Dual Presentation with Math Using GELLMU

TEX Users Group (TUG) in San Diego

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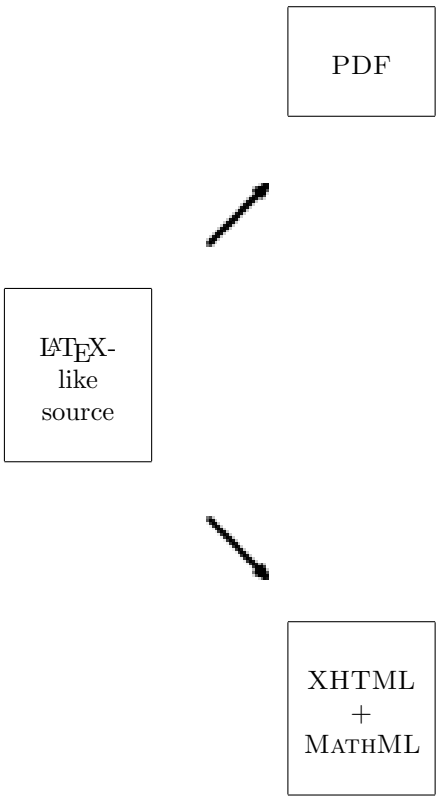
July, 2007

1 The Idea



2 Example

The following identity may be regarded as a formulation of the Weierstrass product for the Gamma function.

$$\int_0^\infty t^x e^{-t} \frac{dt}{t} \;=\; \frac{1}{x} \prod_{k=1}^{\infty} \frac{\left(1+\frac{1}{k}\right)^x}{\left(1+\frac{x}{k}\right)}$$

Understanding the derivation of this identity is reasonable for a bright student of first year undergraduate calculus in the United States.

These are XHTML + MathML slides!

3 Computation of a Continued Fraction

$$\begin{aligned}
\sqrt{10} &= 3 + \frac{1}{\frac{1}{\sqrt{10}-3}} \\
&= 3 + \frac{1}{\sqrt{10}+3} \\
&= 3 + \frac{1}{6 + \frac{1}{\frac{1}{\sqrt{10}-3}}} \\
&= 3 + \frac{1}{6 + \frac{1}{\sqrt{10}+3}} \\
&= 3 + \frac{1}{6 + \frac{1}{6 + \frac{1}{\cdots}}}
\end{aligned}$$

4 Finding the tangent at a point

Curve: $y^2 = x^3 - 7x + 10$
Point: $B = (1, -2)$

Use implicit differentiation to find the slope:

$$2yy' \;=\; 3x^2 - 7$$

Evaluate when $(x, y) = (1, -2)$: $y' = 1$ The tangent line at $(1, -2)$ is parallel to any vector with slope 1, e.g., $V = (1, 1)$.

Parametric equation:

$$p(t) \;=\; B + tV \;=\; (1, -2) + t(1, 1) \;=\; (1 + t, -2 + t)$$

5 Mozilla MathML Torture Test 13

$$\sqrt{1+\sqrt{1+\sqrt{1+\sqrt{1+\sqrt{1+\sqrt{1+\sqrt{1+x}}}}}}}$$

6 Mozilla MathML Torture Test 24

$$\det \begin{vmatrix} c_0 & c_1 & c_2 & \cdots & c_n \\ c_1 & c_2 & c_3 & \cdots & c_{n+1} \\ c_2 & c_3 & c_4 & \cdots & c_{n+2} \\ \vdots & \vdots & \vdots & & \vdots \\ c_n & c_{n+1} & c_{n+2} & \cdots & c_{2n} \end{vmatrix} > 0$$

7 Madore's Challenge

In a letter to Godfrey Harold Hardy, Sr̲īn̲ivāsa Rāmān̲ujan̲ Aiyaṅkār asserts that

$$\frac{1}{1+\frac{e^{-2\pi\sqrt{5}}}{1+\frac{e^{-4\pi\sqrt{5}}}{1+\frac{e^{-6\pi\sqrt{5}}}{\cdots}}}} = \left(\frac{\sqrt{5}}{1+\sqrt[5]{5^{3/4}\left(\frac{\sqrt{5}-1}{2}\right)^{5/2}-1}} - \frac{\sqrt{5}+1}{2}\right) e^{2\pi/\sqrt{5}}$$

8 Zeta function calculation

With the condition $Z_X(0) = 1$ the function $Z_X(t)$ is determined by its logarithmic derivative:

$$\begin{aligned} \frac{d}{dt}\log Z_X(t) &= \sum_{x \text{ closed}} d(x)\frac{t^{d(x)-1}}{1-t^{d(x)}} \\ &= \frac{1}{t}\sum_{r\geq 1}\sum_{\{\,x \text{ closed} \mid d(x) = r\}} r\frac{t^r}{1-t^r} \\ &= \frac{1}{t}\sum_{r\geq 1} r c_r \frac{t^r}{1-t^r} \quad = \quad \frac{1}{t}\sum_{r\geq 1} r c_r \sum_{m\geq 1} t^{rm} \\ &= \sum_{\nu\geq 1} N_\nu t^{\nu-1} \end{aligned}$$

9 Dual Presentation

- One source
- Print and HTML outputs
- Print and XHTML + MathML if math is involved

10 How to write for dual presentation (I)

Standard Answers

1. Write LaTeX, then translate to HTML
2. Write SGML or XML, then
   (a) Translate to LaTeX
   (b) Translate to XHTML + MathML

11 How to write for dual presentation (II)

Translating

Translating from LaTeX involves

- Carefully written LaTeX source
- Customized tuning
- Hidden learning curve

Tough

12 How to write for dual presentation (III)

The GELLMU Approach

- Must first learn how
- Write with LaTeX-like syntax
- Use the vocabulary of an SGML document type

Easier!

