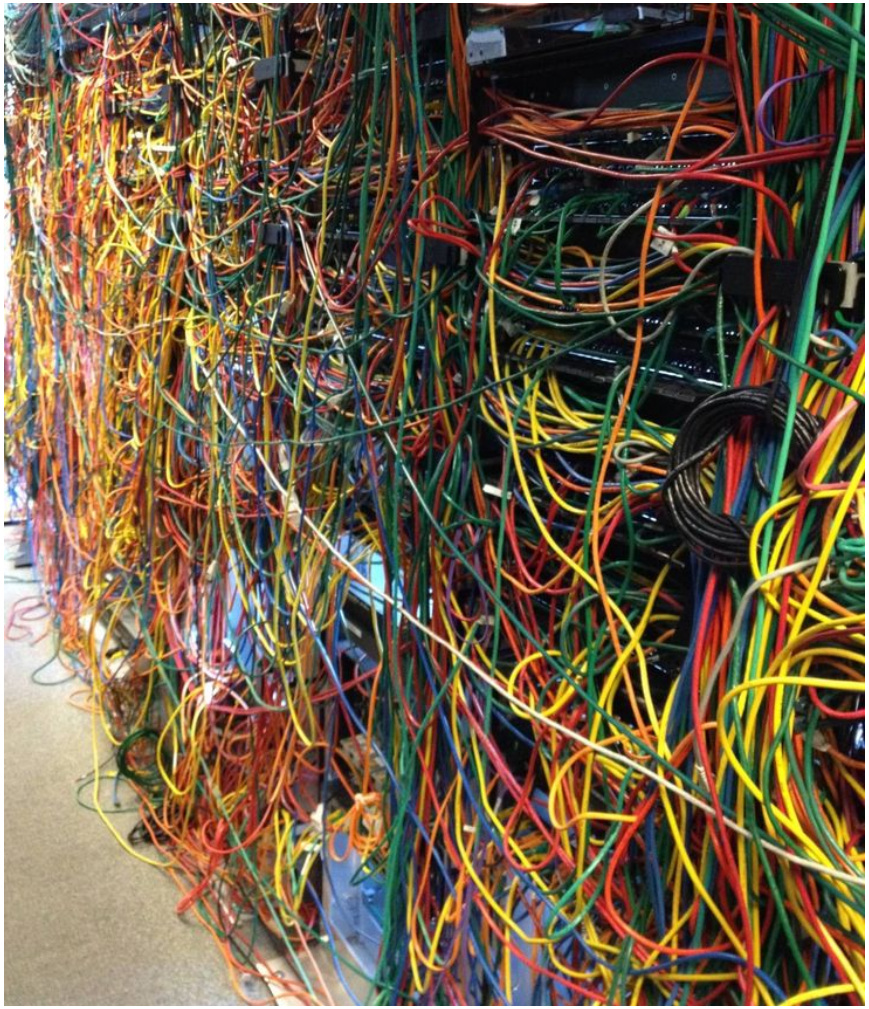


Potentially, depends on context.

Today I am talking about assessments that are:

- Medium-stakes (10-20%)
- First-year, mid semester

Can technology help?

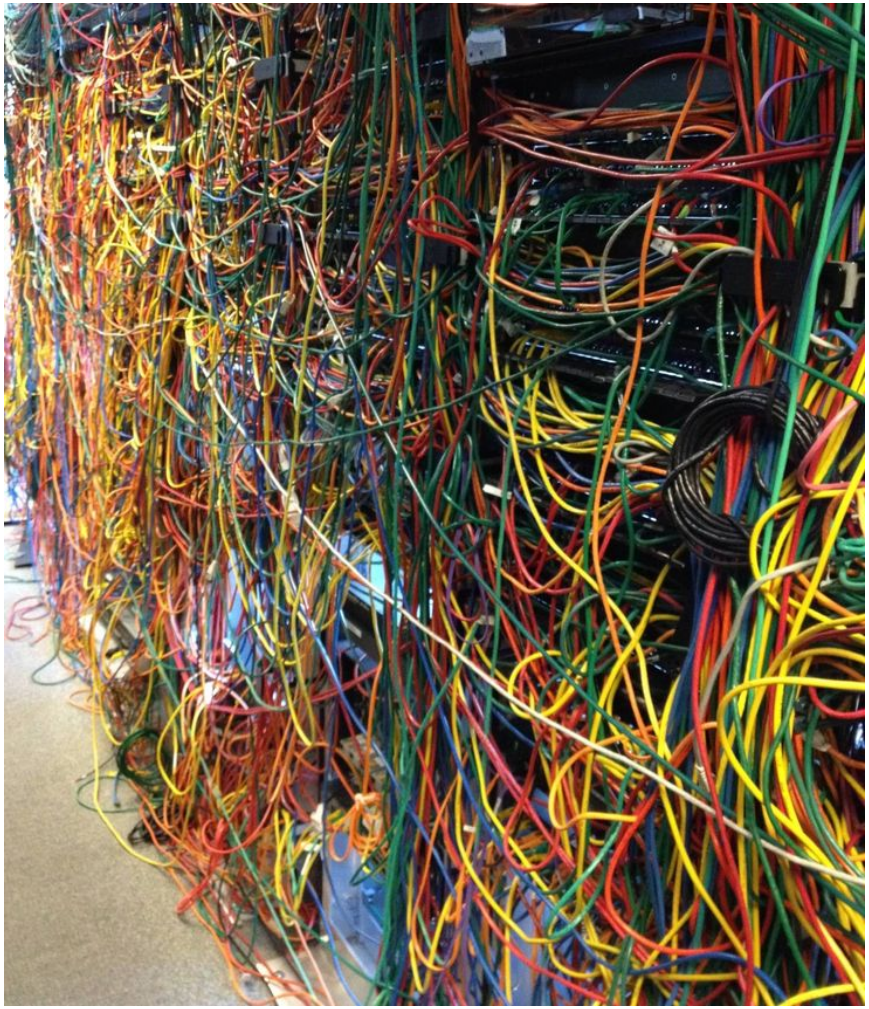


Potentially, depends on context.

Today I am talking about assessments that are:

- Medium-stakes (10-20%)
- First-year, mid semester
- "authentic"

Can technology help?

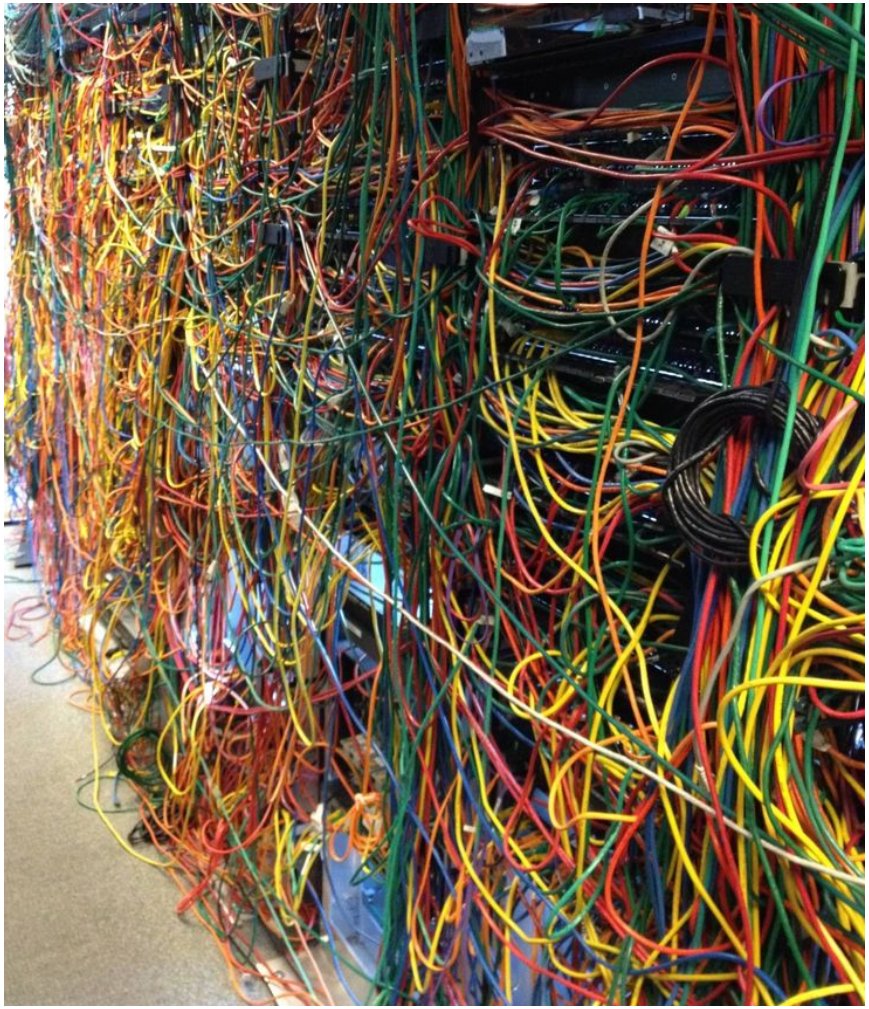


Potentially, depends on context.

Today I am talking about assessments that are:

- Medium-stakes (10-20%)
- First-year, mid semester
- "authentic"
- Each student has a slightly different problem to solve

Can technology help?

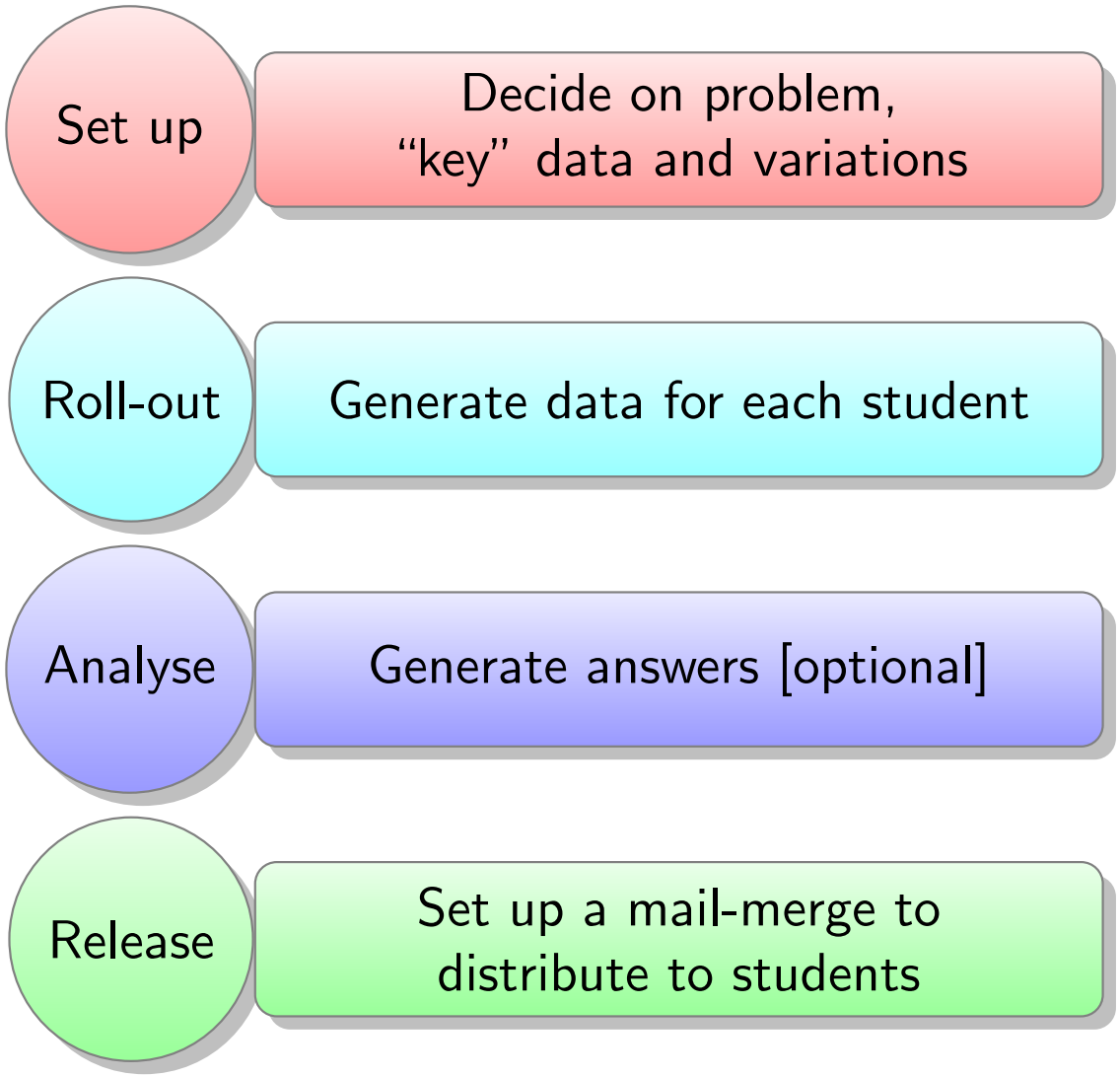


Potentially, depends on context.

