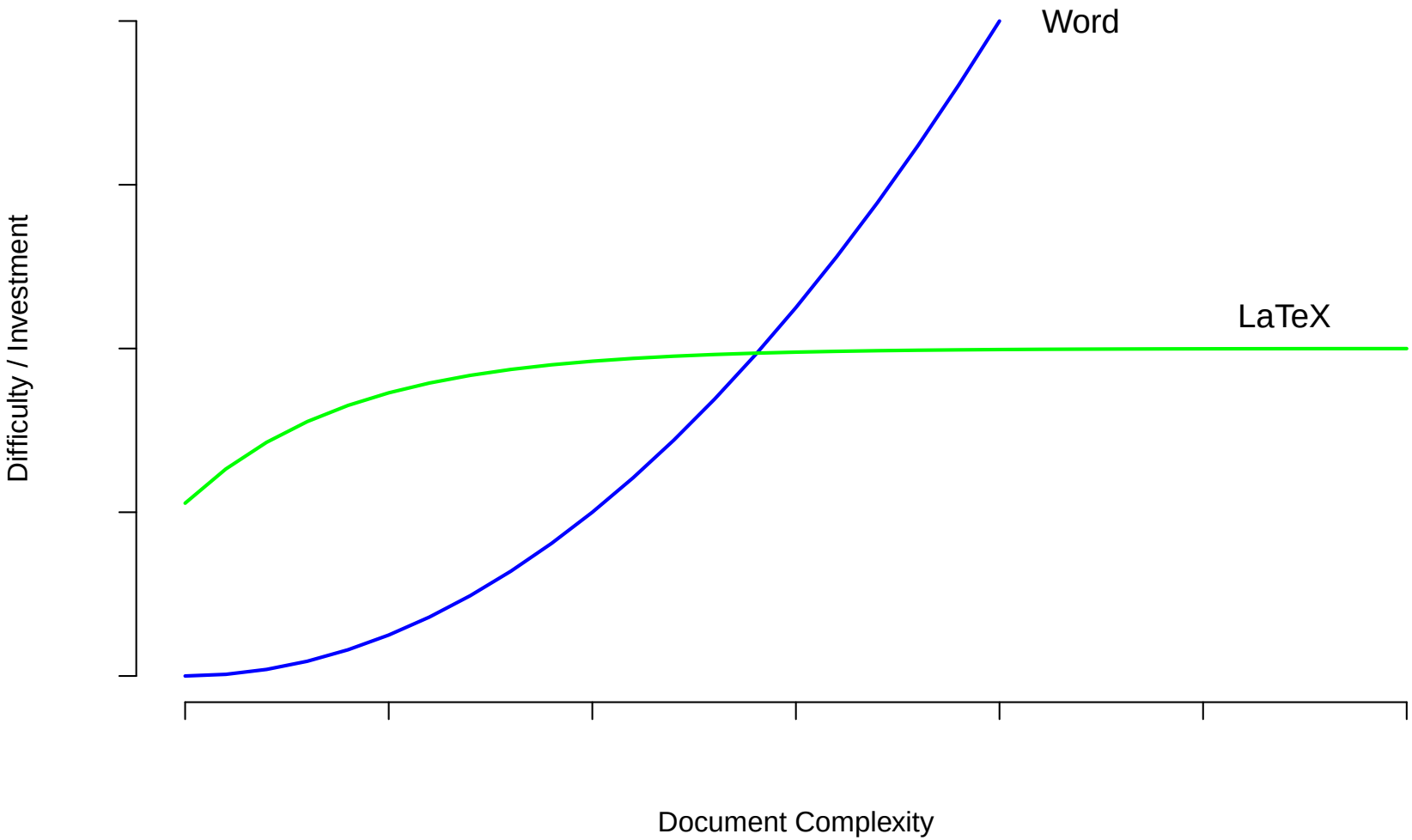
A very brief introduction to LaTeX

December 11-12, 2013.

