TEX, \LaTeX, and Farsi\TeX

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“Things have changed in the past decades.”, quotes Professor Donald Knuth from Bill Gates. The \TeX{} system is known to have revolutionized the art of computer typesetting in the past three decades. After talking about the history of \TeX{}, we will turn to \LaTeX{} and focus on what it offers an author, to reduce the time spent on style and work on the content.
What is \TeX

- A computer language designed for use in typesetting; particularly, for typesetting math and other \TeXnical (from Greek \textit{techne}, i.e. art/craft, the stem of \textit{technology}) material.

- \textit{\TeX}, pronounced similar to “blecch”, not to the state known for “Tex-Mex” chili.
History of \TeX

• In the late 1970s, Donald Knuth of Stanford University, was not satisfied when he saw first samples of the new computer typesetting for the second volume of his multivolume opus *The Art of Computer Programming*.

• He set out to learn what were the traditional rules for typesetting math.

• A year after Knuth was invited by the American Math Society (AMS). The topic he presented was his new work on \TeX.
History of \TeX{} (continued)

- \TeX{} came along just before the beginnings of the personal computer. It was developed on one of the last of the academic mainframes.

- It was very quickly ported to some early HP workstations and, as they emerged, the new personal systems.

- After some highly useful enhancements in about 1990, \TeX{} handles the composition of many different languages according to their own traditional rules, and is for this reason quite widely used in eastern Europe.
Why did \TeX\ Attract Scientists

- It was intended to be used directly by authors (and their secretaries) who are the ones who really know what they are writing about.

- It came from an academic source, and was intended to be available for no monetary fee.

- It was available on just about any computer and operating system.
Why did \TeX \ Attract Scientists (continued)

- Other systems available at the time for mathematical composition were:
  - proprietary,
  - very expensive,
  - often limited to specific hardware,
  - if WYSIWYG*, the same expression in two places in the same document might very well not look the same, never mind look the same if processed on two different systems.

*What You See Is What You Get
Main Features of $\TeX$

- A $\TeX$ system can stand on its own, provided all the fonts one needs are available. It does not require any other application.

- The $\TeX$ macro language is an interpreted one:
  - It produces a *device independent* output file in `.dvi` format.
  - It can be run on any operating system.
  - Running $\TeX$ on different platforms result in exactly identical outputs.

- $\TeX$ and its friends are available freely with source code. Moreover, the $\TeX$ itself is not even copyrighted.
Main Features of \TeX \ (continued)

- Instead of the user, \TeX\ automatically tries thousands of combinations of line breaks and page breaks on every job, picking the most charming one.

- You do not need to specify the exact appearance of everything. Whenever you leave something unspecified, it knows how to conform to standard practice of the used stylesheet.

- There are many tools, fonts, and macros developed for \TeX. Moreover, there is a \TeX\ engine named pdf\TeX, which produces pdf files directly.
Main Features of \TeX{} (continued)

- The command language is very low level (skip so much space, change to font $X$, set this string of words in paragraph form, ...), but is amenable to being enhanced by defining macro commands to build a very high level user interface.

- \TeX{} has a very powerful algorithmical base. Some of the algorithms in \TeX{}, for example the paragraph breaking algorithm, have not been bettered in any of the composition tools devised in the years since \TeX{} appeared.

- \TeX{} has all the paraphernalia of academic publishing, e.g. footnotes, floating insertions (figures and tables), etc.
Main Features of \TeX\ (continued)

- A text written in \TeX\ is a plain ASCII file with markup codes inserted, for example

\[
\begin{align*}
\prod_{i=1}^{n} \prod_{j=0}^{c_{i}-1} (n-j)! & \frac{1}{n-j} \\
\leq & \frac{n! n e^{n(3+\frac{\ln(2 \pi n)^2}{4})}}{(n-k)! n e^k}
\end{align*}
\]

will produce:
Main Features of \TeX{} (continued)

- \TeX{} files can be typed, viewed, and edited with any file editor or word processor.

- \TeX{} You do not have to worry about whether subtle details of typography are visible on the screen. Instead, you type \TeX{} commands and \TeX{} will set exactly what you tell it to.

- A completely separate file called a style sheet (actually a set of \TeX{} macros) defines what the commands like `\chapter` and `\section` and their kin, actually should do. The typist does not have to worry about the physical layout or consistency of chapter or section headings on the screen.
Main Features of $\TeX$ (continued)

- It is designed for archival purposes. The same document will produce exactly the same output ten years later, with the $\TeX$ of that era.

- It is designed for batch processing. The input file to $\TeX$ is in a text file, so you can easily create your project result tables automatically as a $\TeX$ input file, process it, and get a nice PDF.

