CSCE 222

Discrete Structures for Computing

LaTeX

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Based on slides by Andreas Klappenecker

Tripitaka Koreana

- Palman Daejanggyeong ("Eighty-Thousand Tripitaka")
- South Korean collection of Buddhist scriptures
- Carved onto 81,258 wooden printing blocks in the 13th century
- The world's most comprehensive and oldest intact version of Buddhist canon in Hanja script, with no known errors or errata in the 52,382,960 characters

Haeinsa - UNESCO World Heritage Site

般若波羅蜜多心經

唐三藏法師玄奘譯

觀自在菩薩行深般若波羅蜜多時照見五蘊皆空度一切苦厄舍利子色不異空空不異色色即是空空即是色受想行識亦復如是舍利子是諸法空相不生不滅不垢不淨不增不減是故空中無色無受想行識無眼耳鼻舌身意無色聲香味觸法無眼界乃至無意識界無無明亦無無明盡乃至無老死亦無老死盡無苦集滅道無智亦無得以無所得故菩提薩埵依般若波羅蜜多故心無罣礙無罣礙故無有恐怖遠離顛倒夢想究竟涅槃三世諸佛依般若波羅蜜多故得阿耨多羅三藐三菩提故知般若波羅蜜多是大神呪是大明呪是無上呪是無等等呪能除一切苦真實不虛故說般若波羅蜜多呪即說呪曰

揭帝揭帝 般羅揭帝 般羅僧揭帝 菩提僧莎訶

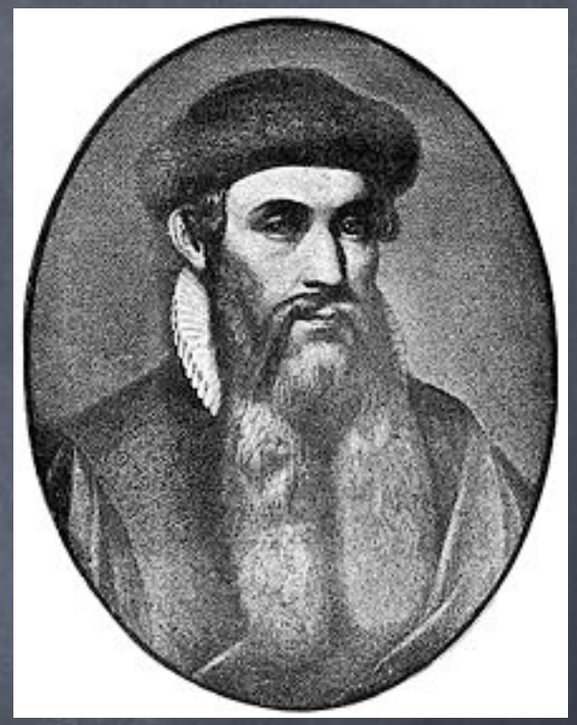
般若波羅蜜多心經

戊戌歲高麗國大藏都監奉

勅彫造

Gutenberg

- Johannes Gutenberg
- Introduced movable metal type to Europe (in around 1439)
- Invented the printing press
- Started a revolution in printing in Europe