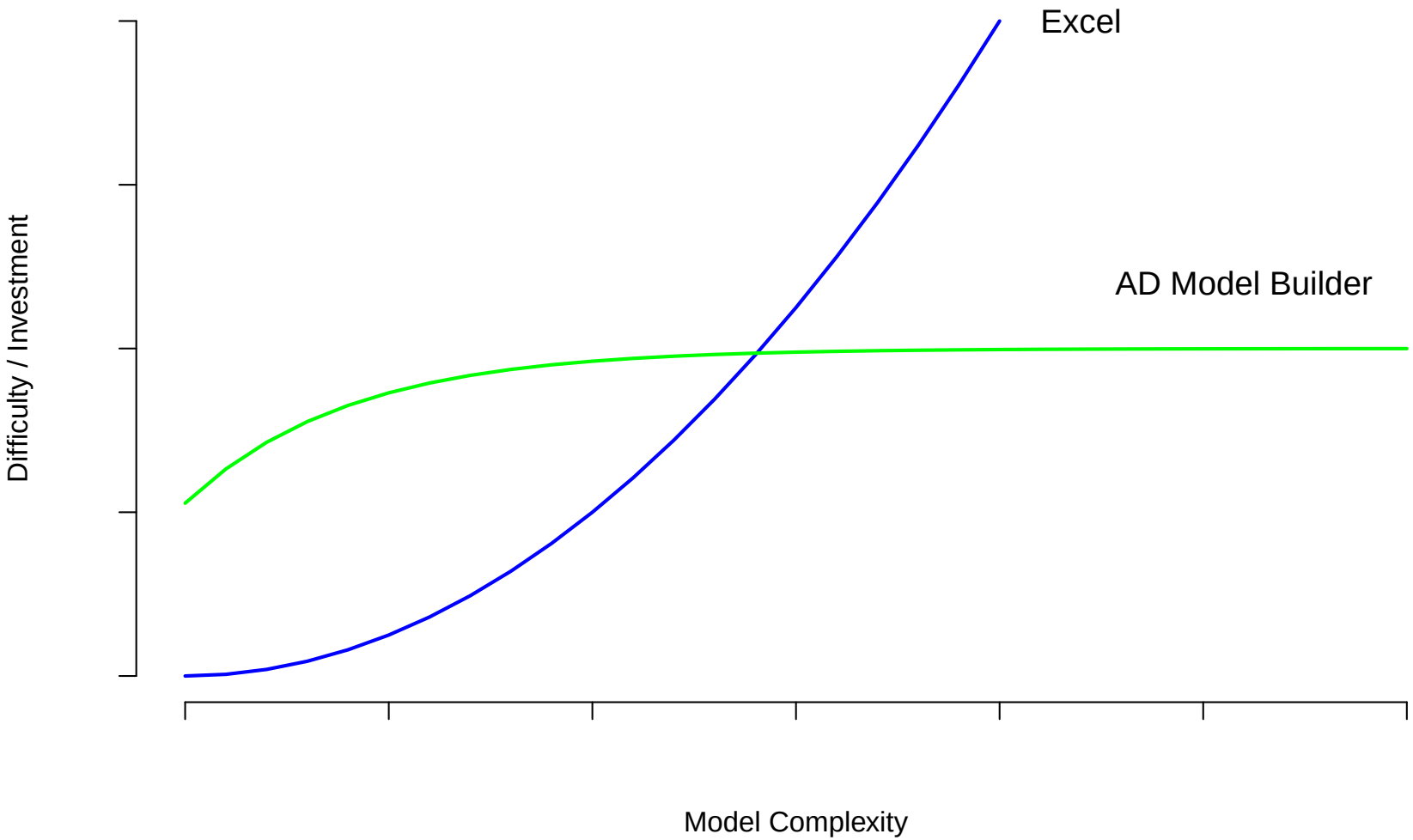
What is LaTeX?

- mark-up language and document preparation system
- originally invented in 1980s by Leslie Lamport
  - mature, powerful
- provides high level language on top of TeX (Donald Knuth)
- continues to be widely used in academia, publishing and industry
- particularly well suited for developing complex documents and books
- excellent support for type-setting formulas and equations
  - widely used in mathematics and physics

Latex Learning curve versus Word



A fisheries analogy



Latex Basics

- philosophy remove formatting and presentation concerns from author
- author focuses on basic document structure and content, LaTeX handles typesetting, formatting and cross references
- addon-packages (http://www.ctan.org) provide additional functionality
- different than Word and other "What-You-See-Is-What-You-get" applications
- LaTeX uses plain text files (*.tex)

A Minimal Example

Example (/examples/0_minimal_latex/min.tex)

```
% minimal latex example
\documentclass{article}
\begin{document}
  \LaTeX{} is a document preparation system for the
  \TeX{} typesetting program.
\end{document}
```

Preamble

- precedes the \begin{document} command
- loads required packages
- document specific settings
- possible to define macros

Example

```
\documentclass[12pt,letterpaper]{article}
\usepackage{longtable}
\usepackage{ctable}
\graphicspath{{figures/}}
\title{Fill in title here}
\author{Your Name}
```

Top Matter

Example

```
\title{Basic \LaTeX{} Document Structure}
\author{Homer Simpson\\
  742 Evergreen Terrace,\\
  Springfield,\\
  United States,\\
  123456\\
  \texttt{hsimpson@simpsons.com}}
\date{\today}
\maketitle
```

Sections

- define document structure with sections

Examples

```
\section{Introduction}
\subsection{A Subsection Under Introduction}
\subsubsection{A Subsubsection}
\paragraph{paragraph}
\subparagraph{subparagraph}

% suppress numbers with asterisk
\section*{Introduction}
```

Environments

- provide specific functionality associated with type setting various document components
- environments can be nested within one another
- examples include:
  - center
  - table
  - figure
  - equation