13 Conceptual Differences

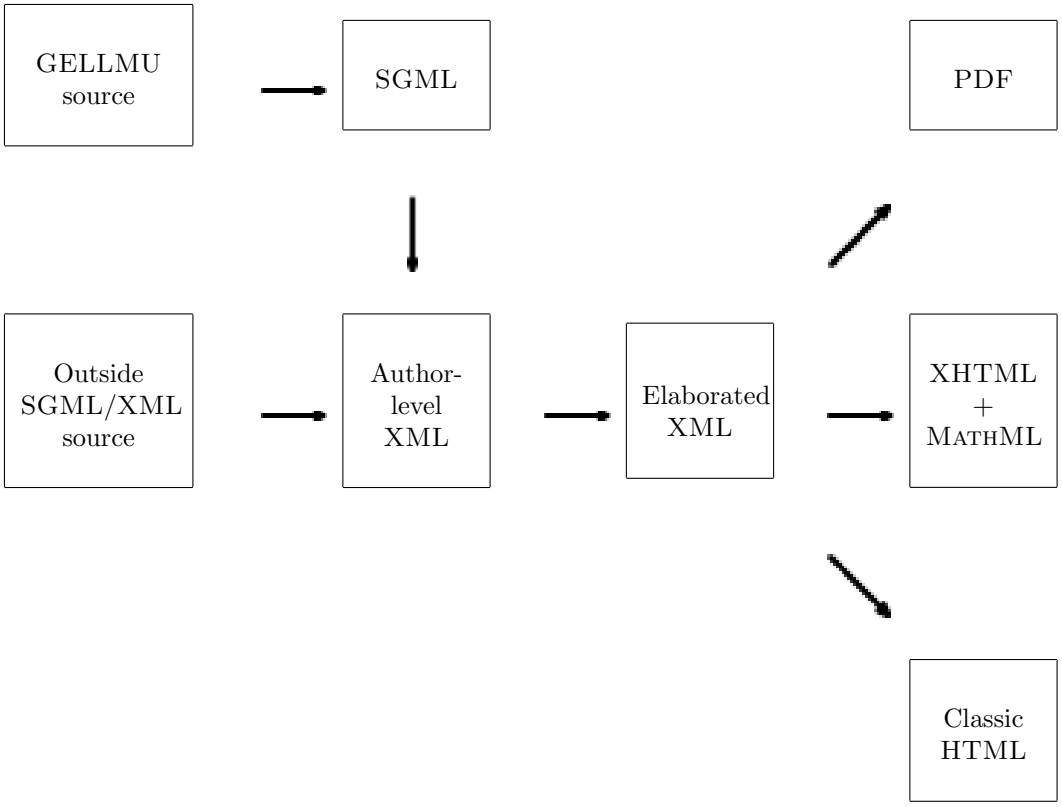
- No pages
- No vertical lengths

- Relative horizontal lengths
- Content, yes.
- Style, no.
- Fonts, no.

14 Markup Differences in GELLMU

- No declaration style markup (like `{\centering ...}`)
- Braced zones provide logical grouping but not scope.
- `\begin{display} ... \end{display}` is the same as `\display{ ... }`
- No space allowed between a command and its arguments or between its successive arguments.
- The 33 non-alphanumeric but printable ASCII characters may all be referenced by names, e.g., `\tld;` for "~" is useful in URLs.
- Counters ride with labels.

15 Flow Chart



16 Style

Style choices are made in formatters
(arrows at the right end of the chart)

17 Style vs. Content

Style	**Content**
`\begin{center} ... \end{center}`	`\display{ ... }`
`\it` or `\textit`	`\emph`
`\bf` or `\textbf`	`\bold`
`\textsc`	`\abbr`
`\tt` or `\texttt`	`\quostr` or `\path`

18 Commands Correspond to XML Elements

LaTeX	**GELLMU source**	**GELLMU XML**
`\\`	`\\`	`<brk/>` or `<fcell>...</fcell>`
`&`	`&`	`<acell>...</acell>`
`\'e`	`\acute{e}`	`<acute>e</acute>`
é	`&#xE9;` or é	é
`\frac23`	`\frac{2}{3}`	`<frac><nm>2</nm><dn>3</dn></frac>`
`\left\{...\right\}`	`\balbr{ ... }`	`<balbr> ... </balbr>`
`\sum_j ...`	`\sum_j ... \sum:`	`<sum><sub>j</sub>...</sum>`

19 Write a Document

Source for a document:

```
\documenttype{article}
\title{A Simple Sum}
\begin{document}

This is a simple summation formula:
\[ \sum_{k=1}^n k \sum: = \frac{n(n+1)}{2} \ \eos \]
It may be proved easily using mathematical induction.

Mathematical induction is part of deductive, not
inductive, logic.

\end{document}
```

20 Build a Document

1. Save it as `"smalldoc.glm"`.
2. At a command line enter

```
mmkg  smalldoc .
```

3. Read the scroll.
4. Inspect the yield:

XHTML PDF XML LaTeX HTML

21 Example Documents

- The *User Guide* (PDF) (Source)
- The *Manual* (PDF) (Source)
- A calculus handout (PDF) (Source)
- A port to GELLMU of Lamport's `"sample2e.tex"` (PDF) (Source)
- Port of an article from *The New Journal of Mathematics*

22 Acknowedgement

The XHTML + MathML version of these slides uses W3C's *Slidy* by Dave Raggett, a JavaScript/CSS package for sizing and flow control of an HTML or XHTML slide show.

(The slides were generated in a non-standard fashion from GELLMU source.)