Today I am talking about assessments that are:

- Medium-stakes (10-20%)
- First-year, mid semester
- "authentic"
- Each student has a slightly different problem to solve
- Multiple-approaches possible

Individualised assessments



Example 1: MTH10008 Aviation Mathamtics

Background

Unit for two groups of students

- BSc. Aviation (piloting)
- BSc. Aviation Management

"Piecemeal" areas of study: vectors, complex numbers, calculus, finance, descriptive statistics, probability.

Example 1: MTH10008 Aviation Mathamtics

Background

Unit for two groups of students

- BSc. Aviation (piloting)
- BSc. Aviation Management

"Piecemeal" areas of study: vectors, complex numbers, calculus, finance, descriptive statistics, probability.

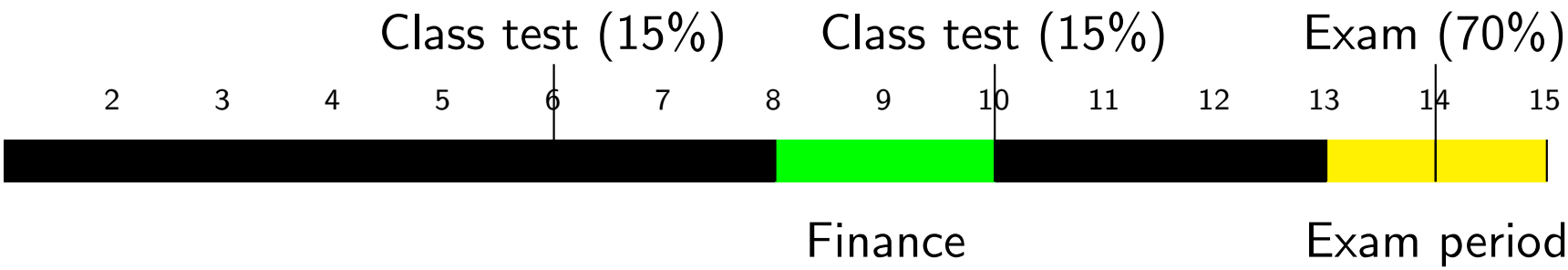
Example 1: MTH10008 Aviation Mathamtics

Background

Unit for two groups of students

- BSc. Aviation (piloting)
- BSc. Aviation Management

"Piecemeal" areas of study: vectors, complex numbers, calculus, finance, descriptive statistics, probability



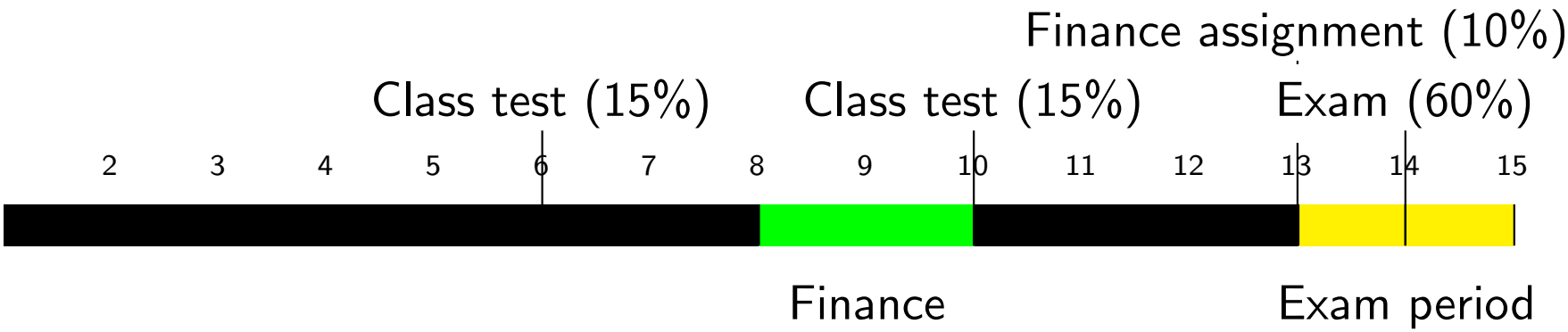
Example 1: MTH10008 Aviation Mathamtics

Background

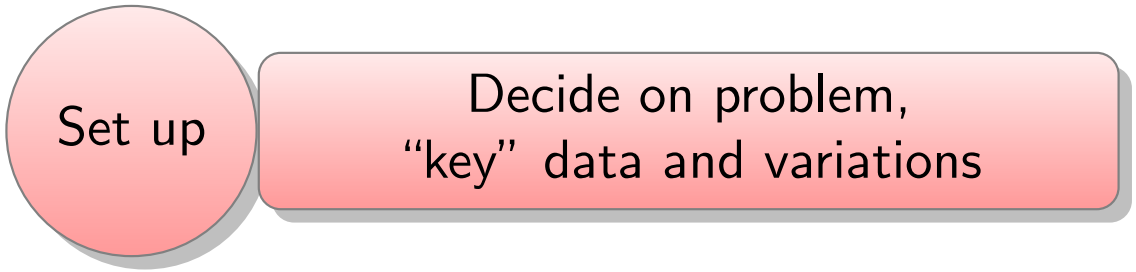
Unit for two groups of students

- BSc. Aviation (piloting)
- BSc. Aviation Management

"Piecemeal" areas of study: vectors, complex numbers, calculus, finance, descriptive statistics, probability



Set-up



Set-up

Set up

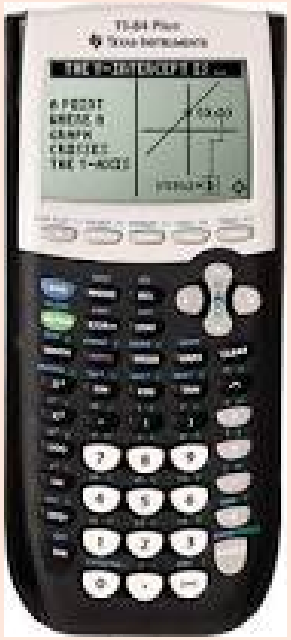
Decide on problem,
"key" data and variations

Discounted cash flow analysis — TI84 required

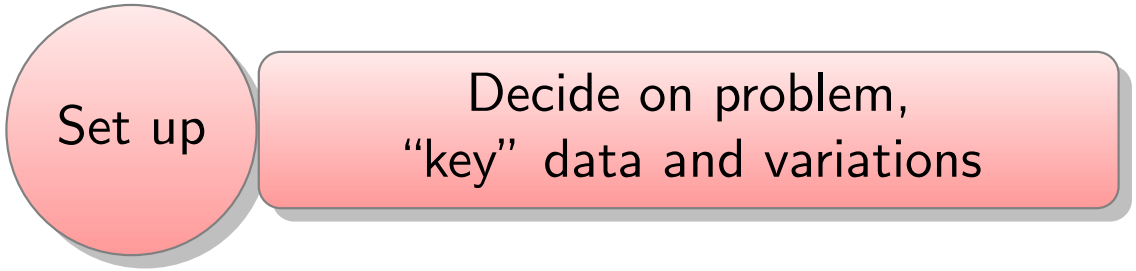
15. **[06 marks]** A company plans to invest \$1,000,000 in a new plant. Their accountant makes the following net cash flow projections on the investment. The final cash flow in year 4 includes a residual value. The cost of capital is 8% over the life of the investment project.

Year	NET CASH FLOWS
0	(\$1,000,000)
1	\$200,000
2	\$250,000
3	\$300,000
4	\$550,000

(a) Calculate the Net Present Value (NPV) and Internal Rate of Return (IRR) of this investment plan. [4 marks]

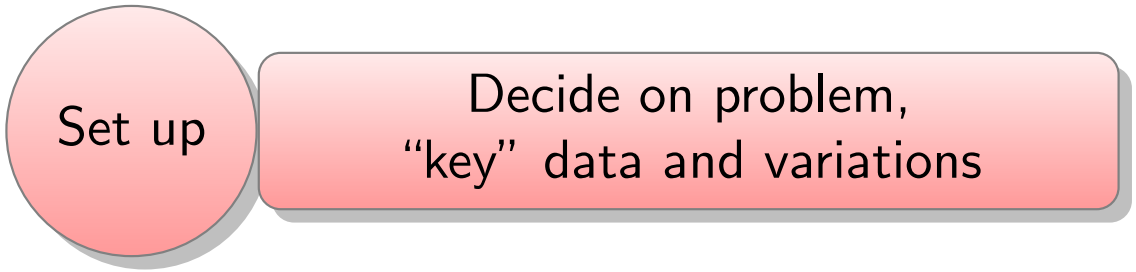


Set-up



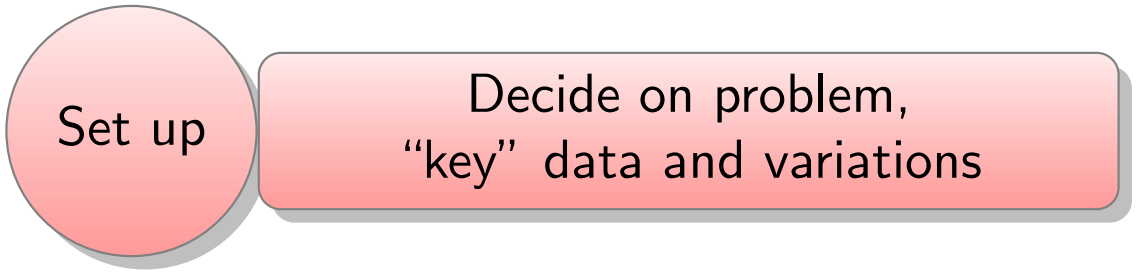
- Consultation with aviation academics and industry

Set-up



- Consultation with aviation academics and industry
- Identified "real-life" situation

