# Going in the Deep-End: Batch-Generating Question Banks for Moodle Quizzes

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Teaching Commons Webinar June 18th, 2020

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# Online Exams – Wishlist

- Many variations of a question
  - Maintain academic integrity
- Manage large number of questions easily
- Check and edit questions and answers easily
- Ask a range of questions (not just MC)

➢ Question Banks!

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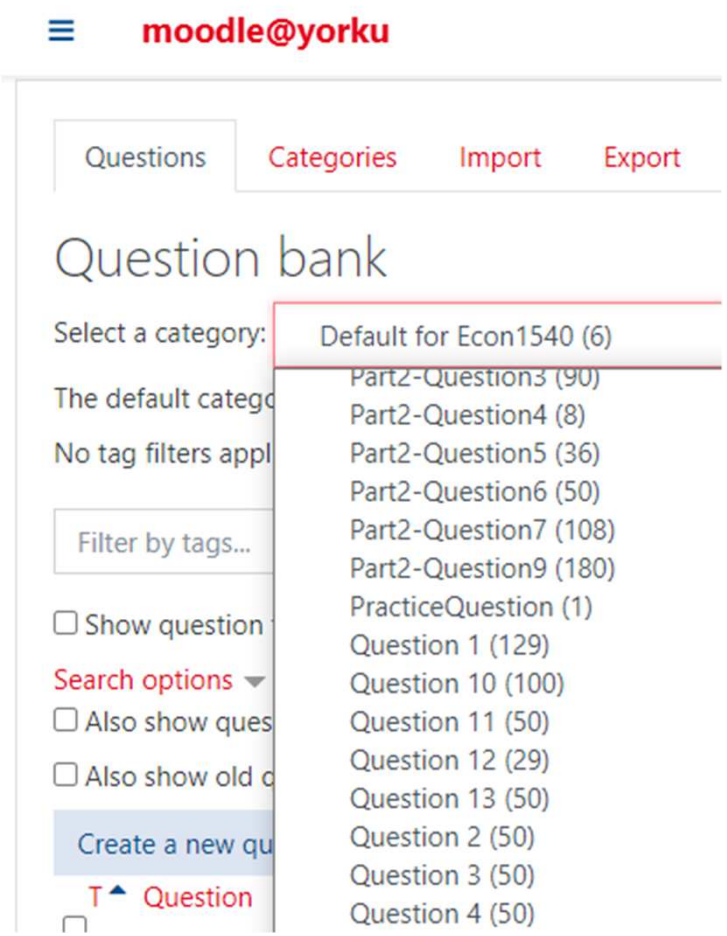
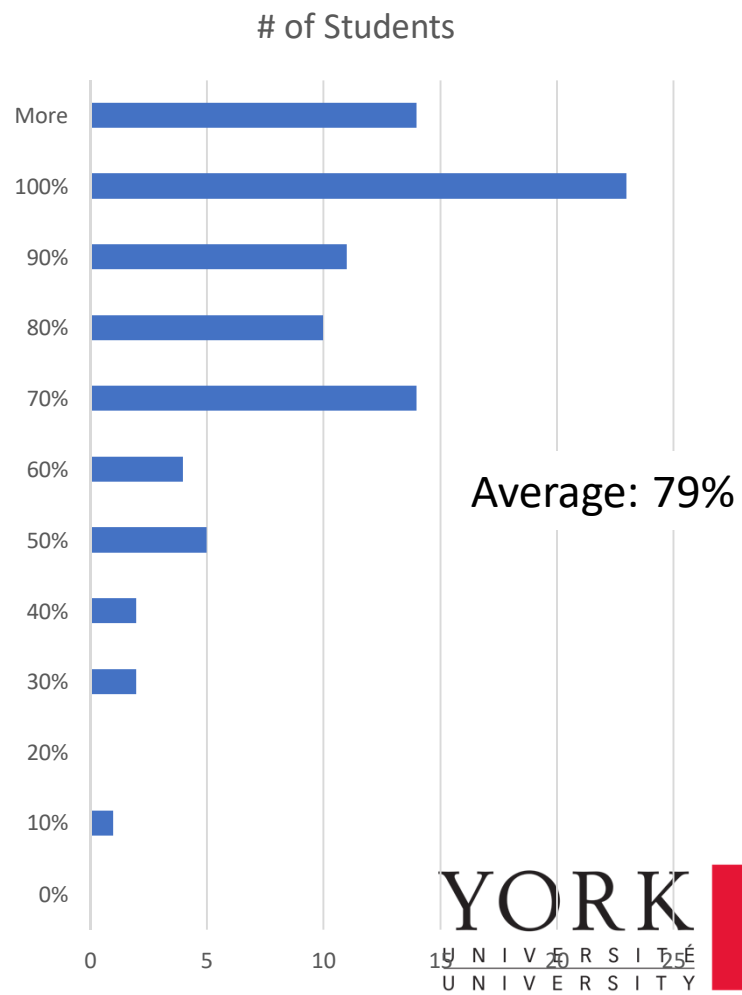
# For example …

10-50 variations per question.




Distribution: asynchronous, timed, open-book online exam (non-deferring students only)



# For example …

… Combine numeric and multiple choice question with regard to same set-up.

Question **9**

Not yet answered

Marked out of 2.00

Flag question

Edit question

This question is worth 2 points. Try to spend no more than 10 minutes on it.

To get a better sense for the workings of the Lagrangian, it is a good idea to work out a one-dimensional constrained optimization problem. For example, consider the following optimization problem

$$max_x \; 21x - 3x^2 \quad s.t. \quad x \leq 3.$$

Write down the Lagrangian, derive, and solve the first order conditions.

Answer:

$x^* =$ _____ $\lambda^* =$ _____

Note that the Lagrangian multiplier $\lambda^*$ in this case is _____ . Therefore, the constraint _____ .