- ...
\TeX and Other Systems

- Alternatives to \TeX are FrameMaker and Adobe InDesign, which both are professional typesetting systems.
- Microsoft Word is not counted as a professional typesetting system, but a word processor.
- \TeX both produces the high quality of a typesetting system, and holds the ease of use of a word processor.
\textTeX{} versus Microsoft Word

- \textTeX{}’s math mode is a thing of beauty. Equations come out looking perfect.

- Unlike Word files, \textTeX{} documents are small and clean.

- In \textit{What You See Is What You Get} word processors, it is very hard to write a large consistent text.

- \textTeX{} versions are compatible. A given Word file produces different results on different versions of Word, so all the painstaking effort you put in getting a perfect document in version 7 is broken in version 8.
TEX versus Microsoft Word (continued)

- Unlike \TeX, Microsoft Word is not available for all operating systems.

- There are no \TeX macro viruses. You can safely receive TeX documents by email and not worry about it reading your address book and mailing copies of itself to all your friends.

- The typesetting algorithm employed by Microsoft Word sacrifices quality to the speed required for setting and resetting type of the user’s input in real time. The final product is greatly inferior to that of a real typesetting system.
When Should We Use It

- TeX is the best tool for writing a scientific text, but

- If you want a tool for producing a newspaper or a novel or a slick advertisement or a letter to Aunt Henrietta, TeX is not the tool for you.*

- Professor Knuth in an interview has said that:

  I never expected TeX to be the universal thing that people would turn to for the quick-and-dirty stuff. I always thought of it as something that you turned to if you cared enough to send the very best.

*TeX is actually in use for producing many scientific and TeXnical magazines and journals.
Bugs of \TeX

- Donald Knuth, a professor of computer science at Stanford University and the author of numerous books on computer science and the TeX composition system, rewards the first finder of each typo or computer program bug with a check based on the source and the age of the bug.

- Typos and other errors in books typically yield $2.56 each once a book is in print (pre-publication \textit{bounty-hunter} photocopy editions are priced at $.25 per).

- Program bugs’ cost rise by powers of 2 each year from $2.56 to a maximum of $327.68.

- So you can imagine how bug-free is \TeX!
Donald Ervin Knuth
What is \LaTeX

- The \TeX{} language is very low level.

- Originally \TeX{} comes with a package called plain.

- There are many high level macro packages available.

- The most popular is \LaTeX{}, another one is \ConTeX{}t.

- \LaTeX{} knows how to format each logical part of the document.

- \LaTeX{} is Leslie Lamport’s high level definition of a document, later developed by the \LaTeX{} Project Team.
Structure of a \LaTeX Document

- Starts with a preamble. The preamble is logically structured as below:
  - The document class definition (e.g. `\documentclass{article}).
  - Include packages used (e.g. `\usepackage{color}).
  - Configuration (e.g. `\textwidth=10in).
  - User macro definitions (e.g. `\definecolor{backgroundcolor}{rgb}{.5,0,0}).

- The document body. Starts with `\begin{document} and ends with `\end{document}.

- Everything after the body is ignored.
\LaTeX Document Classes

• There are some predefined classes:
  
  – article
  
  – report
  
  – book
  
  – letter
  
  – slides

• It is always possible to define new classes based on available ones, or from scratch.
Structure of the Document Body

Structure of the document body depends on the document class used, but for articles, reports, and books it is something like this:

- Title, Author, and Date definitions
- The title of the document
- The table of contents
- The abstract
- Parts, Chapters, Sections, Subsections, etc, in a nested manner
- Appendices
- The Bibliography
- The Index
\documentclass{article} % the standard class `article'
\begin{document}
\maketitle
\begin{abstract} ... \end{abstract}
\section{...}
\section{...}
\subsection{...}
\subsubsection{...}
\section{...}
\begin{thebibliography} ... \end{thebibliography}
\end{document}
Structure of a Simple Book

\documentclass{book} % the standard class ‘book’
\begin{document}
\maketitle
\section*{...} % e.g. section named like ‘Preface’
\tableofcontents % chapter with the table of contents
\listoffigures % chapter with the list of figures
\listoftables % chapter with the list of tables
\part{...}
\chapter{...}
\section{...}
\chapter{...}
\part{...}
\appendix % following chapters are appendices
\chapter{...}
\chapter{...}
\begin{thebibliography}{...} \end{thebibliography}
\begin{theindex} ... \end{theindex}
\end{document}
Other Things \TeX and \LaTeX Take Care of

- Footnotes* (e.g. Footnotes\footnote{This is a footnote})
- Floats (Tables and Figures)
- Equations
- Theorems and friends
- References
- Index terms
- Citations

*This is a footnote
Properties Shared by All Objects

- New objects of all kinds can be defined.

- All objects are automatically numbered in its own way.

- Numbering of different objects can be defined to follow your own style.