Set-up

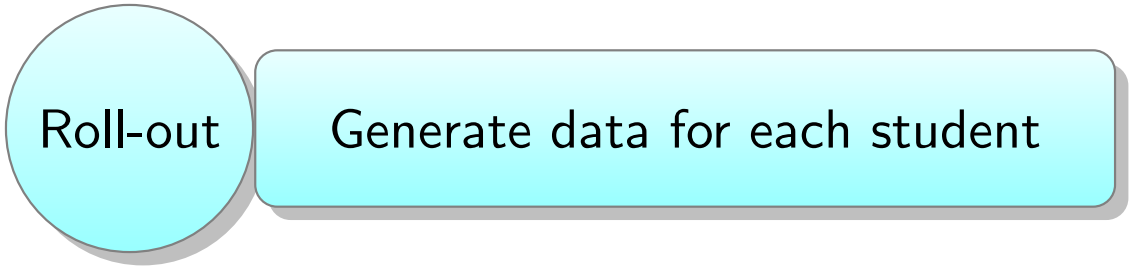


- Consultation with aviation academics and industry
- Identified "real-life" situation

Bangula, Malawi

- New mining operation
- Different options for routes
- Many different constraints
- Messy, nonlinear brief
- Produce a business case for the airline's shareholders

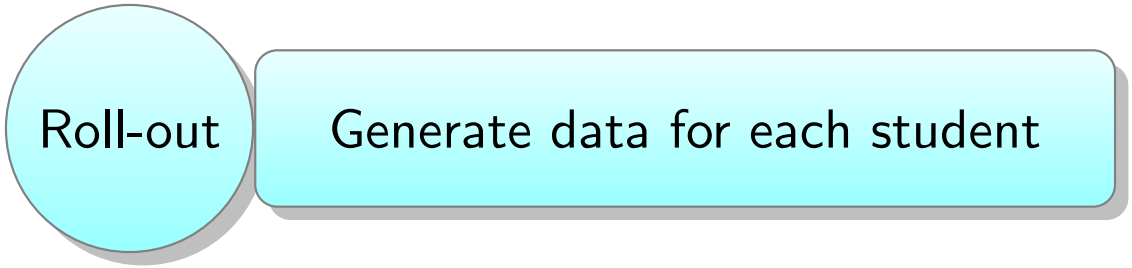
Set-up



Using Excel to produce variables for n students.

1. Keep the "key" values in one tab

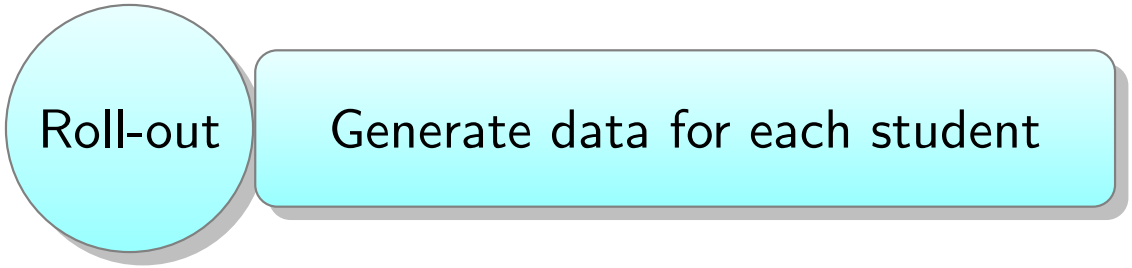
Set-up



Using Excel to produce variables for n students.

1. Keep the "key" values in one tab
2. Use another tab with a single frozen row to randomise by a multiplicative factor of $\pm\frac{\delta}{2}$

Set-up

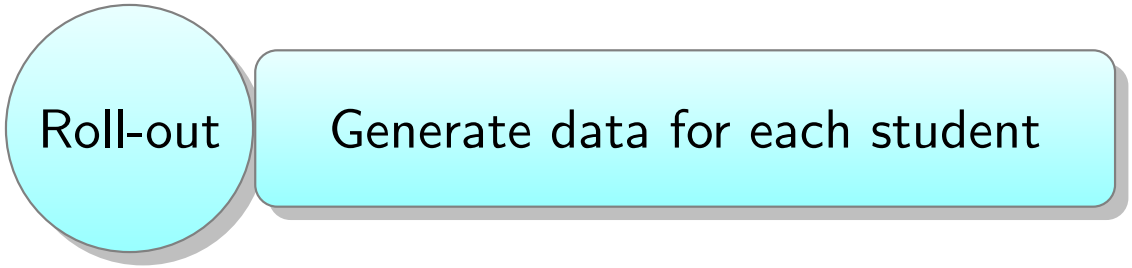


Using Excel to produce variables for n students.

1. Keep the "key" values in one tab
2. Use another tab with a single frozen row to randomise by a multiplicative factor of $\pm\frac{\delta}{2}$

   `=cell*(1+`δ`*rand()-`δ`/2)`

Set-up

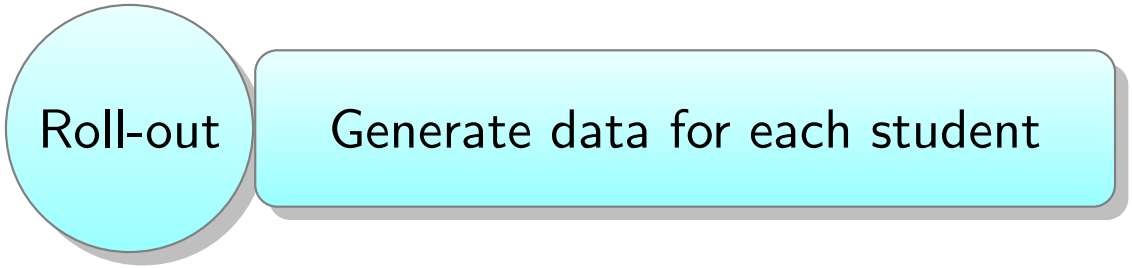


Using Excel to produce variables for n students.

1. Keep the "key" values in one tab
2. Use another tab with a single frozen row to randomise by a multiplicative factor of $\pm\frac{\delta}{2}$

   `=cell*(1+`δ`*rand()-`δ`/2)`
3. Fill down from this row n times

Set-up

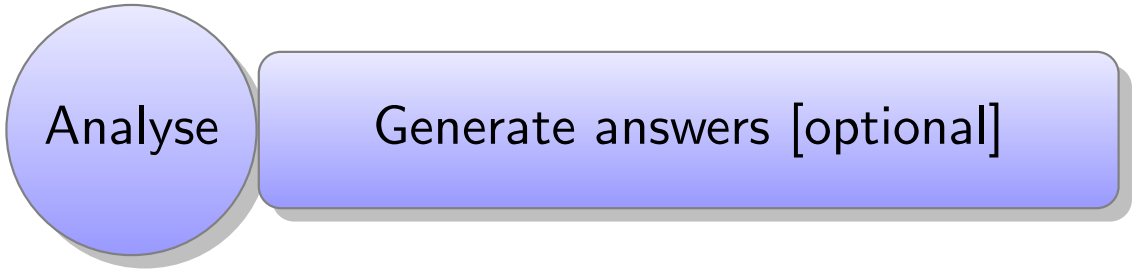


Using Excel to produce variables for n students.

1. Keep the "key" values in one tab
2. Use another tab with a single frozen row to randomise by a multiplicative factor of $\pm\frac{\delta}{2}$

   =cell*(1+δ*rand()-δ/2)
3. Fill down from this row n times
4. Immediately copy and "paste as values" on top of row 2 to $(n+1)$

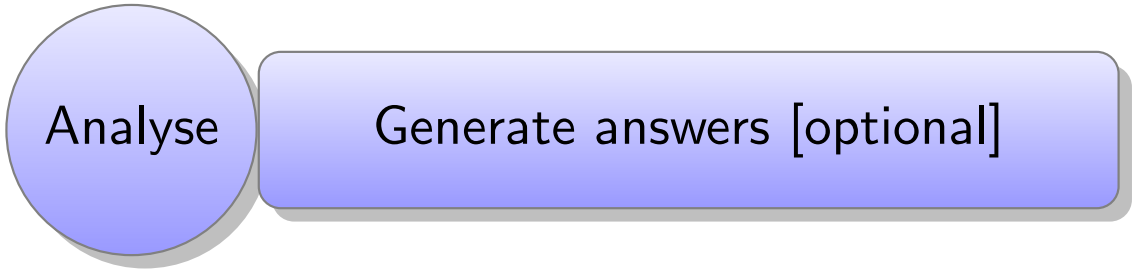
Set-up



1. Use another tab to check answers

   e.g. Extreme cases

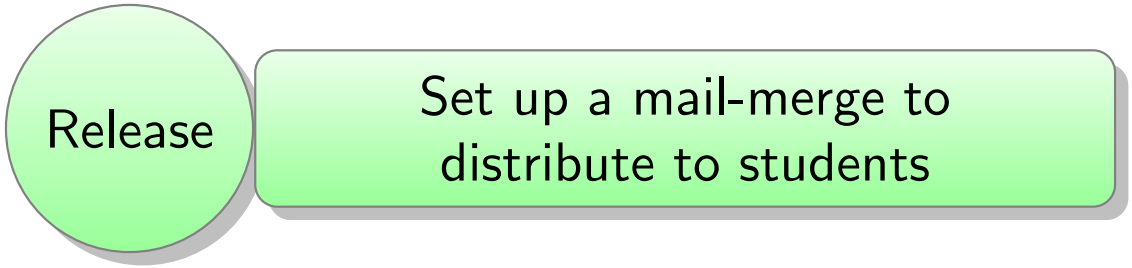
Set-up



1. Use another tab to check answers

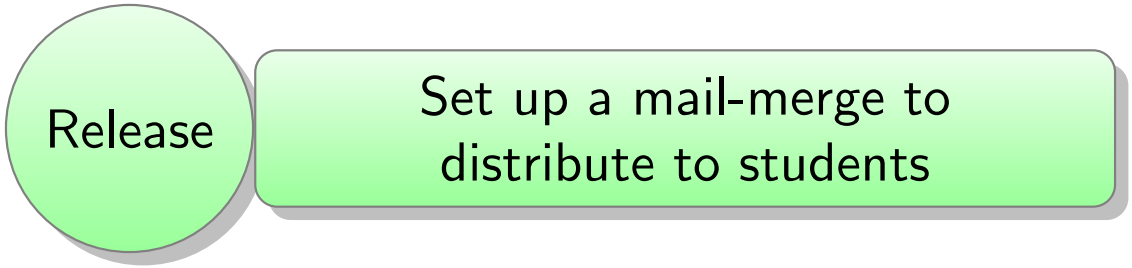
   e.g. Extreme cases
2. Potentially use this tab also to create dependencies

Set-up



1. Format as much as possible in Excel first

Set-up

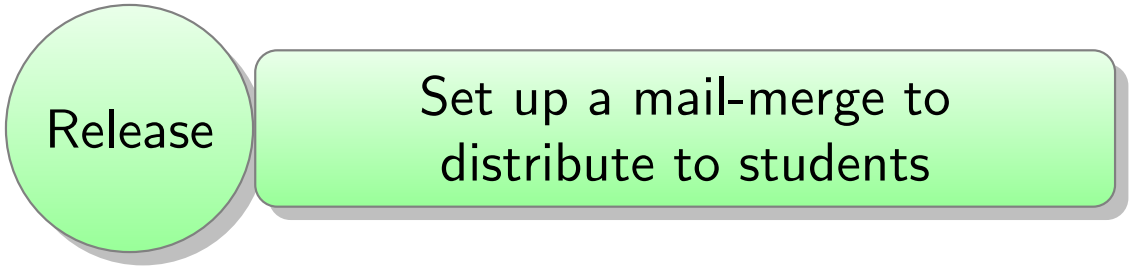


1. Format as much as possible in Excel first
2. Testing and "post-production" formatting in Word

Format	Excel	Word
percentage	50%	0.5
Currency	$12.50	12.5
Telephone	039145393	39145393

https://knowledgecenter.zuora.com/CB_Billing/IA_Invoices/Creating_a_Custom_Invoice_Template/B_Define_the_Format_for_Date_and_Number_Fields

Set-up



1. Format as much as possible in Excel first
2. Testing and "post-production" formatting in Word

Format	Excel	Word
percentage	50%	0.5
Currency	$12.50	12.5
Telephone	039145393	39145393

`https://knowledgecenter.zuora.com/CB_Billing/IA_Invoices/Creating_a_Custom_Invoice_Template/B_Define_the_Format_for_Date_and_Number_Fields`

3. Use Word to run mailmerge in Outlook

Outcomes

Cohort size [assignments submitted]

2017 79 students

2018 106 students

No issues with scaling in terms of rollout (additional marker in 2018)

Outcomes

Cohort size [assignments submitted]

2017 79 students

2018 106 students

No issues with scaling in terms of rollout (additional marker in 2018)

Issues

- Open-ended nature
  - issues with "what to do"
  - clarifications after marking
  - difficult to mark students who had gone off-piste
- Marking relied still involved manual checking of spreadsheet

Outcomes

Cohort size [assignments submitted]

2017 79 students

2018 106 students

No issues with scaling in terms of rollout (additional marker in 2018)

Issues

- Open-ended nature
  - issues with "what to do"
  - clarifications after marking
  - difficult to mark students who had gone off-piste
- Marking relied still involved manual checking of spreadsheet

Benefits

- It seemed to work (!)
- No student questioned value of assessment
- Students seeking help were genuinely engaged with the project

Example 2: MTH10010 Essential Mathematics

Background

From c.2005–2015 we taught a "one-stop shop" for entry-level mathematics

- For students without Mathematics Methods entry
- For students taking their last mathematics unit at University ("terminal" students)

This was bad for both groups...