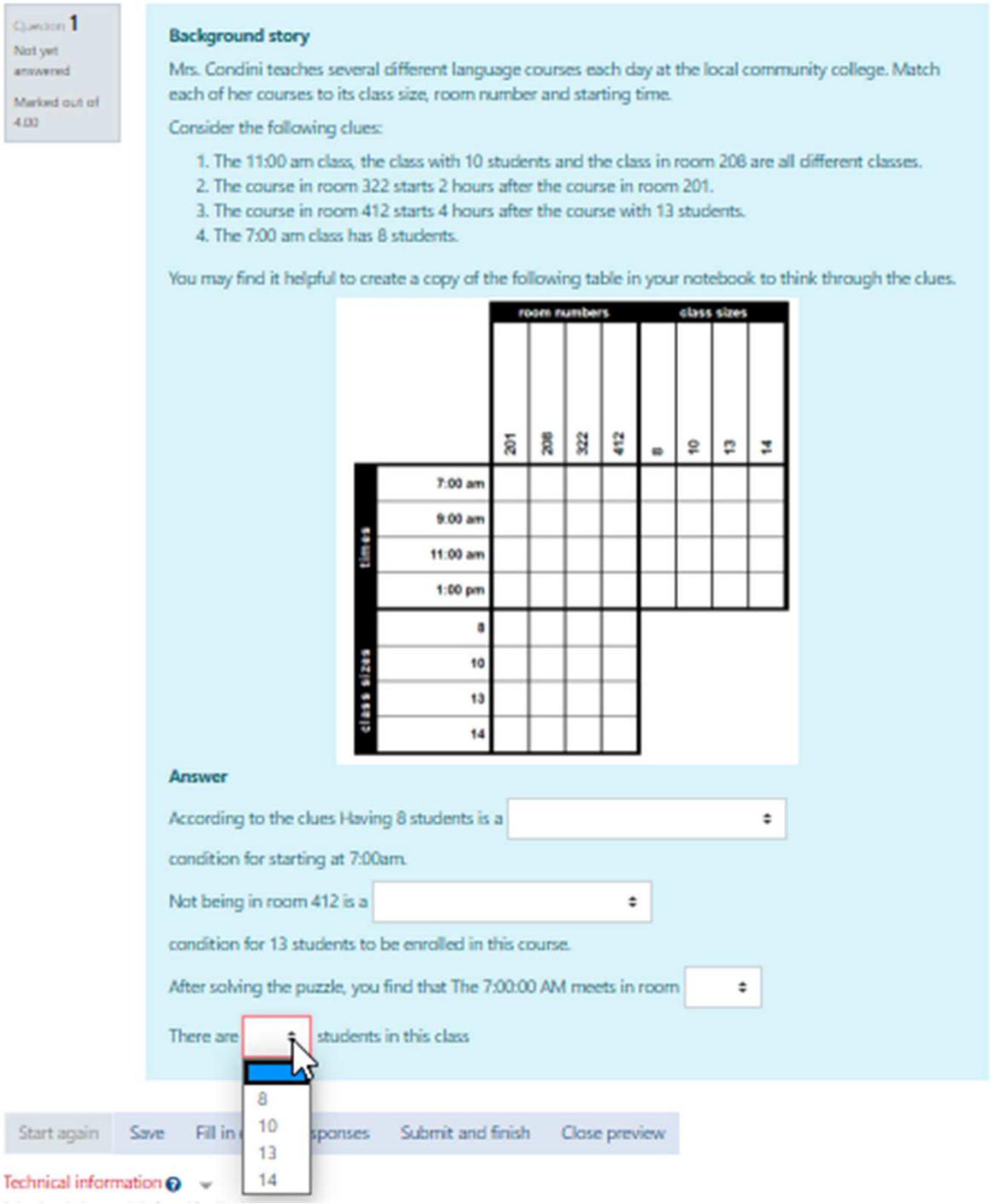
negative
zero
positive

(As an aside: If you have taken up the practice of drav ojective functions, I encourage you (after the exam, maybe) to check graphically what happens t constraint increases and compare this to how the Lagrangian multiplier changes.)

Next page

# For example …

… Embed graphics/ tables in a question and ask various questions.



Question 1

Not yet answered

Marked out of 4.00

**Background story**

Mrs. Condini teaches several different language courses each day at the local community college. Match each of her courses to its class size, room number and starting time.

Consider the following clues:

1. The 11:00 am class, the class with 10 students and the class in room 208 are all different classes.
2. The course in room 322 starts 2 hours after the course in room 201.
3. The course in room 412 starts 4 hours after the course with 13 students.
4. The 7:00 am class has 8 students.

You may find it helpful to create a copy of the following table in your notebook to think through the clues.

| | | room numbers | | | | class sizes | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 201 | 208 | 322 | 412 | 8 | 10 | 13 | 14 |
| times | 7:00 am | | | | | | | | |
| | 9:00 am | | | | | | | | |
| | 11:00 am | | | | | | | | |
| | 1:00 pm | | | | | | | | |
| class sizes | 8 | | | | | | | | |
| | 10 | | | | | | | | |
| | 13 | | | | | | | | |
| | 14 | | | | | | | | |

**Answer**

According to the clues Having 8 students is a

condition for starting at 7:00am.

Not being in room 412 is a

condition for 13 students to be enrolled in this course.

After solving the puzzle, you find that The 7:00:00 AM meets in room

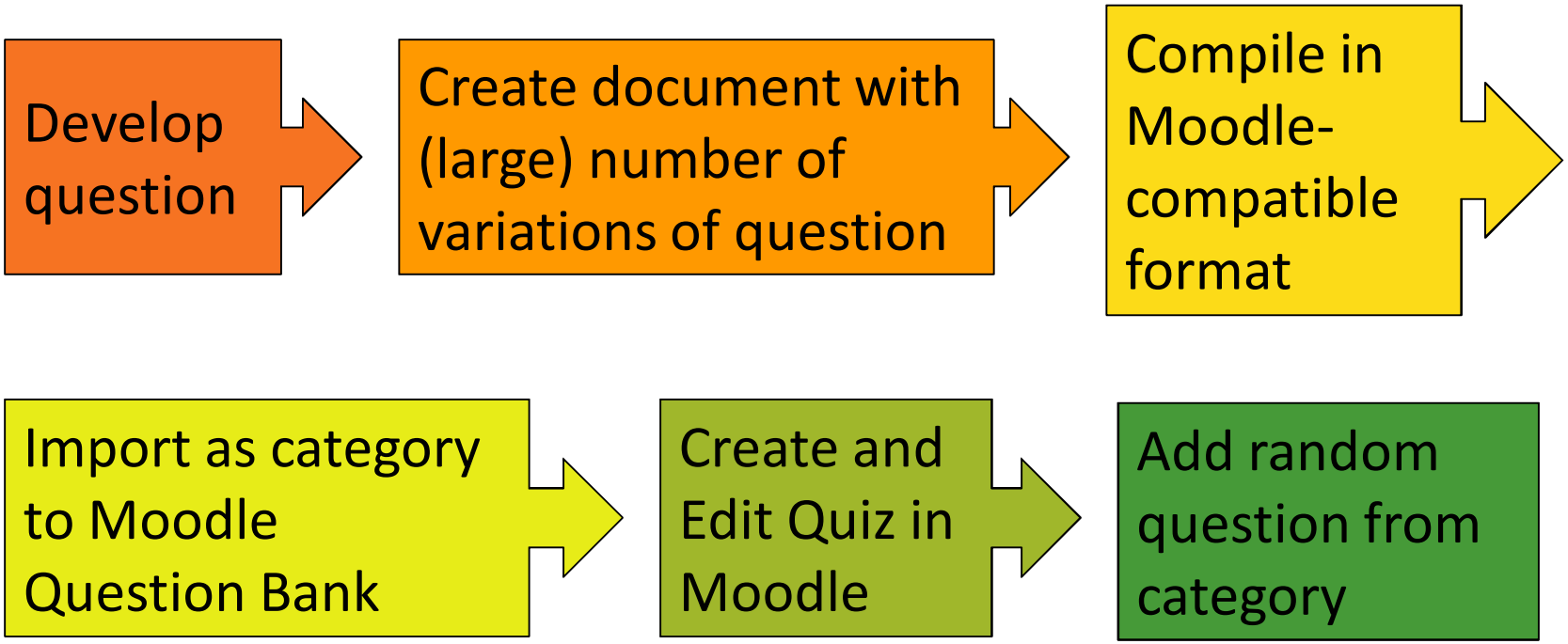
There are students in this class

8
10
13
14

Start again Save Fill in sponses Submit and finish Close preview

Technical information

# Workflow overview




(repeat)

For this talk: We'll work backward through the workflow.

First: Reminder on bottom row elements.