Figures

Example

```
\begin{figure}
  \begin{center}
    \includegraphics[width=\textwidth]{figurename}
  \end{center}
  \caption[short caption]{full caption}
  \label{fig:figurename}
\end{figure}
```

Tables

LaTeX:

```
\begin{table}
  \begin{center}
    \begin{tabular}{ l l }
      Name & Value \\
      \hline
      A1 & B1 \\
      A2 & B2 \\
    \end{tabular}
  \end{center}
  \caption[shortcaption]{longcaption}
  \label{tbl:simpletable}
\end{table}
```

Produces:

Table : longcaption

Name	Value
A1	B1
A2	B2

Equations

- LaTeX excellent support for mathematical type setting
- simple in-line formula can be included by wrapping statement in $
  - `$\alpha + \beta = \delta$` will render as $\alpha + \beta = \delta$
- more complicated equations require either `displaymath` or `equation` environment

Equations (cont'd)

LaTeX

```
\begin{equation}
L_i = L_{\infty} (1 - e^{-k(t_i-t_0)}) + e_i
\end{equation}
```

will appear as:

$$L_i = L_\infty(1 - e^{-k(t_i-t_0)}) + e_i \tag{1}$$

References

- LaTeXcomes with build in support for references
- add-ons make using references much easier
  - `BibTex` - an application comes with LaTeXto compile bibliography
  - `natbib` - a latex package that provides additional commands and flexible formatting of references
  - `RefTex` - built-in emacs mode for handling cross reference in (LaTeX) documents

BibTex

- stand alone application that is bundled with LaTeX
- references are maintained in '*.bib' file
  - plane text format widely available and easily generated by most reference management software
- `bibtex` must be called independently on `*.tex` file
- what `bibtex` does:
  - `bibtex` parses `*.tex` document
  - compiles references (`\cite{<key>}`)
  - replaces `\cite{<key>}`) with "Quinn and Deriso (1999)"
  - formats and builds References section of report

BibTex (cont'd)

- requires additional processing to get references and labels correct
  - instead of a single call to `pdflatex`
  - requires multiple calls:
    - `pdflatex - bibtex - pdflatex - pdflatex`
  - a custom emacs function has been provided in the workshop configuration file to automate this. (`M-x ac-run-lbll`).

natbib package

- provides additional commands and more flexible formatting options

usage

```
\usepackage[numbers]{natbib}
\bibpunct{(}{)}{;}{a}{,}{,}
\begin{document}
....
\bibliographystyle{<bst_filename>}     % without .bst
\bibliography{<bib_filename>}          % without .bib
\end{document}
```

natbib package (cont'd)

helpful commands

```
\citet{QuinnDeriso1999}  ->  Quinn and Deriso (1999)
\citep{QuinnDeriso1999}  ->  (Quinn and Deriso, 1999)
```

- bibliographic styles
  - contained in '*.bst' file
  - several included with natbib (e.g. plainnat)
  - dozens of journal specific formats available on web
  - cjfas.bst included in `~/workshop/utils`

RefTex

- emacs minor mode to facilitate working with cross referenced objects
  - references, tables, figures, index, glossary, table of contents, etc.
- configured to start automatically in latex mode in workshop configuration

Some useful RefTex key bindings

`C-c [`	reftex-citation
`C-c (`	reftex-label
`C-c )`	reftex-reference

Abstracts

- so common have designated environment

Example

```
\begin{abstract}
Your abstract goes here...
...
\end{abstract}
```

Multi-part Documents

- for multi-parts documents use `\input{}` or `\include{}`
- main.tex contains preamble and document-wide settings (TOC, lists of figure and tables, etc.)

main.tex

```
...   % preamble
\begin{document}
...
\include{first_chapter.tex}
\include{second_chapter.tex}
\include{third_chapter.tex}
...
\end{document}
```

Presentations

- `Beamer` package for producing slides and presentations
- provides a number of specialized functions and commands
- `frame{....}` environment produces a slide
- dozens of pre-built themes available (see: http://www.hartwork.org/beamer-theme-matrix/)
- an example of a dynamic beamer presentation has been provided in `/examples/6_Presentations/sweave_beamer.rnw`
- all of the presentations in this workshop were created using beamer

Debugging

- errors in LaTeX can be difficult to diagnose
  - `! I can't write on file '<YourFile>.pdf' \`
  - `Runaway argument`
- defensive coding
  - compile early and often
  - use tools that insert closing delimiters (e.g. - yasnippets)
- debugging strategies
  - `M-x check-parens`
  - `M-x how-many`
  - isolate errors by:
    - ★ commenting out blocks
    - ★ moving `\end{document}`

Resources

- Official Repository of packages:
  - http://www.ctan.org/
- A useful tutorial:
  - http://www.andy-roberts.net/writing/latex
- symbols
  - http://www.artofproblemsolving.com/Wiki/index.php/LaTeX:Sy
- TexStackExchange (similar to stackoverflow.com)
  - http://tex.stackexchange.com/

Recap