Example 2: MTH10010 Essential Mathematics

Background

In 2015 we split these into two units.

- Essential Mathermatics is the "terminal" unit, written from scratch (by me)

Example 2: MTH10010 Essential Mathematics

Background

In 2015 we split these into two units.

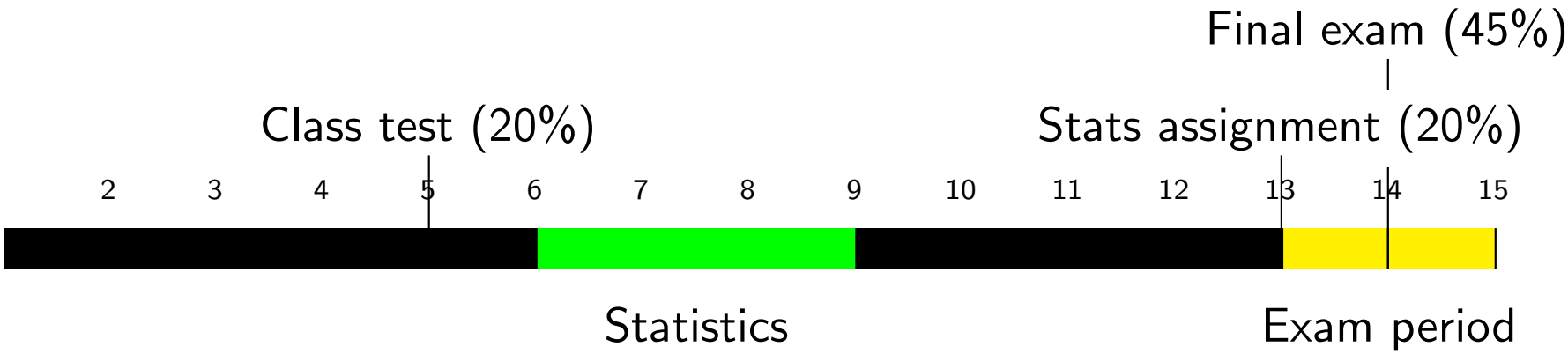
- Essential Mathermatics is the "terminal" unit, written from scratch (by me)
  - Mathematics Methods (or equivalent) requirement
  - Primarily BSc Science students
  - Functions, Statistics, Calculus

Example 2: MTH10010 Essential Mathematics

Background

In 2015 we split these into two units.

- Essential Mathermatics is the "terminal" unit, written from scratch (by me)
  - Mathematics Methods (or equivalent) requirement
  - Primarily BSc Science students
  - Functions, Statistics, Calculus

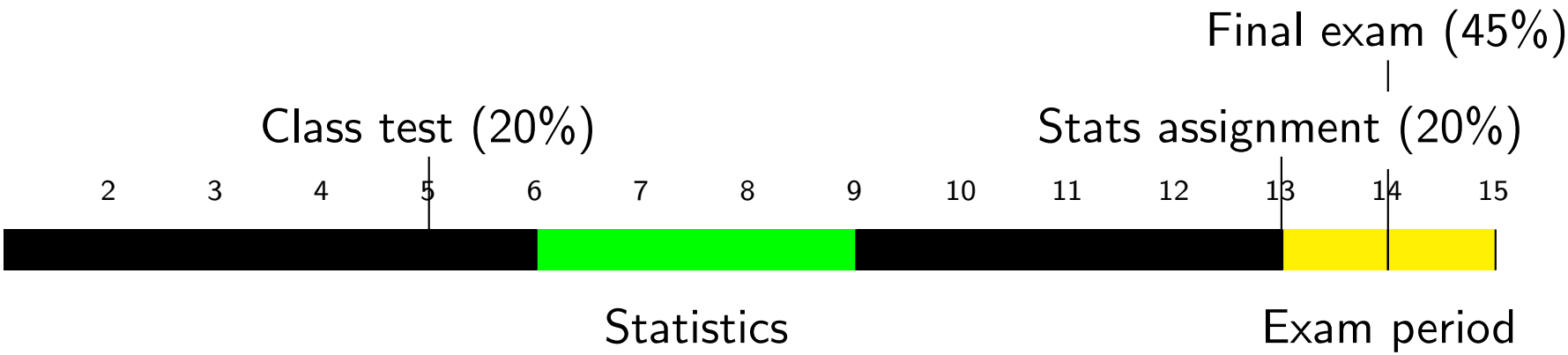


Example 2: MTH10010 Essential Mathematics

Background

Statistics taught in **R** labs.

- Practical focus
- Using **R** to calculate descriptive stats, correlation, regression
- meaning of terms such as effect size, power in inferential statistics (t-tests only)
- Hybrid individual-group assignment (milestones from week 8 onwards)

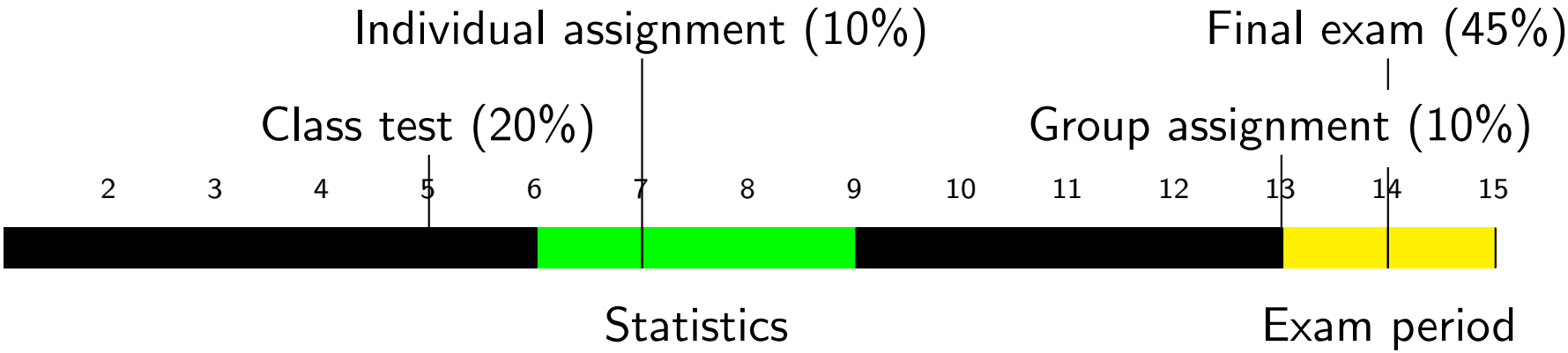


Example 2: MTH10010 Essential Mathamtics

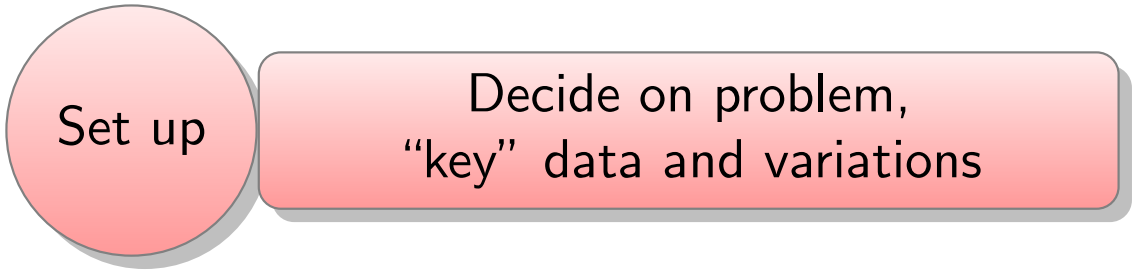
Background

Statistics taught in **R** labs.

- Practical focus
- Using **R** to calculate descriptive stats, correlation, regression
- meaning of terms such as effect size, power in inferential statistics (t-tests only)
- Hybrid individual-group assignment (milestones from week 8 onwards)



Set-up

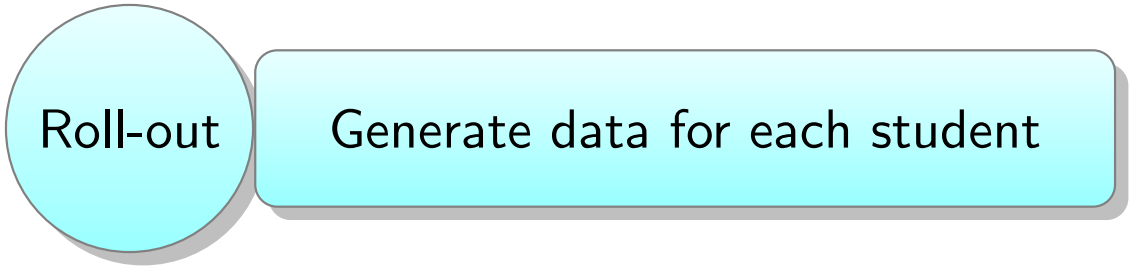


Descriptive statistics in **R**

The final part of my daily commute is travelling to level 7 of the EN building. Once I go through the main entrance I must then must choose how to reach my office opposite lecture theatre EN715. I can take the lift, which is slow but quite consistent in its journey time. The escalators are faster—especially if I walk up them—but congestion sometimes makes this frustratingly slow.

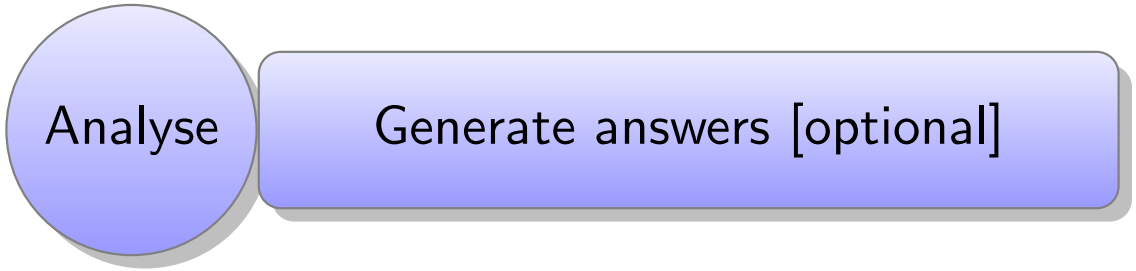
For your individual project you will be given timing data on these routes. This task involves you preparing some descriptive statistics for me in the form of a written report.