Add random question from category

**Category** = Grouping of questions
**Sub-Category** = Subgrouping of question

In Person Exam

**Exam Version A**

Question 1A

Question 2A

Question 3A

**Exam Version B**

Question 1B

Question 2B

Question 3B

**Exam Version C**

Question 1C

Question 2C

Question 3C

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Add random question from category

**Category** = Grouping of questions
**Sub-Category** = Subgrouping of question

Online Exam

**Question 1**

Question 1A

Question 1B

Question 1C

**Question 2**

Question 2A

Question 2B

Question 2C

**Question 3**

Question 3A

Question 3B

Question 3C

**Moodle Categories**
from which random questions are drawn

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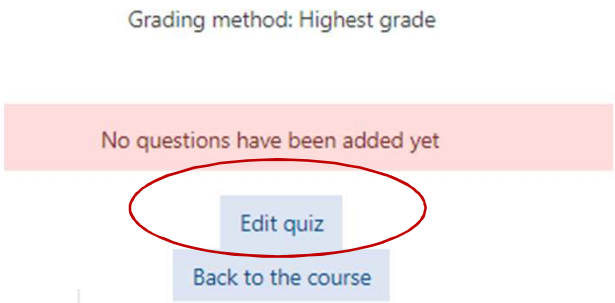
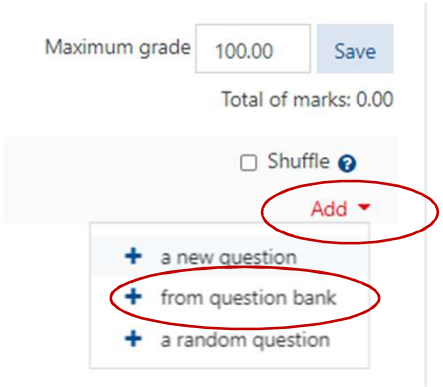
# Add random question from category

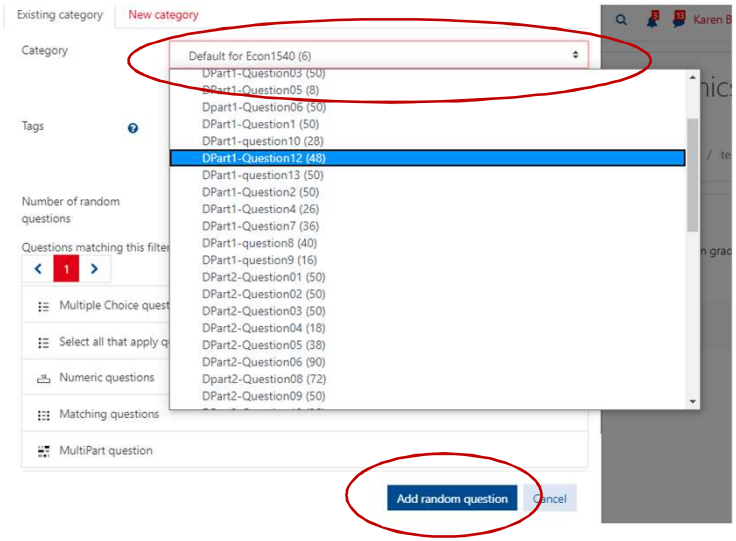
Step 1: Edit quiz.




Step 2: On right hand side, click “add question.” Then select “from question bank.”

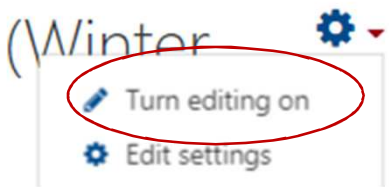



Step 3: in pop-up window, select question category and number of questions to be chosen for quiz. Click “add selected questions.”

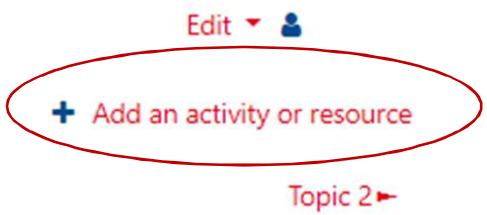


# Create and Edit Quiz in Moodle

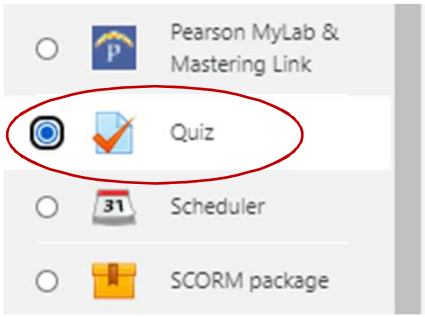
Step 1: On course front page, turn editing on




Step 2: Add activity or resource




Step 3: Select Quiz activity, click “Add”




Step 4: Enter Name and description

Step 5: Choose settings for timing, display, grading, etc.

Step 6: Select “save and display”

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Create and Edit Quiz in Moodle

For more details on those steps and settings, see:

- G. Colby: "Creating Online Multiple Choice Exams with Random Question Pools Using the Moodle Quiz Activity" https://teachingcommons.yorku.ca/teaching-commons-webinar/

- Moodle documentation https://docs.moodle.org/38/en/Quiz_settings

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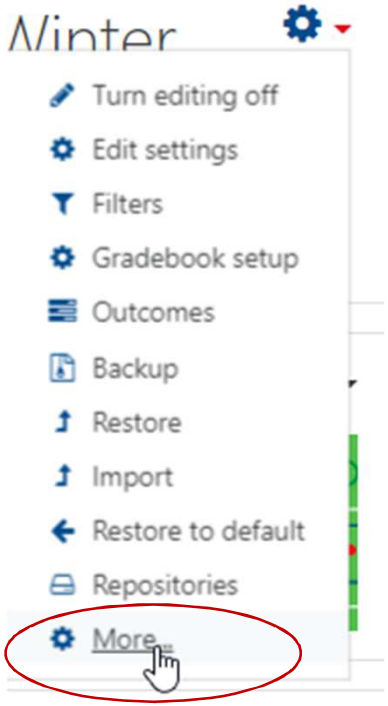
**Import** as category to Moodle Question Bank

Step 1: Click on cog wheel in top right hand corner of course front page.




Step 2: Select “More.”

Step 3: Scroll to the bottom of the page to “Question Bank.”

Step 4: Click on “Import.”

