Ubbr: A Python/SageMath package for mathematical e-assessment

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September 14, 2016

Who might be particularly interested?

- People interested in problem authoring - especially for higher mathematics such as abstract algebra, graph theory, ...
- Python users
- anyone interested in SageMath

Ubbr is **not** a standalone turnkey solution for assessment.

What is our relationship with the software that we use?

Structure of talk

- Some context and reflections on some software
- A few examples (with code!!). See http://poincare.nuigalway.ie/EAMS/sandbox/examples
- Plans

- WeBWorK (since 2010)
- OKUSON (since 2008)
- MyMathLab
- Blackboard
- Various bespoke systems

My goal - add to the confusion :)

What is SageMath?

Created by William Stein (check out his Talk Python to me podcast)

from www.sagemath.org

> "SageMath is a free open-source mathematics software system licensed under the GPL. It builds on top of many existing open-source packages: NumPy, SciPy, matplotlib, Sympy, Maxima, GAP, FLINT, R and many more. Access their combined power through a common, Python-based language or directly via interfaces or wrappers."

http://cloud.sagemath.com/ - SageMath, Jupyter, R, LATEX, linux, . . .

http://sagecell.sagemath.org/ is a great teaching resource.

Another assessment system? Really??

Another assessment system? Really??

- WeBWorK, Numbas, . . . - among many other features, non-coder friendly, scaleable, large problem databases, standalone multifaceted systems . . .
- Python - beginner friendly, flexible, nice object model. . .
- Interesting (relatively) recent developments.
    - Web frameworks have become *very* high level
    - MathJax has essentially solved the rendering problem
    - Python scientific stack and SageMath
    - Websockets
- How do we relate to software? e.g. LaTeX
- If the horse (me) won't come to the water (Perl). . . (assuming the horse is thirsty)

A little bit of glue

Ubbr is basically a Python HTML template engine

```
<p> Standard HTML markup, one new tag ...
<ubbr>
p = x^2
g = p.derivative(x)
</ubbr>
What is the derivative of \(
<ubbr>
echo(p)
</ubbr>
\) with respect to \(x\)?
```

A small number of custom functions that echo output to the HTML.

http://poincare.nuigalway.ie/EAMS/sandbox/examples

Project status

- Allows me to create problems easily for any of my own courses.
- Large 1st year class. ≈ 17000 student-problem instances over a semester. No major issues
- 3rd year course on life contingent risk - 40 students. Lots of calculations based on life tables.
- 'Proof of Concept' implementation.
  - error handling needs to be improved to help with problem debugging
  - the user/course management sytem is very bare bones - essentially a Django admin site

I find this very useful - maybe others will?

Immediate roadmap

Sabbatical starting in January :)

- Publish the engine on PyPI.
- Richer interactive representations of data and problem statements
    - Ubbr + matplotlib + websockets + Tornado = ???
    - Possibly a good way to address the 'wolfram alpha' problem.

    . . . towards a web framework for more mathematically intelligent problems.
- Make a minimal publishable admin site (probably polish up the existing Django site)

Get some other people involved!