Set-up



- Each student received 30 paired data points (15 per route)
- Matlab generated the data for n students
  - Set up array of size $15 \times 2 \times n$
  - One distribution was randomly sampled from known data $N(\bar{x}, s^2)$ (`makedist`, `truncate` to eliminate impossible times, then `random`)
  - Other distribution was randomised from the first, point by point
  - (`rand` with a similar setup to before)

Set-up

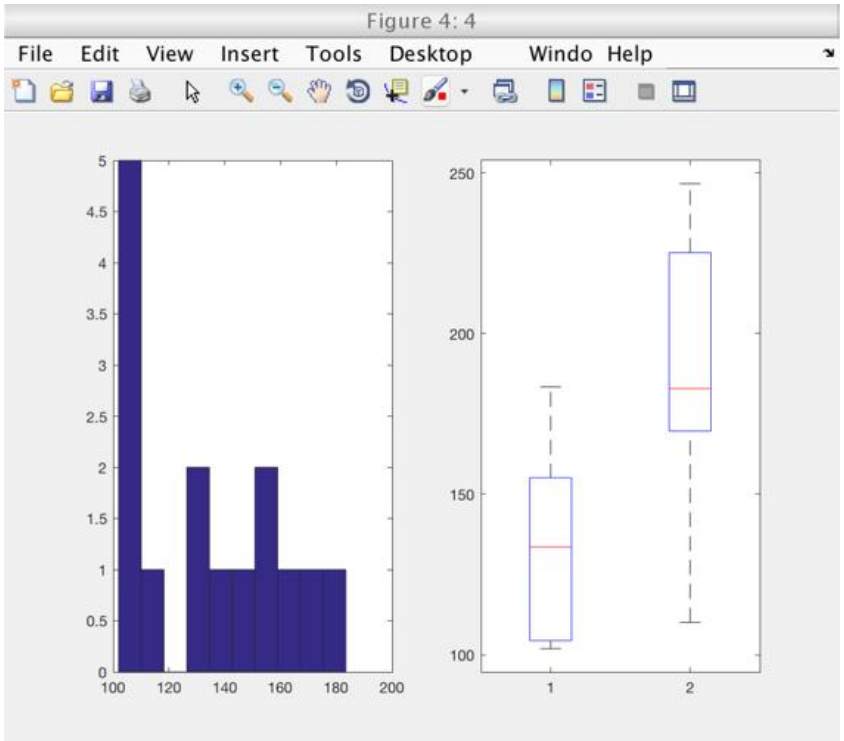


1. Matlab code generated the descriptive statistics and graphs
2. Published to a pdf document for the marker

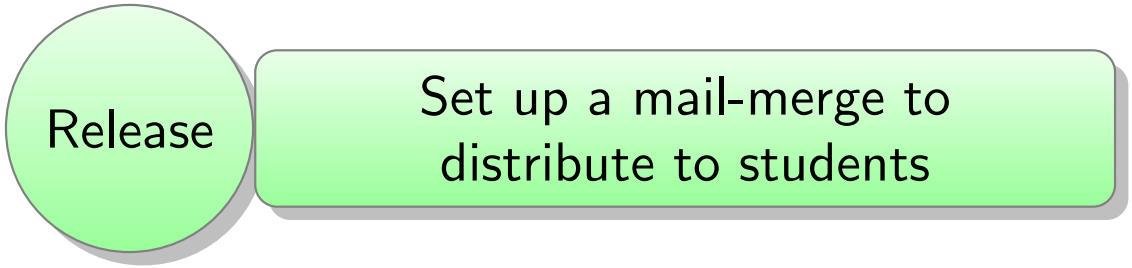
measure	escalator	lift
'mean'	[133.8335]	[189.8259]
'std'	[27.7930]	[40.3288]
'min'	[101.9139]	[110.0907]
'Q1'	[104.4371]	[169.6255]
'med'	[133.6007]	[182.8669]
'Q3'	[155.0967]	[225.1733]
'max'	[183.3910]	[246.6303]

correlation =

0.6349



Set-up



1. Generate csv file from Matlab (using `array2table` and `writetable`)
2. Then, as before

Outcomes

Cohort size [assignments submitted]

2017 59 students

Outcomes

Cohort size [assignments submitted]

2017 59 students

Issues

- Lots of clicking to set up mail-merge
- Wrong answers:

  there are different ways of calculating percentiles
- Limited value for repeating students

Outcomes

Cohort size [assignments submitted]

2017 59 students

Issues

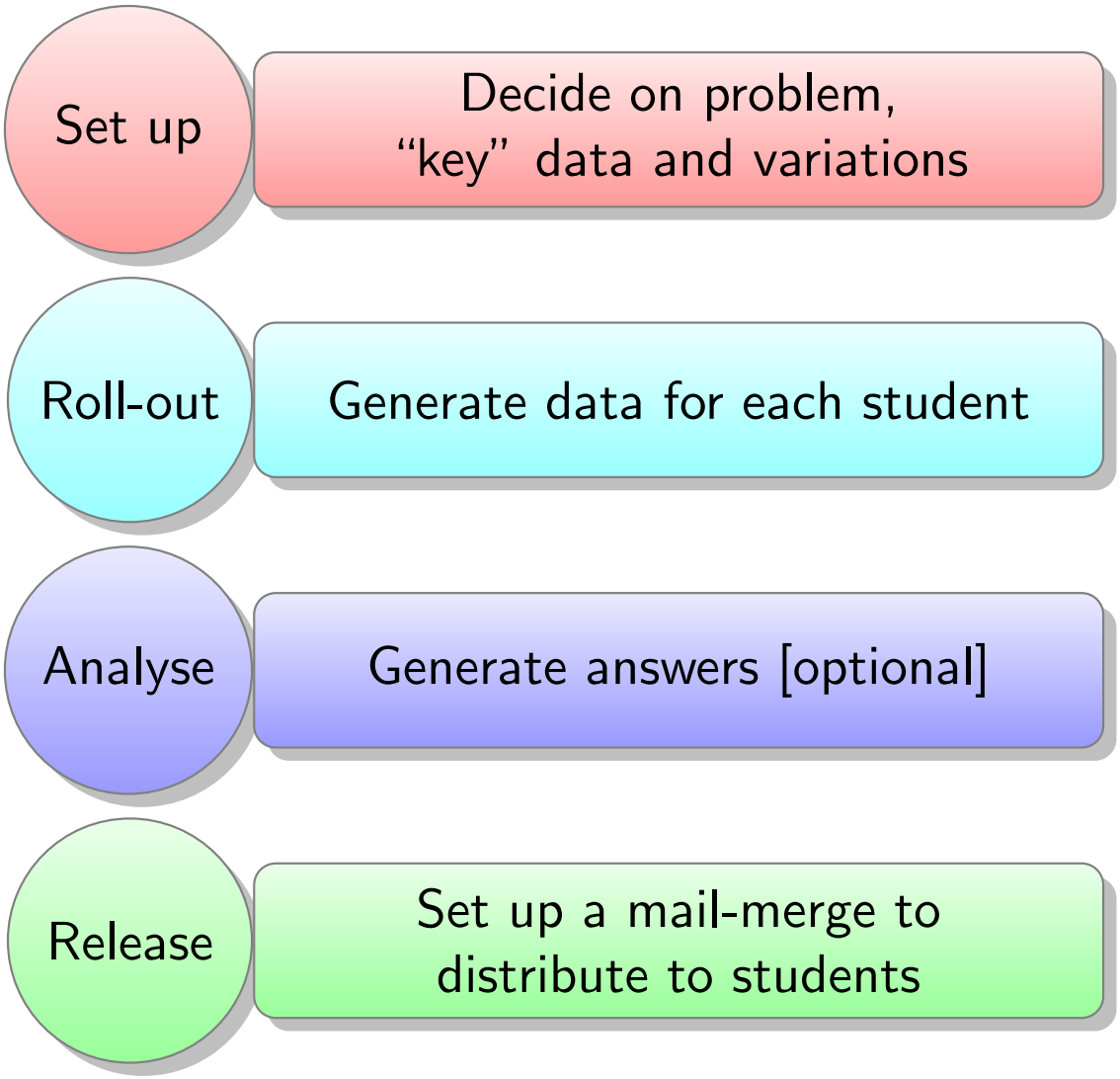
- Lots of clicking to set up mail-merge
- Wrong answers:

  there are different ways of calculating percentiles
- Limited value for repeating students

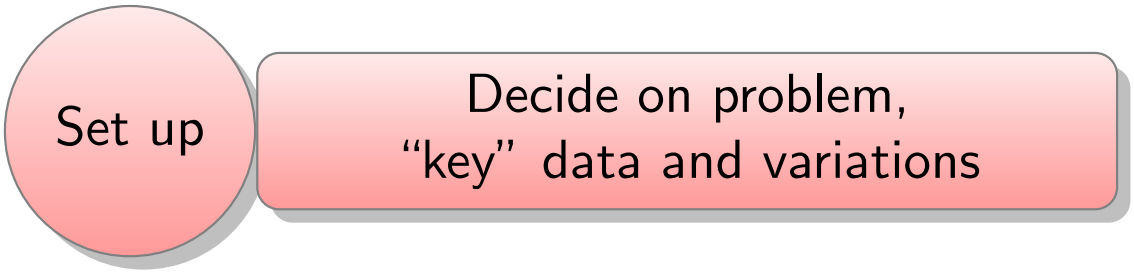
Benefits

- Quick to mark
- Good feedback from the marker
- Worked well throughout
- Very scalable
- Can easily be expanded to auto mark numerical answers