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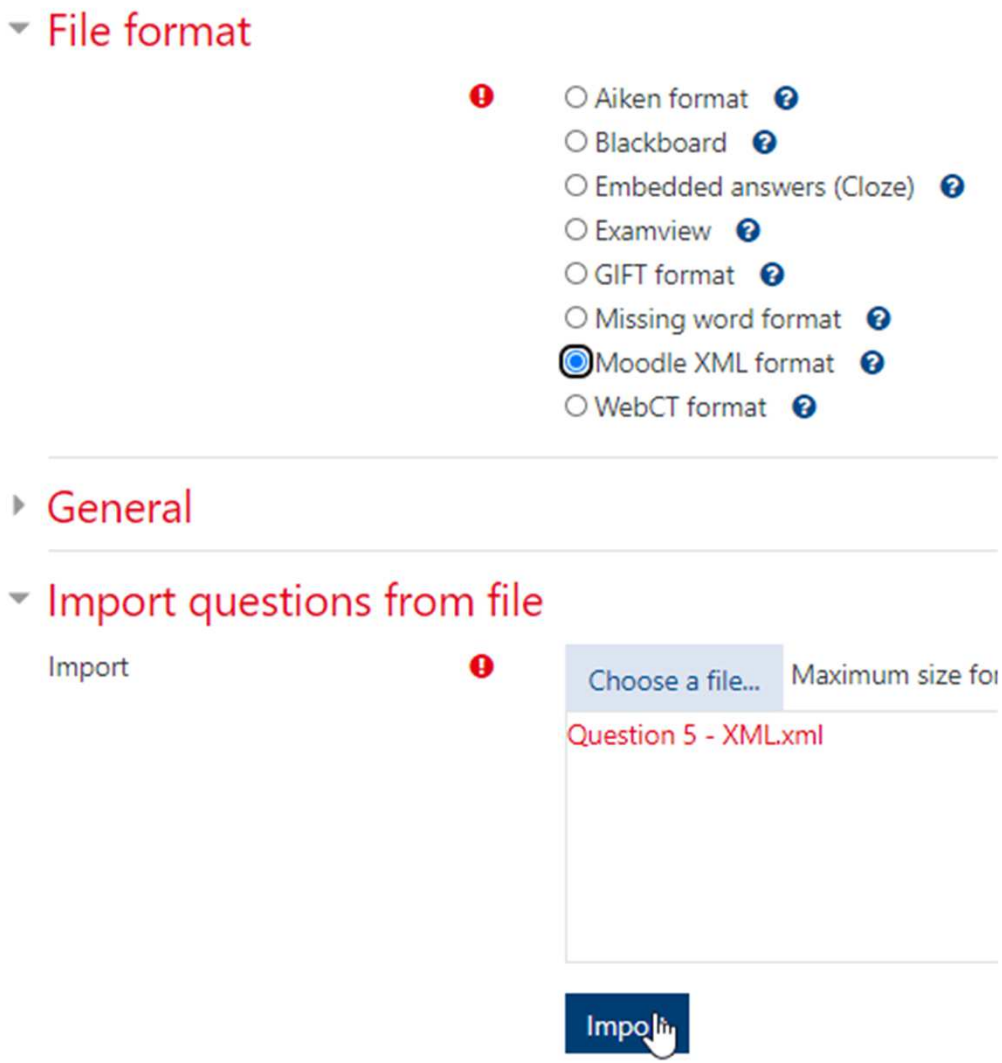
**Import** as category to Moodle Question Bank

Step 5: Select the appropriate File Format.

Step 6: Under “General”, set the categorization.

Step 7: Choose the file with questions – typical Moodle upload.

Step 8: Click on “Import.”

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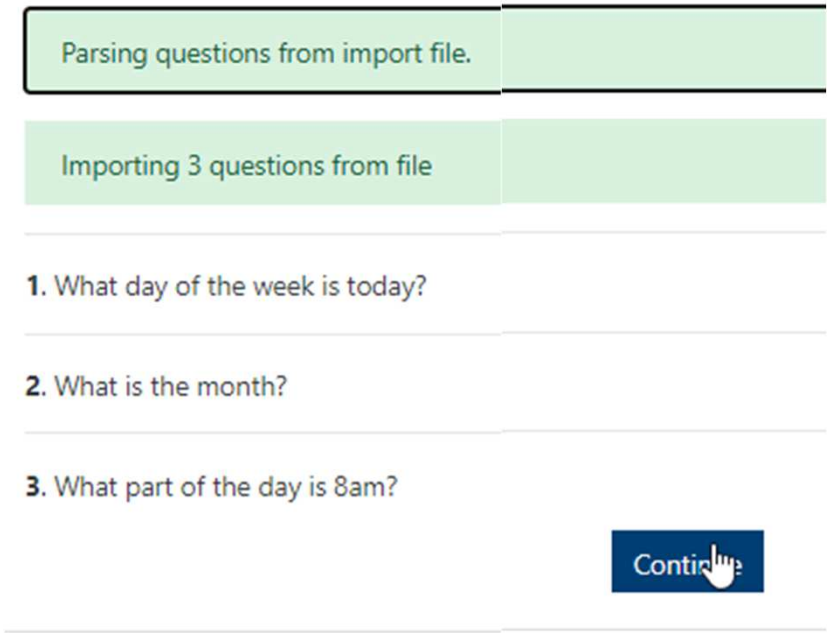
**Import** as category to Moodle Question Bank




Step 9: On next page, review questions.

Step 10: Click “continue."

On the next page, all questions are listed.

Step 11: Click on a magnifying glass to double check selected questions.

A pop-up window will show question as displayed in the quiz.

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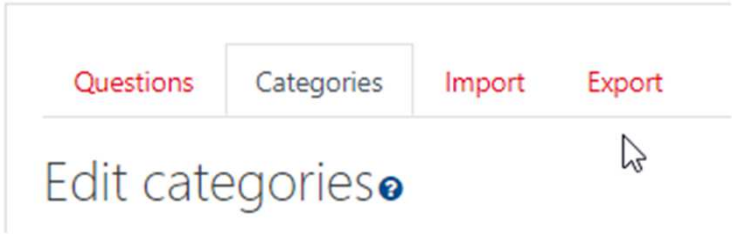
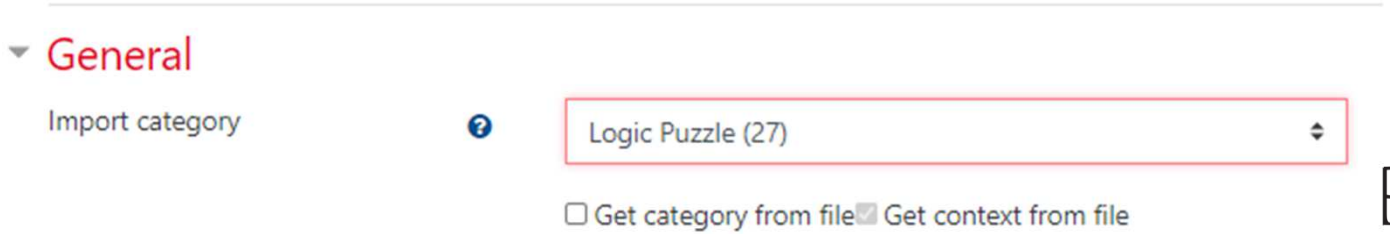
Import **as category** to Moodle Question Bank

- Some file formats (GIFT, XML) allow category to be included in the question upload. No further action needed.

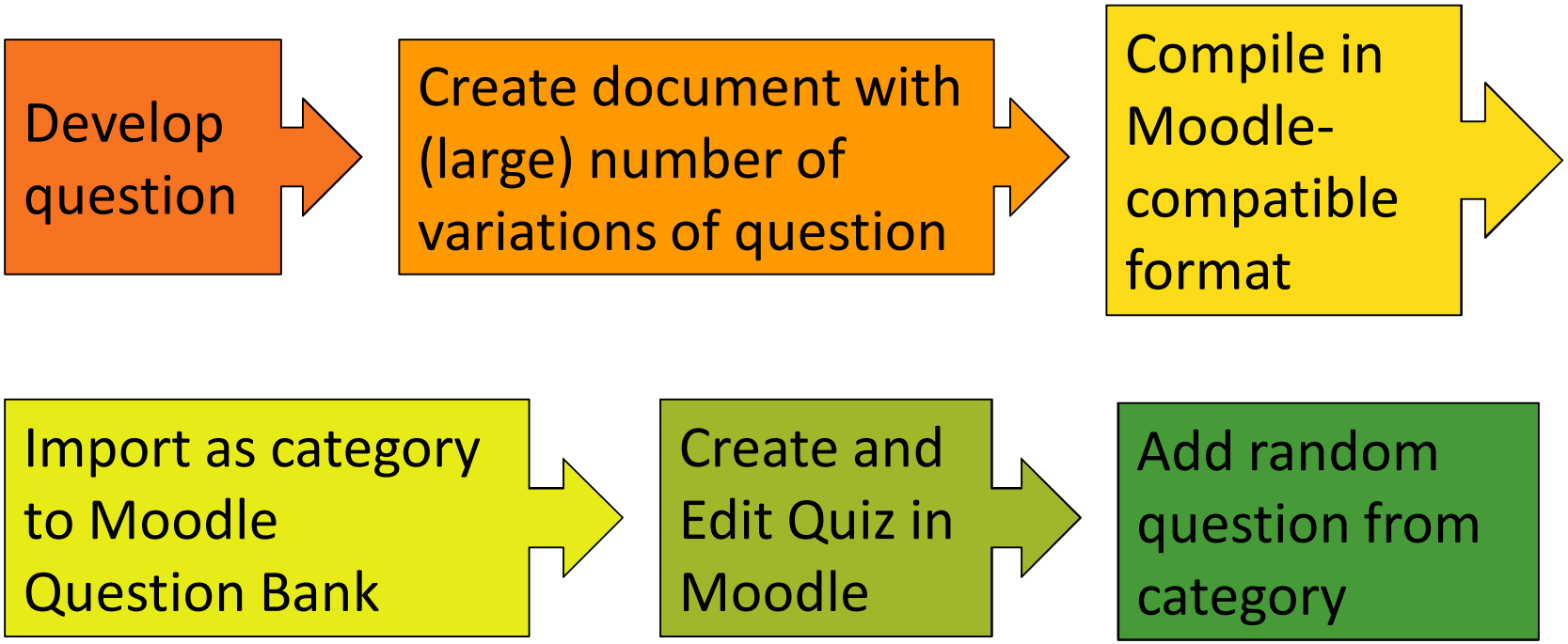
- For other file formats (AIKEN), set-up the category under the category tab.