- Objects without number or caption can be declared.
Float Objects

- A float object is a box with a type and caption.

- Table and Figure are already defined as floats.

- New floats can be defined. For example, there is a package to define an Algorithm float object.

- List of floats of a type can be placed anywhere in the document.

- Floats are automatically placed in top of a page, or at the end of the chapter or document.

- A float can be forced to be placed where it is defined.
A Simple Float

\begin{algorithm}
\caption{No comments}
\label{errless}
\begin{center}
\begin{enumerate}
\item Err and err and err again
\item but less and less and less
\end{enumerate}
\end{center}
\end{algorithm}

1. Err and err and err again

2. but less and less and less

Algorithm 1: No comments
Theorem-like Objects

- These are objects like Theorem, Lemma, Corollary, Congecture, etc.

- New theorem-like objects can be defined.

- Like all other objects, they can be numbered globally, or inside a part, chapter, section, etc.

- They are defined simply by `\newtheorem{lemma}{Lemma}`

- They can be used by
  \begin{lemma}\label{texlovers}Anyone \ldots \end{lemma}:

  **Lemma 1** Anyone heard of \( \TeX \) would use it to typeset her thesis.
References

- A point to be referenced is defined by \texttt{\label{labelname}}.

- To refer to a defined label, you use \texttt{\ref{labelname}}.

- \LaTeX\ knows what kind of object the label is referring to and puts the object’s number.

- References to page numbers of objects is also supported. Moreover, \LaTeX\ can also handle references to objects in the same page, facing page, next or previous page.

- For example Lemma \texttt{\ref{texlovers}} and Algorithm \texttt{\ref{errless}} will produce: Lemma 1 and Algorithm 1.
Indexes

- An occurrence of an index term in the document is identified by `\index{term}`.

- A program called `makeindex` takes care of merging, sorting, and preparing the index.

- The `\begin{theindex} ... \end{theindex}` puts the index in the document.
Citations

- Citations in the text are made by `\cite{refname}`.

- References are then defined in the `\begin{thebibliography} ... \end{thebibliography}`.

- There is a program named BibTeX, which can extract used references from a big set of reference definition file.
The Slides Class

• Each slide is placed between \begin{slide} ... \end{slide}.

• The slides come out highly readable, and well spaced.

• As there is almost no fancy feature, the audience’s focus will be on the content.

• There is a package* which enables parts of an slide to become visible in the next step.

*stepslide, by Behdad Esfahbod
What is Farsi\TeX

- Farsi\TeX is a Persian enabled version of \LaTeX.

- The current release of Farsi\TeX is based on the old \LaTeX2.09. The current version of \LaTeX is \LaTeX2\epsilon.

- Farsi\TeX supports almost all features of article, book, report, and letter classes, but not slides.

- All you need to use Farsi\TeX is the editor and macros. The rest is simply \LaTeX.
Where to Find Them

- **\TeX** Users Group’s (TUG) Home Page at [http://www.tug.org/](http://www.tug.org/) is the best place to look for \TeX\ related tools and articles.

- **\TeX**, \LaTeX, and all of their tools, fonts, etc can be found on Comprehensive \TeX\ Archive Network (CTAN) set of CDs, downloadable from [http://dante.de/](http://dante.de/).

- Farsi\TeX, is available from [http://www.farsitex.org/](http://www.farsitex.org/).
Where to Find Them (continued)

- There are many distributions:
  - \TeX\live, by Sebastian Rahtz, is a set of CDs, ready to run under Windows, Linux, MacOS, etc. It can be downloaded from http://dante.de/ too.
  - \MiKTeX{} by Christian Schenk, is a distribution for Microsoft Windows. It is available from http://www.miktex.org/.
  - \TeX\live{} by Thomas Esser, is a distribution for Unices (based on Karl Berry’s kpathsea, and web2c), but ported to Windows under Cygwin, and also as another distribution named \fpTeX{}, by Fabrice Popineau. It is distributed by almost all Linux distributions, as well as Cygwin.
Conclusions

The \LaTeX \ system has become the \textit{de-facto} standard for typesetting mathematical and technical papers, reports, and books. We have shown some of the aspects of \TeX, and \LaTeX \ and mostly attracts authors all around the world to set type of their work themselves with \LaTeX. Interested audience are encouraged to read \LaTeX, \textit{A Document Preparation System}, and then get their hands on \LaTeX, to feel what is known as the spirit of \TeX.

\Farsi\TeX, as a Persian enabled \LaTeX \ system, is widely used in Iranian academic centers, but as we mentioned, it is far from a modern Persian \LaTeX \ system. Work is getting done to port \Farsi\TeX \ to the latest standards of \LaTeX \ system.
References


\TeX Users Group Home Page. Available at http://www.tug.org/.