Mail-merge based approach summary

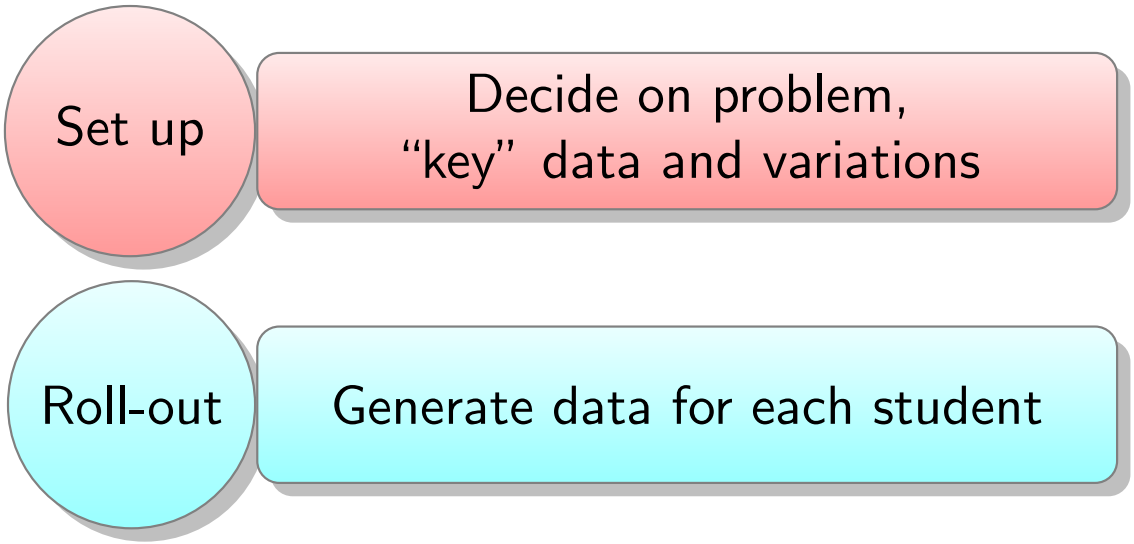


Mail-merge based approach summary



Independent of software package

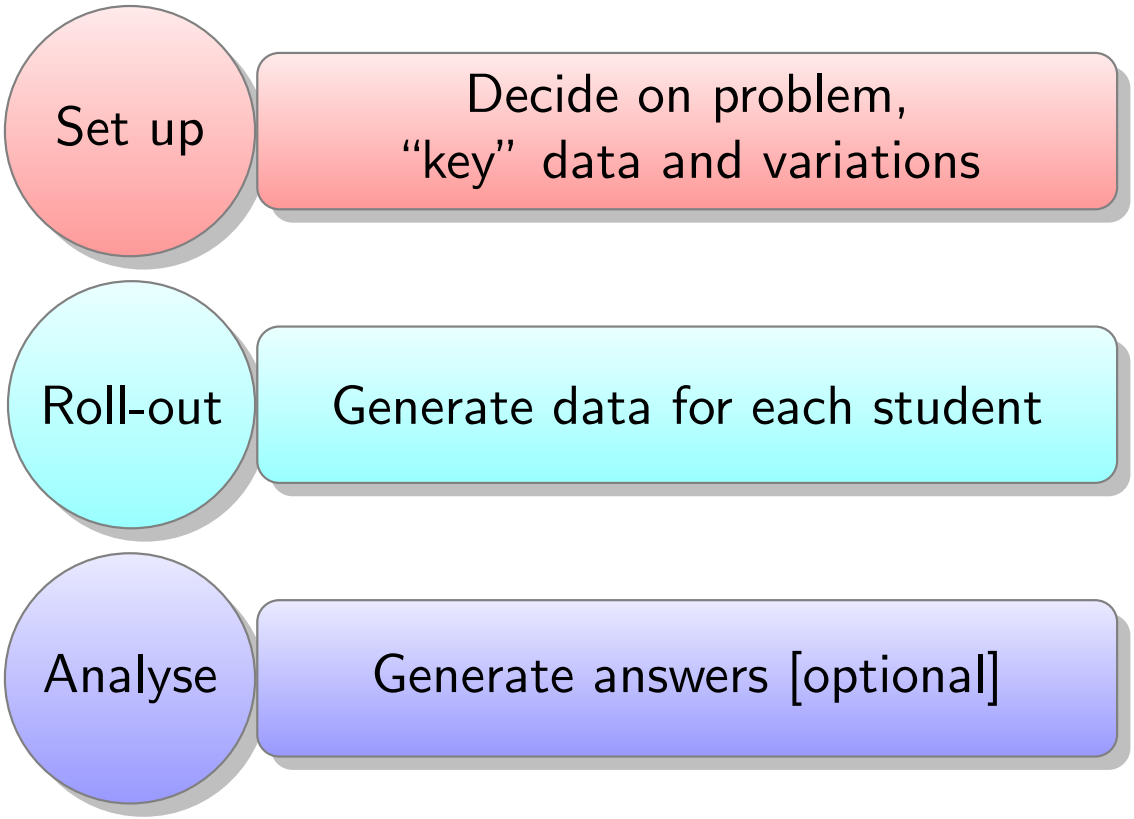
Mail-merge based approach summary



Independent of software package

Depends on sophistication of mathematics

Mail-merge based approach summary

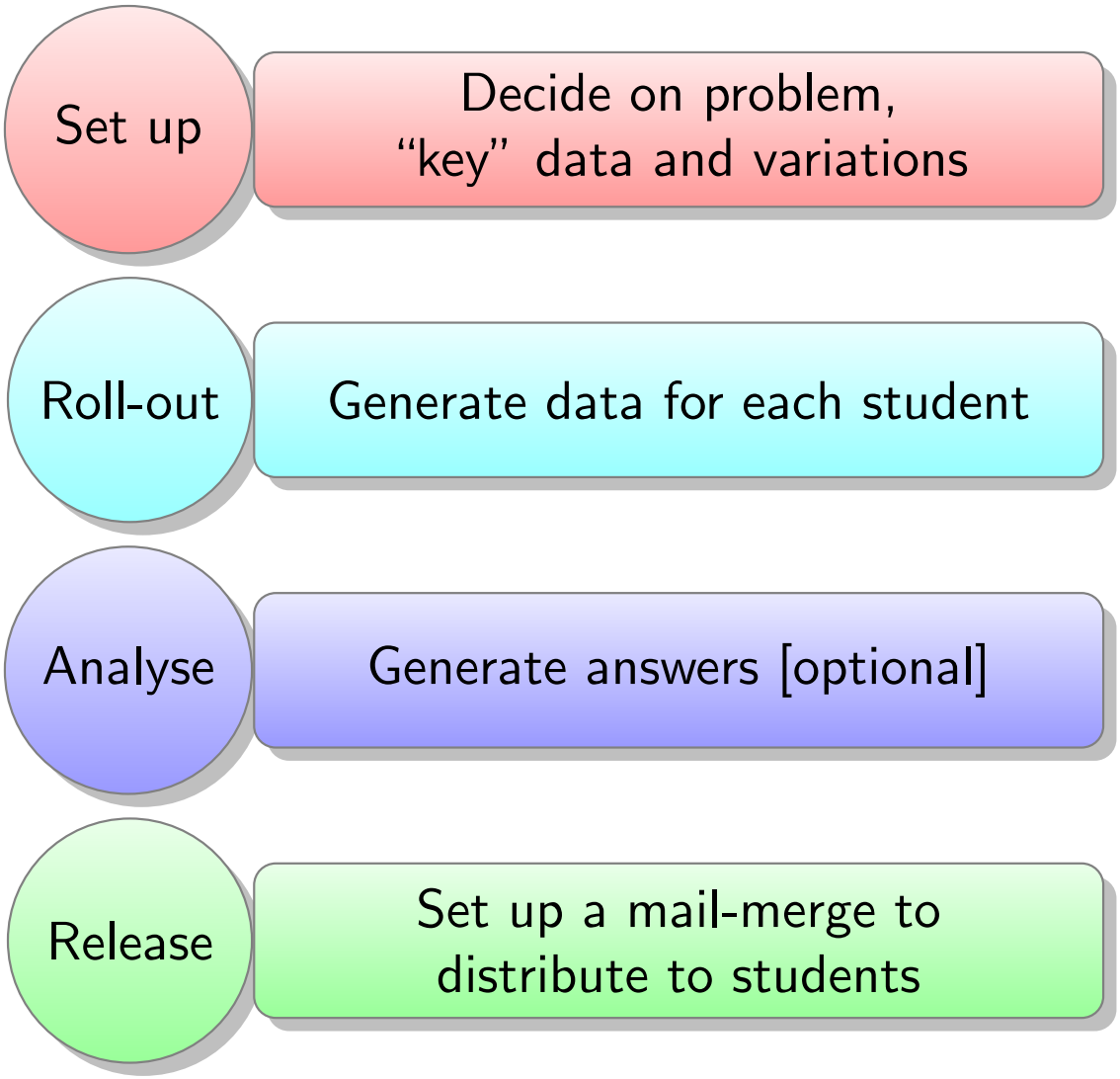


Independent of software package

Depends on sophistication of mathematics

”

Mail-merge based approach summary



Independent of software package

Depends on sophistication of mathematics

"

Requires a mail client that can mail-merge with a database or spreadsheet

Mail-merge based approach reflections

Two strategies for individualised assessments have been presented:

Mail-merge based approach reflections

Two strategies for individualised assessments have been presented:

- Mail-merge using Excel, Word and Outlook
- Mail-merge using Matlab, Excel, Word and Outlook

Mail-merge based approach reflections

Two strategies for individualised assessments have been presented:

- Mail-merge using Excel, Word and Outlook
- Mail-merge using Matlab, Excel, Word and Outlook
- Mail-merge using <package> and <productivity suite>

Mail-merge based approach reflections

Two strategies for individualised assessments have been presented:

- Mail-merge using Excel, Word and Outlook
- Mail-merge using Matlab, Excel, Word and Outlook
- Mail-merge using <package> and <productivity suite>

Quality of assessment

- Authenticity of assessment
- Academic challenge
- Identity verification
- Replicability
- Scalability
- Sustainability

Time & Resourcing

- student time
- marking staff time
- teaching staff time
- support staff time
- convening staff time

Mail-merge based approach reflections

Two strategies for individualised assessments have been presented:

- Mail-merge using Excel, Word and Outlook
- Mail-merge using Matlab, Excel, Word and Outlook
- Mail-merge using <package> and <productivity suite>

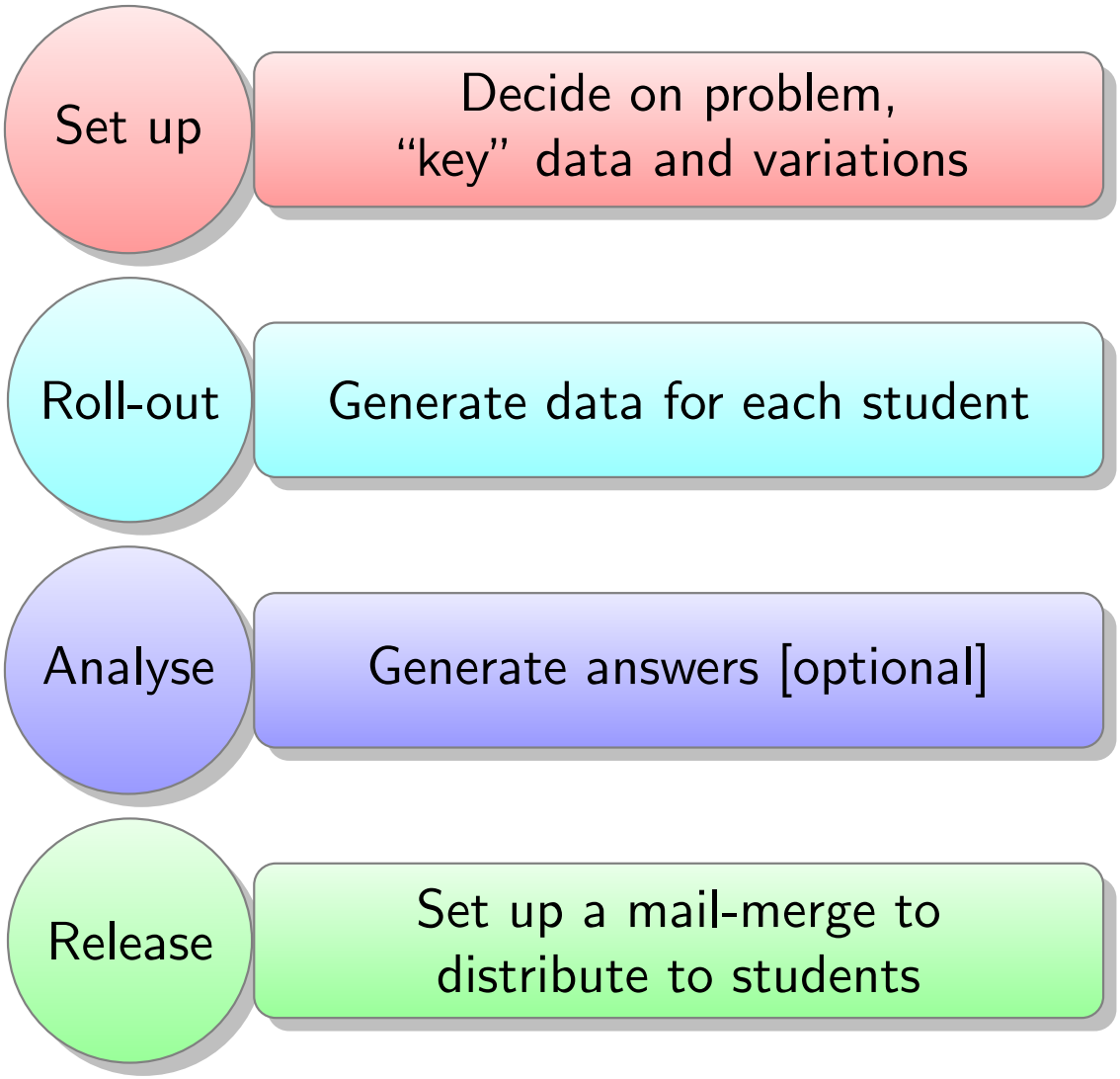
Quality of assessment

- ✓ Authenticity of assessment
- ✓ Academic challenge
- × Identity verification
- ? Replicability
- ✓ Scalability
- ✓ Sustainability