Then select the category in the General tab when importing.



# Workflow overview




(repeat)

Next: Top row – core of this presentation.

Compile in Moodle-compatible format

Moodle import supports a variety of question bank formats. In this webinar, focus on three.

## File format

- Aiken format
- Blackboard
- Embedded answers (Cloze)
- Examview
- GIFT format
- Missing word format
- Moodle XML format
- WebCT format

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Compile in Moodle-compatible format

**Mark-Up Language**

Using tags along with questions/ answer texts. Tags are interpreted by Moodle. Question/ answer texts are displayed.

## AIKEN

One plus one is zero.

A. True

B. False

ANSWER: B

## GIFT

::Q1:: One plus one is zero. {F}

## XML

```
- <question type="truefalse">
  - <name>
      <text>Q1</text>
    </name>
  - <questiontext format="html">
    - <text>
      - <![CDATA[
            <p><p>One plus one is zero.</p><br></p>
          ]]>
      </text>
    </questiontext>
  + <generalfeedback format="html">
    <defaultgrade>1.0000000</defaultgrade>
    <penalty>1.0000000</penalty>
    <hidden>0</hidden>
    <idnumber/>
  - <answer format="moodle_auto_format" fraction="0">
      <text>true</text>
    + <feedback format="html">
    </answer>
  - <answer format="moodle_auto_format" fraction="100">
      <text>false</text>
    + <feedback format="html">
    </answer>
</question>
```

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Compile in Moodle-compatible format

## Mark-Up Language

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XML


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- <question type="truefalse">
  - <name>
      <text>Q1</text>
    </name>
  - <questiontext format="html">
    - <text>
      - <![CDATA[
          <p><p>One plus one is zero.</p><br></p>
        ]]>
      </text>
    </questiontext>
  + <generalfeedback format="html">
    <defaultgrade>1.0000000</defaultgrade>
    <penalty>1.0000000</penalty>
    <hidden>0</hidden>
    <idnumber/>
  - <answer format="moodle_auto_format" fraction="0">
      <text>true</text>
    + <feedback format="html">
    </answer>
  - <answer format="moodle_auto_format" fraction="100">
      <text>false</text>
    + <feedback format="html">
    </answer>
</question>
```


Simplicity

Powerful

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Compile in Moodle-compatible format

| | Question Type | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | True/False | Multiple Choice | Multiple Answers | Short Answers | Matching | Missing Word(s) | Numerical | Embedded Questions | Can include graphics |
| AIKEN | ☑ | ☑ | | | | | | | |
| GIFT | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ | | |
| XML | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ |

Avoid, due to high "chance performance." Use MA instead.

Be mindful of formatting concerns. See next slides.

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Compile in Moodle-compatible format

Warning

## Multiple Answer format in Moodle

- Requires that weight assigned to “yes” answers add to 100%.
- Requires specifying negative weights for “no” answers.
- Default: Selecting all answers yields 100%.
- Assigning equal weights to correct “yes” and correct “no” answers typically not possible.

➢ Better implemented as multiple T/F statements in Cloze environment.

## Numerical Format

- Moodle cannot interpret fractions, e.g., “1/2,” but allows them.

➢ Include instructions in question text, to enter answer in decimal format.

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Compile in Moodle-compatible format

Warning

## Short Answer format

- Allows students to write answer in free form.
- ➢ Only use this format, if you can specify complete list of acceptable answers, including all misspellings, etc. or if you can specify format of answer in instructions.

## Matching format

- Asks students to match, e.g., capitals to countries.
- ➢ Do not use this format for "ordering" questions such as "bring the following steps in the right order by matching them with "step 1," "step 2," … etc." Moodle cannot assign partial credit if step 3-5 are conditionally correct.

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Create document with (large) number of variations of question

| Moodle Format | Editor | Generation | File Format |
|---|---|---|---|
| AIKEN | | | .txt (UTF-8) |
| GIFT | | | .txt (UTF-8) |
| XML | | | .xml |

# Software Used

- LMS: York Moodle
- MS Word & MS Excel (York license): https://student.computing.yorku.ca/software/free-microsoft-office-365-software/
- Tex-compiler (free): Miktex https://miktex.org/ (other tex compiler available for Mac, Unix)
- Tex-editor (free): TexStudio https://www.texstudio.org/ (other editor available for Windows, Mac, Unix)
- Matlab (York license): https://matlab.info.yorku.ca/

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Create document with (large) number of variations of question

AIKEN

- No special code.
- No line breaks in question text.
- Each answer must start with a single uppercase letter, followed by a period "." or a right parenthesis ")", then a space or line break.
- The answer line must immediately follow, starting with "ANSWER: " (with a space after the colon) and then give the letter for the correct answer.
- Questions are separated by line breaks.
- Safe as “txt” file. Choose Unicode UTF-8 format.

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Create document with (large) number of variations of question

Examples

AIKEN

Albert Camus wrote Wuthering Heights.
A. True
B. False
ANSWER: B

In which country does the city of Toronto lie?
A. Canada
B. Nigeria
C. Mali
D. Ireland
ANSWER: A

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Create document with (large) number of variations of question

AIKEN

Step 1: Create document (in Word or notepad), following formatting standards.

Step 2: Save as "*name*_AIKEN.txt" file. Choose "other encoding," then "Unicode (UTF-8)."

Step 3: Within Moodle question bank, create a new category.

Step 4: Import "*name*_AIKEN.txt" into Moodle. Choose created category under general tab.

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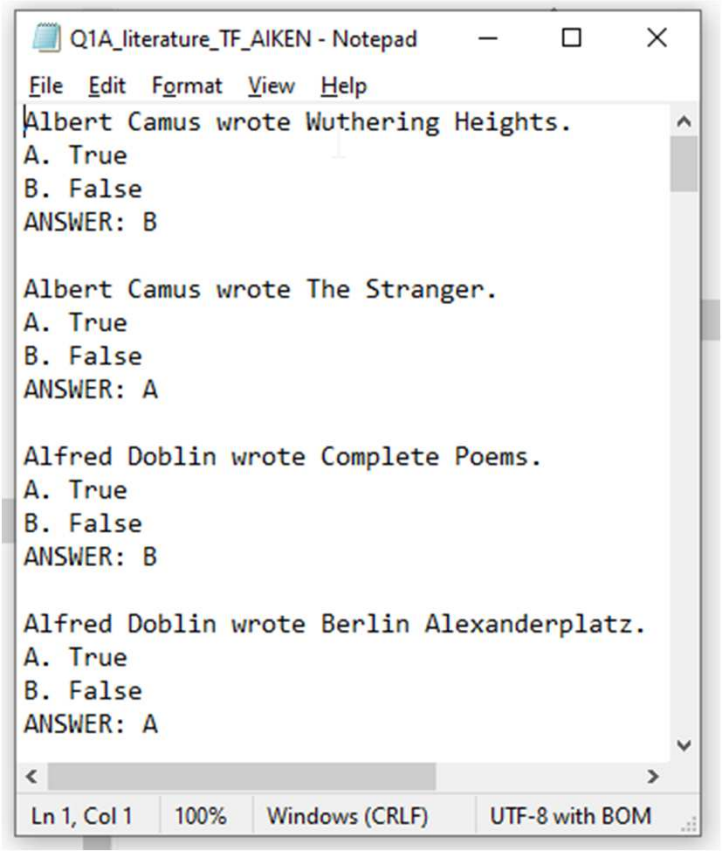
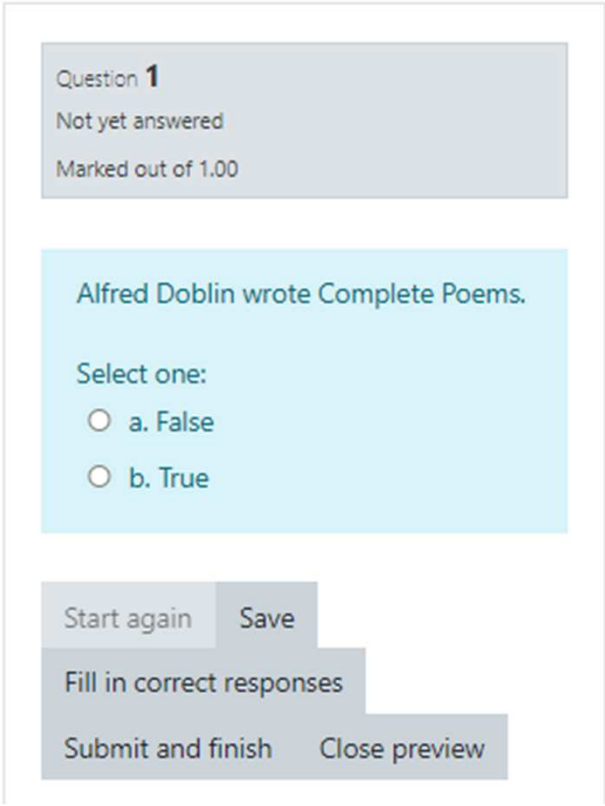
Create document with (large) number of variations of question

AIKEN




UTF-8 Text file




Moodle Imported file

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Create document with (large) number of variations of question

GIFT

- Questions are separated by line breaks.
- Safe as “txt” file. Choose Unicode UTF-8 format.

| **Basic Symbols** | **Use** |
|---|---|
| ::title:: | Question title (optional) |
| text | Question text (becomes title if no title specified) |
| { ….. } | Start answer(s) -- without any answers, text is a description of following questions …. End answer(s) |
| {T} or {F} | True or False answer; also {TRUE} and {FALSE} |
| { ... =right ... } | Correct answer for multiple choice, multiple answer, or fill-in-the-blank |
| { ... ~wrong ... } | Incorrect answer for multiple choice or multiple answer |
| {# …. } | Start numeric answer(s) … end answer(s). |

For further symbols, see https://docs.moodle.org/39/en/GIFT_format

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Create document with (large) number of variations of question

Examples

GIFT

::Q1:: Albert Camus wrote Wuthering Heights. {F}

::Q2:: In which country does the city of Toronto lie?
{ =Canada ~Nigeria ~Mali ~Ireland }

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Create document with (large) number of variations of question

GIFT

Step 1: Create document (in Word or notepad), following formatting standards.

Step 2: Save as "*name*_GIFT.txt" file. Choose "other encoding," then "Unicode (UTF-8)."

Step 3: Within Moodle question bank, create a new category.

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Create document with (large) number of variations of question

GIFT

City_Country_GIFT - Notepad

File Edit Format View Help

```
::Q2:: In which country does the city of Toronto lie?
{ =Canada   ~Nigeria ~Mali  ~Ireland }

::Q2:: In which country does the city of Montreal lie?
{ =Canada   ~Mauritius ~South Africa  ~Colombia }

::Q2:: In which country does the city of Vancouver lie?
{ =Canada   ~Laos ~Monaco  ~Sri Lanka }

::Q2:: In which country does the city of Quebec City lie?
{ =Canada   ~Sao Tome and Principe ~Palestine  ~Madagascar }

::Q2:: In which country does the city of Toronto lie?
{ =Ontario   ~Iran ~Benin  ~Angola }

::Q2:: In which country does the city of Chicago lie?
{ =United States   ~Sao Tome and Principe ~Slovakia  ~United States }

::Q2:: In which country does the city of New York City lie?
{ =United States   ~Argentina ~Comoros  ~Sri Lanka }

::Q2:: In which country does the city of Los Angeles lie?
{ =United States   ~Myanmar ~Cabo Verde  ~Oman }
```

Ln 1, Col 1 | 100% | Windows (CRLF) | UTF-8 with BOM

UTF-8 Text file

Question **1**

Not yet answered

Marked out of 1.00

In which country does the city of Vancouver lie?

Select one:

- a. Sri Lanka
- b. Laos
- c. Canada
- d. Monaco

Start again | Save

Fill in correct responses

Submit and finish | Close preview

Moodle Imported file

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Create document with (large) number of variations of question

XML

Do not write XML directly. Use a tex-compiler to turn text into XML.

LaTeX: document preparation system.
Write: plain text + code.
Compiler: Interprets code and outputs formatted text.

Examples:

| | |
|---|---|
| \section{Introduction} | \emph{this} item |

yields

| | |
|---|---|
| 1. Introduction | *this* item |

Compiler: generates pdf output.
can be set to generate XML.

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Create document with (large) number of variations of question

Code Samples

XML

Framing:

```
\documentclass[12pt]{article}
\usepackage{moodle}
\begin{document}
```

Beginning of document

```
\begin{quiz}{Question06}

\end{quiz}
```

Bracketing of collection of questions; “Question06” specifies Moodle category

```
\end{document}
```

End of document;
Compiler ignores text beyond

Moodle package by Anders Hendrickson
For more information: http://tug.ctan.org/tex-archive/macros/latex/contrib/moodle/moodle.pdf

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Create document with (large) number of variations of question

Code Samples

XML

## Multiple Choice:

```
\begin{multi}[points =1]{Capitals}

What is the capital of France?

    \item Berlin
    \item Ottawa
    \ item* Paris
    \item New York

\end{multi}
```

Beginning of question; Assigned points; Question title

Answer choices.
* Marks correct answer.

End of question

Moodle package by Anders Hendrickson
For more information: http://tug.ctan.org/tex-archive/macros/latex/contrib/moodle/moodle.pdf

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Create document with (large) number of variations of question

Code Samples

XML

Numerical:

```
\begin{numerical}[points =1]{Summation}

What is 34.2 + 27.3?