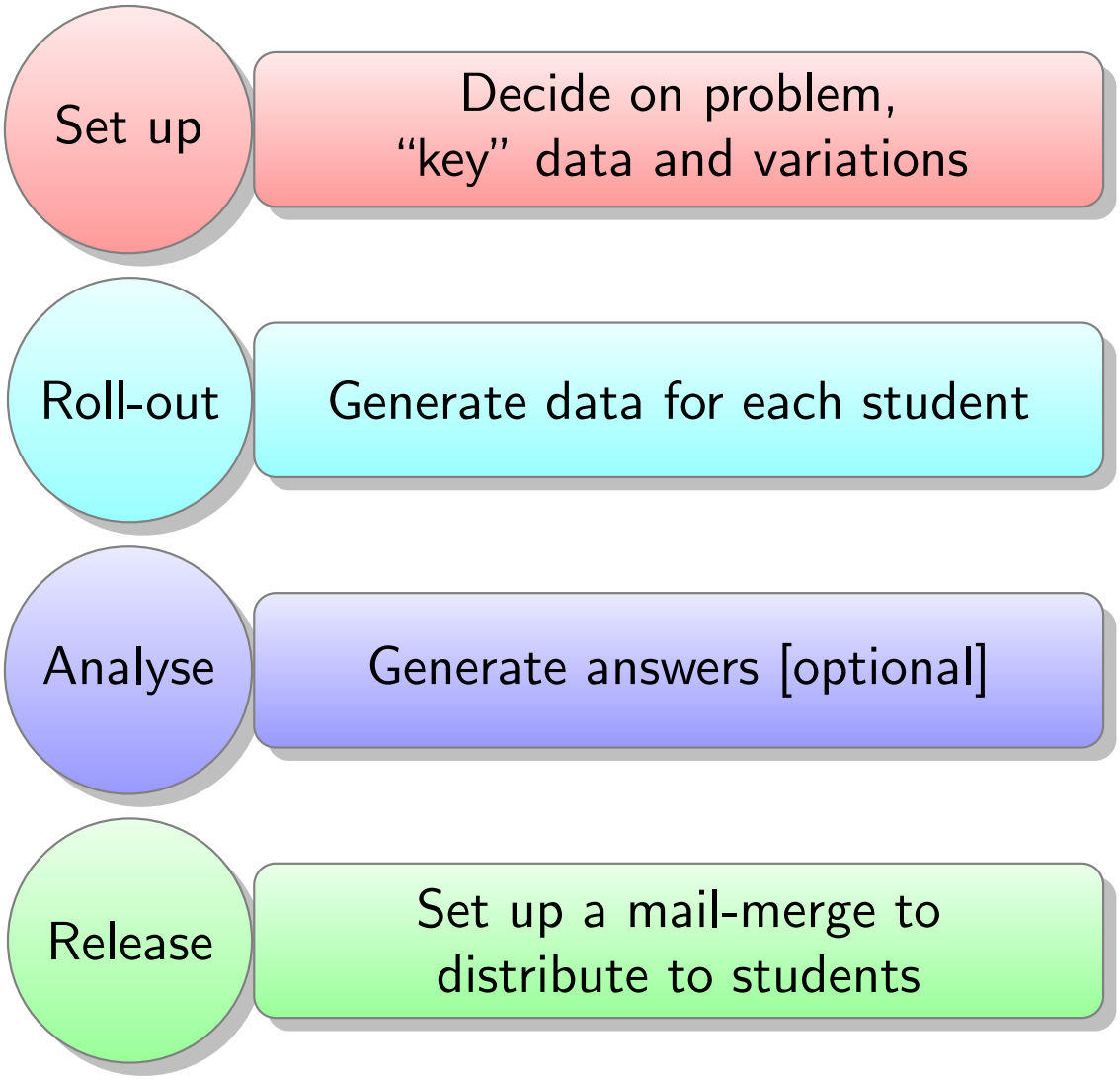
Time & Resourcing

- ✓ student time
- ? marking staff time
- ✓ teaching staff time
- ? support staff time
- × convening staff time

Other approaches

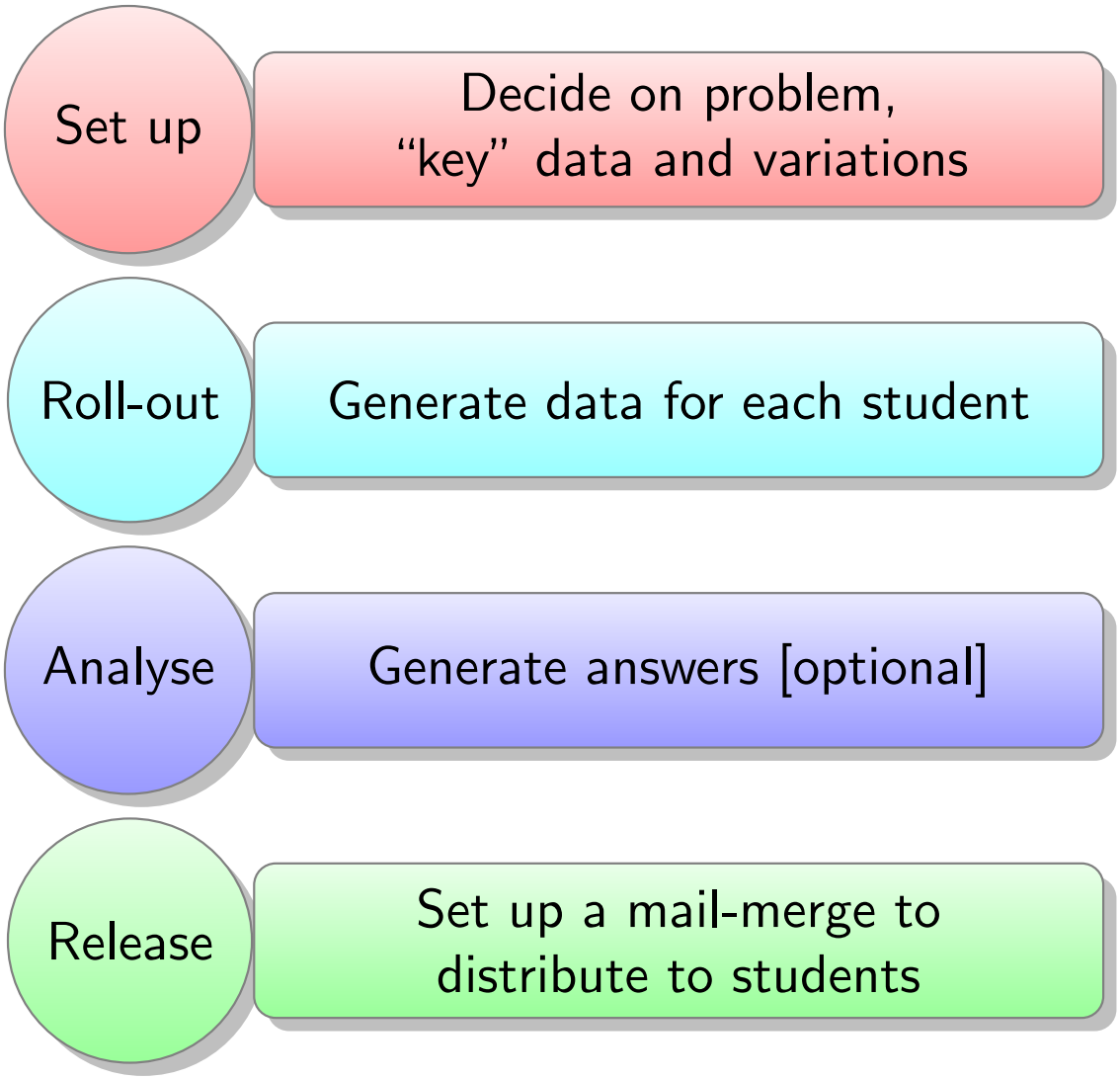


Other approaches



One package to do all of them, via the VLE?

Other approaches



One package to do all of them, via the VLE?

NUMBAS

Numbas

Numbas

NUMBAS

https://www.numbas.org.uk

Numbas

Numbas

- Free, open-source, online question engine

NUMBAS

`https://www.numbas.org.uk`

Numbas

Numbas

- Free, open-source, online question engine
- Emphasis on easy creation of questions

NUMBAS

`https://www.numbas.org.uk`

Numbas

Numbas

- Free, open-source, online question engine
- Emphasis on easy creation of questions
- Can generate individualised tests and answers

NUMBAS

`https://www.numbas.org.uk`

Numbas

Numbas

- Free, open-source, online question engine
- Emphasis on easy creation of questions
- Can generate individualised tests and answers
- Auto-marking possible

NUMBAS

`https://www.numbas.org.uk`

Numbas

Numbas

- Free, open-source, online question engine
- Emphasis on easy creation of questions
- Can generate individualised tests and answers
- Auto-marking possible
- Can be run in VLEs via standalone SCORM package

NUMBAS

`https://www.numbas.org.uk`

Numbas

Numbas

- Free, open-source, online question engine
- Emphasis on easy creation of questions
- Can generate individualised tests and answers
- Auto-marking possible
- Can be run in VLEs via standalone SCORM package

`https://www.numbas.org.uk`

NUMBAS

- not designed for summative assessment

Numbas

Numbas

- Free, open-source, online question engine
- Emphasis on easy creation of questions
- Can generate individualised tests and answers
- Auto-marking possible
- Can be run in VLEs via standalone SCORM package

`https://www.numbas.org.uk`

NUMBAS

- not designed for summative assessment
- issues with student tracking and answer tracking in SCORM (in particular, Blackboard)

Numbas

Numbas

- Free, open-source, online question engine
- Emphasis on easy creation of questions
- Can generate individualised tests and answers
- Auto-marking possible
- Can be run in VLEs via standalone SCORM package

`https://www.numbas.org.uk`

NUMBAS

- not designed for summative assessment
- issues with student tracking and answer tracking in SCORM (in particular, Blackboard)
- "creative, problem-solving tasks are much harder to automate and repeat" (Perfect, 2015)

Numbas

Personalised dataset & auto-marked questions requiring use of **R**

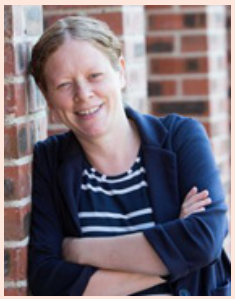
University of Newcastle, Dr Lee Fawcett

`https://numbas-editor.mas.ncl.ac.uk/numbas-previews/exam-1879-mas1802-practical-1/index.html`

Randomised Discount Cash Flow question

Cork Institute of Technology, Dr Julie Crowley

`https://numbas.mathcentre.ac.uk/question/13303/net-present-value-2/`



Searching the Numbas public database

`https://numbas.mathcentre.ac.uk/search/`

Numbas summary

- All-in-one system such as Pearson MyMathLab, Numbas

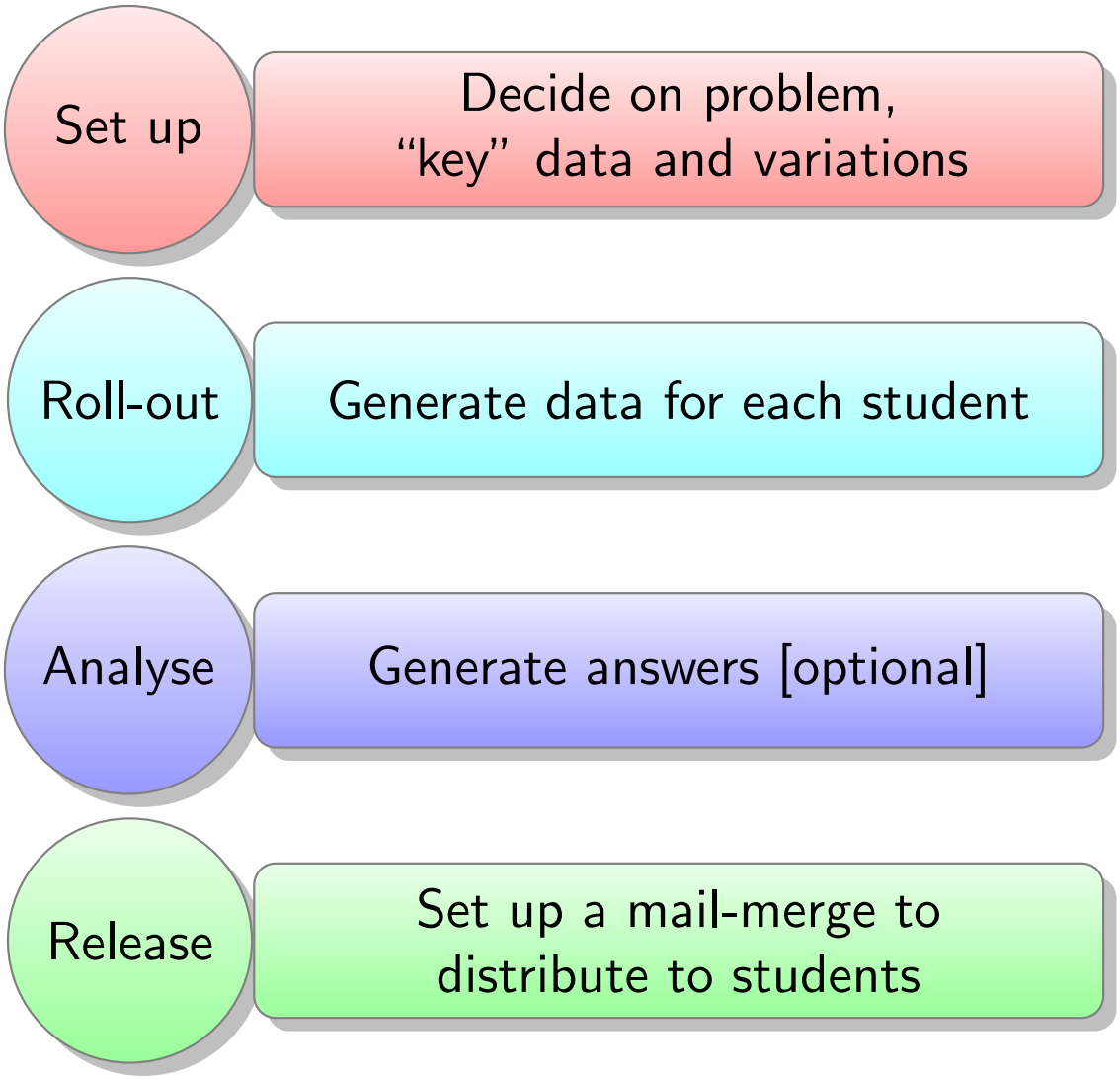
Quality of assessment

- × Authenticity of assessment
- ✓ Academic challenge
- × Identity verification
- ? Replicability
- ✓ Scalability
- ✓ Sustainability

Time & Resourcing

- ? student time
- ✓ marking staff time
- ✓ teaching staff time
- ? support staff time
- × convening staff time

Other approaches



A better way to auto-mark?

Auto Multiple Choice

Auto Multiple Choice (LaTeX)

`https://www.auto-multiple-choice.net`

Auto Multiple Choice

Auto Multiple Choice (LaTeX)

- Free, open-source Latex package

`https://www.auto-multiple-choice.net`

Auto Multiple Choice

Auto Multiple Choice (LaTeX)

- Free, open-source Latex package
- Can generate individualised tests and answers

`https://www.auto-multiple-choice.net`

Auto Multiple Choice

Auto Multiple Choice (LaTeX)

- Free, open-source Latex package
- Can generate individualised tests and answers
- Paper-based

`https://www.auto-multiple-choice.net`

Auto Multiple Choice

Auto Multiple Choice (LaTeX)

- Free, open-source Latex package
- Can generate individualised tests and answers
- Paper-based
- Built-in auto-marking

`https://www.auto-multiple-choice.net`

Auto Multiple Choice

Auto Multiple Choice (LaTeX)

- Free, open-source Latex package
- Can generate individualised tests and answers
- Paper-based
- Built-in auto-marking
- Can be run in VLEs via standalone SCORM package

`https://www.auto-multiple-choice.net`

Auto Multiple Choice

Auto Multiple Choice (LaTeX)

- Free, open-source Latex package
- Can generate individualised tests and answers
- Paper-based
- Built-in auto-marking
- Can be run in VLEs via standalone SCORM package

`https://www.auto-multiple-choice.net`

- requires knowledge of Latex (variables are handled by `pgfmathparse`).

Auto Multiple Choice

Auto Multiple Choice (LaTeX)

- Free, open-source Latex package
- Can generate individualised tests and answers
- Paper-based
- Built-in auto-marking
- Can be run in VLEs via standalone SCORM package

`https://www.auto-multiple-choice.net`

- requires knowledge of Latex (variables are handled by `pgfmathparse`).
- requires basic knowledge of python

Auto Multiple Choice

Auto Multiple Choice (LaTeX)

- Free, open-source Latex package
- Can generate individualised tests and answers
- Paper-based
- Built-in auto-marking
- Can be run in VLEs via standalone SCORM package

`https://www.auto-multiple-choice.net`

- requires knowledge of Latex (variables are handled by `pgfmathparse`).
- requires basic knowledge of python
- main purpose is auto-reading of scanned multiple choice answers

+1/1/60+

Classe d'application d'AMC **Examen du 01/01/2010**

Cet examen a pour but d'illustrer l'utilisation d'*Auto Multiple Choice*. Vous pourrez trouver sur le site d'AMC les copies de Jojo Boulix et André Roullot afin de tester la saisie automatique, ainsi que le fichier listant les étudiants de la classe d'application d'AMC (dont font partie Jojo et André) afin de tester l'association automatique à partir des numéros d'étudiants.

Si vous choisissez une note maximale de 10 et l'arrondi normal pour cet examen, Jojo obtiendra la note 5/10 et André la note 6/10.

☐ **0** ☐ **0** ☐ **0** ☐ **0** ☐ **0** ☐ **0** ☐ **0** ☐ **0**
☐ **1** ☐ **1** ☐ **1** ☐ **1** ☐ **1** ☐ **1** ☐ **1** ☐ **1**
☐ **2** ☐ **2** ☐ **2** ☐ **2** ☐ **2** ☐ **2** ☐ **2** ☐ **2**
☐ **3** ☐ **3** ☐ **3** ☐ **3** ☐ **3** ☐ **3** ☐ **3** ☐ **3**
☐ **4** ☐ **4** ☐ **4** ☐ **4** ☐ **4** ☐ **4** ☐ **4** ☐ **4**
☐ **5** ☐ **5** ☐ **5** ☐ **5** ☐ **5** ☐ **5** ☐ **5** ☐ **5**
☐ **6** ☐ **6** ☐ **6** ☐ **6** ☐ **6** ☐ **6** ☐ **6** ☐ **6**
☐ **7** ☐ **7** ☐ **7** ☐ **7** ☐ **7** ☐ **7** ☐ **7** ☐ **7**
☐ **8** ☐ **8** ☐ **8** ☐ **8** ☐ **8** ☐ **8** ☐ **8** ☐ **8**
☐ **9** ☐ **9** ☐ **9** ☐ **9** ☐ **9** ☐ **9** ☐ **9** ☐ **9**

⟵ codez votre numéro d'étudiant ci-contre, et écrivez votre nom et prénom ci-dessous.

Nom et prénom :

.....

Les questions faisant apparaître le symbole ♣ peuvent présenter zéro, une ou plusieurs bonnes réponses. Les autres ont une unique bonne réponse.

Question 1 Un paquet logiciel est fourni sur le site d'AMC. Quel en est le format ?

☐ deb ☐ slp ☐ rpm ☐ exe

Question 2 ♣ Sur quels logiciels repose l'implémentation d'AMC version 0.199 ?

☐ Gimp
☐ Apache
☐ Perl
☐ LaTeX
☐ ImageMagick ou GraphicsMagick
☐ Firefox
☐ *Aucune de ces réponses n'est correcte.*

Question 3 Sous quelle licence AMC est-il distribué ?

☐ Licence Apache
☐ GNU General Public License V2
☐ Licence commerciale AMC
☐ GNU General Public License V3

Auto Multiple Choice Summary

- Paper-based multiple-choice such as Auto Multiple Choice

Quality of assessment

- ? Authenticity of assessment
- ? Academic challenge
- × Identity verification
- ? Replicability
- ? Scalability
- ✓ Sustainability

Time & Resourcing

- ✓ student time
- ✓ marking staff time
- ✓ teaching staff time
- ? support staff time
- ✓ convening staff time

Summary and recommendations

	Mail-merge	Numbas	AMC
Authenticity of assessment	✓	×	?
Academic challenge	✓	✓	?
Identity verification	×	×	×
Replicability	?	?	?
Scalability	✓	✓	?
Sustainability	✓	✓	✓
Student time	✓	?	✓
Marking staff time	?	✓	✓
Teaching staff time	✓	✓	✓
Support staff time	?	?	?
Convening staff time	×	×	✓

Any questions?

My question for you:

- What are your experiences with individualised assessments?

References

Foster, B., Perfect, C., & Youd, A. (2012). A completely client-side approach to e-assessment and e-learning of mathematics and statistics. International Journal of e-Assessment, 2(2).

Hunt, Neville. (2005). Using Microsoft Office to Generate Individualized Tasks for Students. Teaching Statistics. 27. 45 - 48.

Mueller, J. (2005). The authentic assessment toolbox: enhancing student learning through online faculty development. Journal of Online Learning and Teaching, 1(1), 1-7.

Pérez-Benedito, J. L., Aragón, E. Q., Alriols, J. A., & Medic, L. (2014). Optical mark recognition in student continuous assessment. IEEE Revista Iberoamericana de Tecnologias del Aprendizaje, 9(4), 133-138.

Perfect, C. (2015). A demonstration of Numbas, an e-assessment system for mathematical disciplines. In CAA Conference. Chicago

Stiggins, R. J. (1987). The design and development of performance assessments. Educational Measurement: Issues and Practice, 6, 33-42.

Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes. Cambridge, MA: Harvard University Press.