    \item[tolerance=0.1] 61.5

\end{numerical}
```

Beginning of question; Assigned points; Question title

Question and correct Answer.

End of question

Moodle package by Anders Hendrickson
For more information: http://tug.ctan.org/tex-archive/macros/latex/contrib/moodle/moodle.pdf

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Create document with (large) number of variations of question

# Advantage

XML

| | Question Type | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | True/False | Multiple Choice | Multiple Answers | Short Answers | Matching | Missing Word(s) | Numerical | Embedded Questions | Can include graphics |
| AIKEN | ☑ | ☑ | | | | | | | |
| GIFT | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ | | |
| XML | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ |

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# Blocks of Questions - Cloze

Objective: Ask multiple questions with regard to *same* graph/ table/ case study – but randomize such that different students see different graphs/ tables/ case studies.

Solution: Embed multiple questions within one Moodle question.

- Cloze question.

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# Cloze – Code Sample

XML

Cloze:

```
\begin{cloze}[points =5]{Functions}

 Consider the function $f(x) =x$. It is
      \begin{multi}
            \item a decreasing
            \item* an increasing
      \end{multi}
      function.  Its value at $x = 2$ is
      \begin{numerical}
            \item[tolerance=0.05] 2
      \end{numerical}

\end{cloze}
```

Beginning of question; Assigned points; Question title

Multiple embedded sub-questions and respective correct answers.

End of question

Moodle package by Anders Hendrickson
For more information: http://tug.ctan.org/tex-archive/macros/latex/contrib/moodle/moodle.pdf

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Create document with (large) number of variations of question

XML

File Edit Idefix Tools LaTeX Math Wizards Bibliography Macros View Options Help

LOGIC_PUZZLES_12 graphics.tex

```
\documentclass[12pt]{article}
\usepackage{moodle}
\usepackage{enumerate}
\usepackage{amsmath}
\begin{document}

\begin{quiz}{Logic Puzzle}

\begin{cloze}[points=1]{Logic Puzzle: Girls Badges}

\textbf{Background story}

The mayor of Witleyville today held a ceremony in which he awarded a number of local girl scouts their merit badges. Using only the clues below, determi
award was given, and match each girl to her merit batch.

Consider the following clues:
\begin{enumerate}
\item The youngster who got the second award won the dance badge.
\item Angelina won the first aid badge.
\item Beverly was awarded 1 spot after the girl who won the leadership badge.
\item Patsy was awarded 2 spots after the girl who won the leadership badge.
\end{enumerate}

You may find it helpful to create a copy of the following table in your notebook to think through the clues.

\begin{center} \includegraphics[width=4in]{01_girls_badges.png}\end{center}
\textbf{Answer}

According to the clues Winning the dance badge is a
\begin{multi}
\item* necessary
\item sufficient
\item necessary and sufficient
\item neither necessary nor sufficient
\end{multi}

condition for receiving the merit badge awarded second.

Not being Patsy is a
```

Line: 56 Column: 0 INSERT

Create document with (large) number of variations of question

# Automatizing Text Generation

When question text repeats – automize question generation:

- Create text blocks and answer choices in Excel
- Open new Word document
- Use “Mail Merge” to auto-generate questions
- Save new document in txt format.
  (don’t worry about page breaks)

- Generate parameters for question. Use `fprint` command to write to file and generate a .tex file.
- Compile tex file with LaTeX to generate XML file.

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Create document with (large) number of variations of question

Generate Excel file – one question per row. First row headings. Can use numbers, text. Save as Excel file.

| | A | B | C | D |
|---|---|---|---|---|
| | **Author** | **Title** | **Value** | **Answer** |
| | Albert Camus | Wuthering Heights | F | B |
| | Albert Camus | The Stranger | T | A |
| | Alfred Doblin | Complete Poems | F | B |
| | Alfred Doblin | Berlin Alexanderplatz | T | A |
| | Anon | Love in the Time of Cholera | F | B |
| | Anon | King Lear | F | B |
| | Anon | Othello | F | B |
| | Anon | The Epic of Gilgamesh | T | A |
| 0 | Anon | The Book of Job | T | A |
| 1 | Anon | Mahabharata | T | A |
| 2 | Anton Chekhov | The Complete Tales | F | B |
| 3 | Anton Chekhov | The Iliad | F | B |
| 4 | Anton Chekhov | Selected Stories | T | A |
| 5 | Anton Chekhov | Thousand and One Nights | T | A |

Use Column C for GIFT. GIFT distinguishes T/F from MC questions.

Use Column D for AIKEN. AIKEN only accepts A, B, … as answer.

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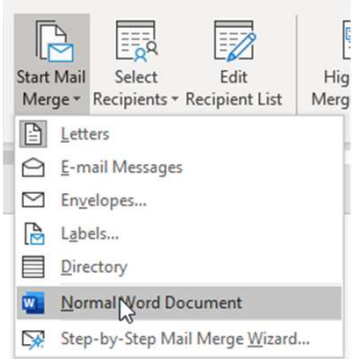
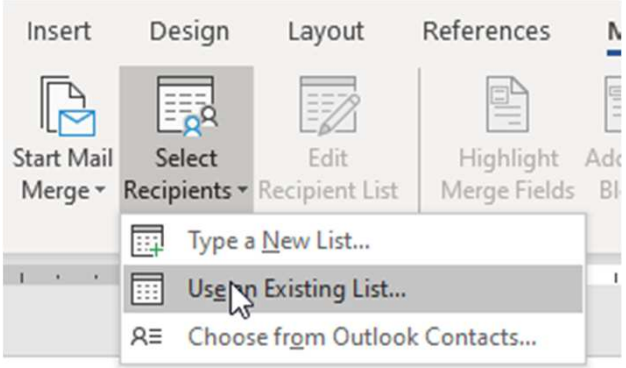
Create document with (large) number of variations of question

Mail merge

Step 1: Open new Word document




Step 2: Choose mailings Ribbon

Step 3: Start mail merge for Word document

Step 4: Click “Select Recipients” and select “Using Existing List.” Pick excel file (which must be closed).

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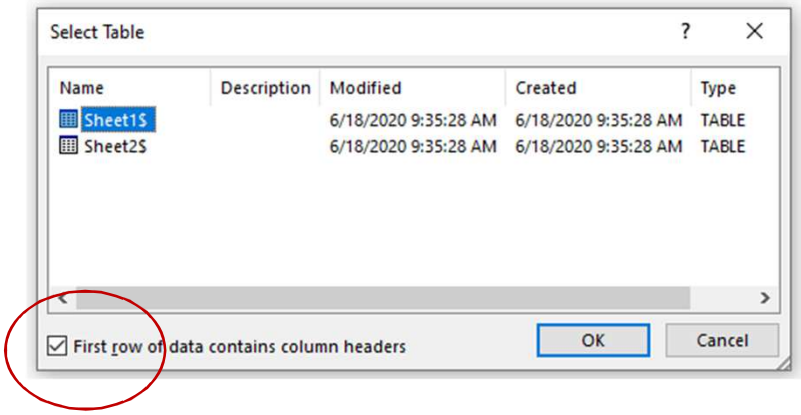
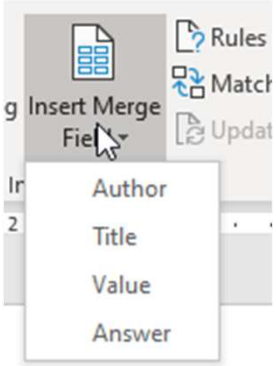
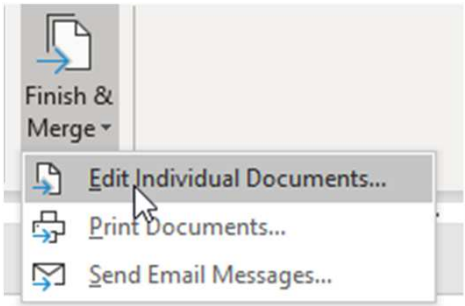
Create document with (large) number of variations of question

Mail merge




Step 5: Select the appropriate worksheet and select "contains column header"

Step 6: Write the question and insert text blocks as appropriate.

Step 7: Click on "Finish Merge" & select "Edit Individual Documents..."

Note: Ignore page breaks introduced through mail merge. Saving document as UTF-8 will cut the page breaks.

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Create document with (large) number of variations of question

XML

MATLAB

LaTeX

EDITOR PUBLISH VIEW

New Open Save Find Files Compare Print FILE

Go To Find NAVIGATE

Insert Comment Indent EDIT

Breakpoints BREAKPOINTS

Run Run and Advance Run Section Advance Run and Time RUN

DPart2_question07.m

```
49 -                lambda = 1/tt;
50
51          % write text
52 -        writeBlockText(fid,text2);
53
54 -        fprintf(fid,'Consider two row vectors \n');
55 -        fprintf(fid,'\\[ \\mathbf{u} = \\begin{pmatrix} %g & %g & %g                    yy, zz);
56 -        fprintf(fid,'\\; \\; \\mathbf{v} = \\begin{pmatrix} %g & %g                    , tt*zz);
57
58 -        fprintf(fid,'First, find $\\lambda$ such that $\\mathbf{u} +
59 -        fprintf(fid,'where $\\mathbf{0}$ is the three-dimensional ve
60 -        fprintf(fid,'then $\\lambda = $\n');
61 -        writeNumerical(fid,lambda);
62
63 -        fprintf(fid,'. \n \n');
64 -        fprintf(fid,'Second, find $a$ such that the angle between $a                    degree (so
65 -        writeNumerical(fid,aa(ang));
66 -        fprintf(fid,'.');
67 -        writeBlockText(fid,text3);
68 -            end
69 -        end
70 -    end
71
72 -    writeBlockText(fid,text4);
73 -    fclose(fid);
74
75 -    end
```

Matlab codes runs through parameter loop. Use fprintf command to create tex file.

Then compile tex file with LaTeX compiler.

Develop question

# Moodle Quiz Activity empowers you.

- Ensure the first student writing your exam is not worse off than the 100th student.
- Ensure that seeing other students' questions (w/o answers) is not more informative than seeing practice/ homework questions.
- Avoid MC questions – there's auto-grading!
  Replace them with short answer question (to test mastery of terminology), numeric question (to test ability to execute), multiple answer questions (to at least reduce the "chance score").

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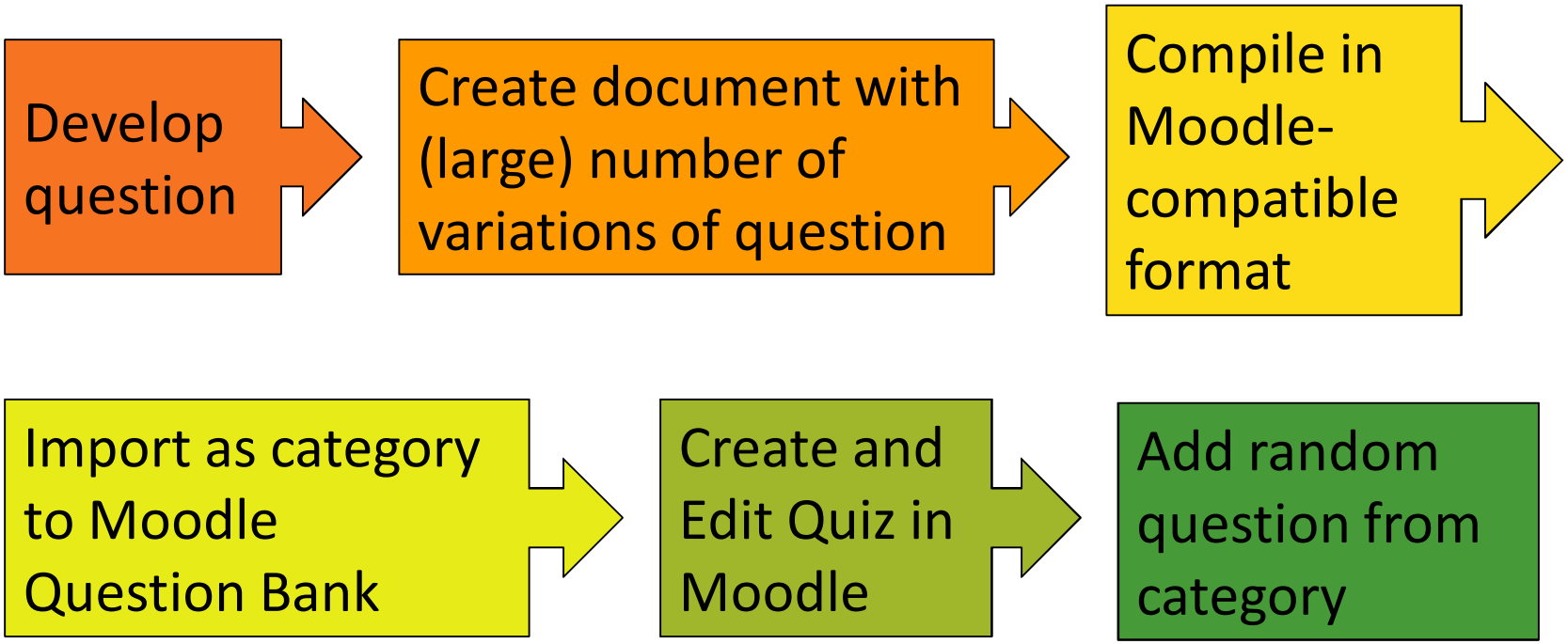
# Workflow overview




(repeat; approx. 2h per question)

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# Online Exams – Wishlist

- ✓ Many variations of a question
  - ✓ Maintain academic integrity
- ✓ Meaningful way to manage large number of questions
- ✓ Can double check and correct questions and answers in reasonable way
- ✓ Can ask a range of questions (not just MC)

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# Q & A

- Can you generate calculated numeric questions?
  - No directly. But not needed.
  - Calculated questions in Moodle generate variations of questions by varying parameters in the question. Also: formulas/ algorithms are limited.
  - Instead: Run through parameters in Excel/ Matlab/ Python, then generate all variations through LaTex or MailMerge. Upload questions as category to Moodle.

- How do you generate the drop-down MC format we saw in some examples?
  - Within the Cloze environment, MC questions can be represented as vertical, horizontal, or drop-down options. Drop-down is the default. The other options can be specified.

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Thank you.

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# Technical notes

- Webcam: My smartphone.
- Software used for this presentation:
  (all free or freely available to the York community)
  - Virtual call: Zoom
  - Slide deck: Powerpoint
  - Smartphone-as-webcam app: ivCam (free version)
- Background image: Douglas reading room at QU
  - Blurred with a 1.5-radius Gaussian Filter in Gimp

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