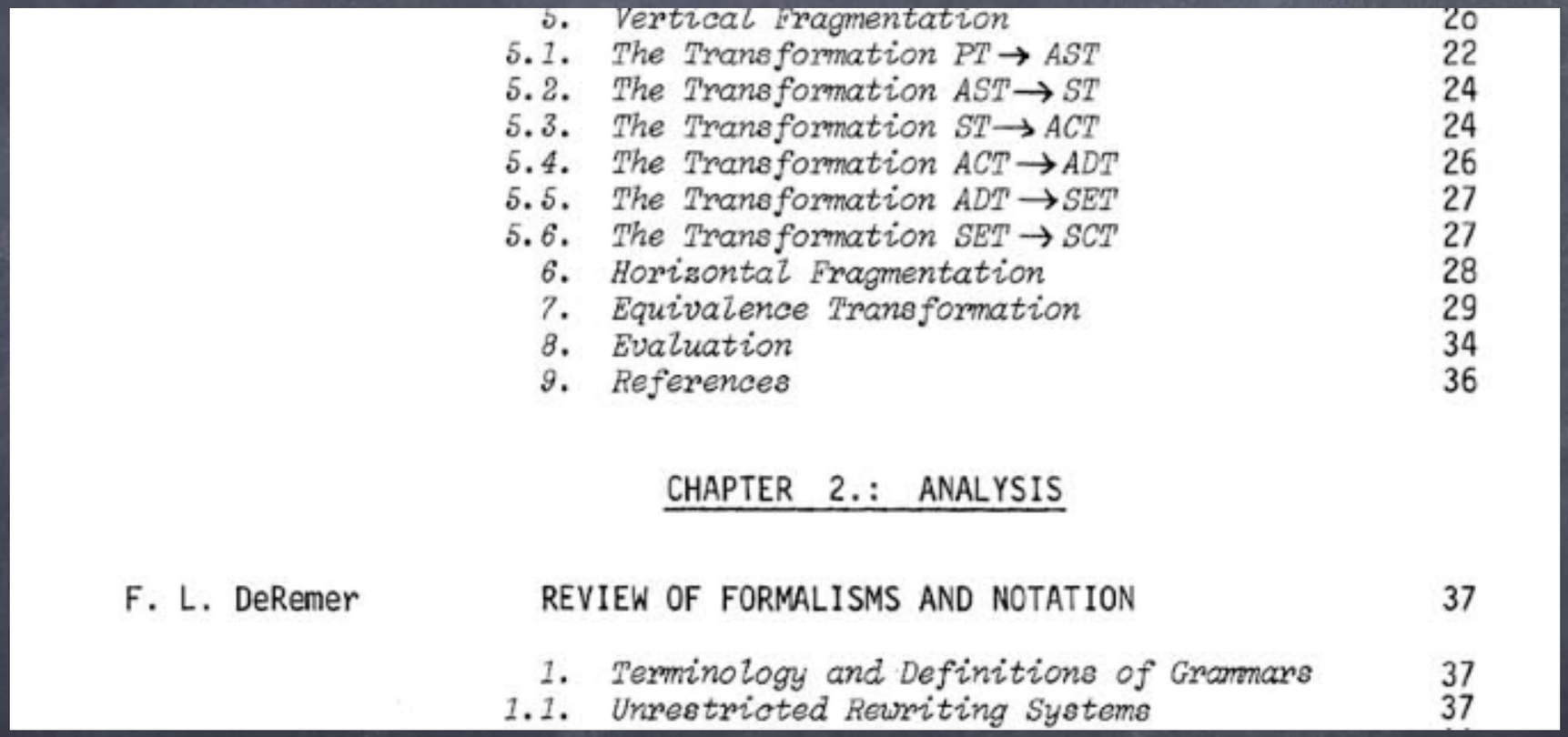
Gutenberg Bible

- Gutenberg demonstrated his printing technology by printing a complete bible.
- The Gutenberg bible was produced at a significantly lower cost than hand copying.
- Still, cost: about 3 years salary of a clerk per bible.
- 1978: Copy sold for $2.2million

Incipit liber genesis quē nos geneſi dicimus

IN principio creauit deus celū. cap primū
et terram. Terra autem erat inanis et
uacua: et tenebre erant sup faciē abyssi:
et spiritus dei ferebatur super aquas.
Dixitq; deus. Fiat lux. Et facta ē lux.
Et vidit deus lucem q̄ esset bona: et
diuisit lucem a tenebris. appellauitq;
lucem diem et tenebras noctem. Factū
q; est vespere et mane dies unus. Dixit
quoq; deus. Fiat firmamentū in me-
dio aquarū: et diuidat aquas ab a-
quis. Et fecit deus firmamentū: diui-
sitq; aquas que erant sub firmamen-
to ab his que erant super firmamen-
tum: et factum est ita. Vocauitq; deus
firmamentū celū: et factum est vespere
et mane dies secundus. Dixit vero de-
us. Congregentur aque que sub celo
sunt in locum unū. et appareat arida.
Et factum est ita. Et vocauit deus ari-
dam terram: cōgregationesq; aquaꝝ
appellauit maria. Et vidit deus q̄ es-
set bonū. et ait. Germinet terra herbā
virentem et facientem semen: et lignū
pomiferū faciens fructum iuxta genus
suū: cuius semen in semetipō sit super
terram. Et factum est ita. Et protulit
terra herbam virentem et facientem
semen iuxta genus suū: lignumq; fa-
ciens fructum et habens unumquodq;
semen secundum speciem suam. Et vi-
dit deus q̄ esset bonum: et factum est
vespere et mane dies tertius. Dixit
quoq; deus. Fiant luminaria in firma-
mento celi: et diuidant diem ac noctē:
et sint in signa et tempora et dies et
annos. Vt luceant in firmamento celi
et illuminent terram. Et factum est
ita. Fecitq; deus duo luminaria magna
luminare maius ut preesset diei: et lu-
minare minus ut preesset nocti: et stel-
las. Et posuit eas deus in firmamento
celi ut lucerent super terram. Et pre-
essent diei ac nocti: et diuiderent lucem
ac tenebras. Et vidit deꝰ q̄ esset bonū:
et factū ē vespere et mane dies quartꝰ.
Dixit etiam deus. Producant aque
reptile anime viuentis et volatile sup
terram: sub firmamēto celi. Creauitq;
deus cete grandia. et omnē animā vi-
ventem atq; motabilem quā produxe-
rant aque in species suas: et omne vo-
latile secundū genus suū. Et vidit de-
us q̄ esset bonū: benedixitq; ei dicens.
Crescite et multiplicamini. et replete a-
quas maris: auesq; multiplicentur
super terram. Et factū ē vespere et mane
dies quintus. Dixit quoq; deus. Pro-
ducat terra animā viuentem in gene-
re suo: iumenta et reptilia. et bestias ter-
re. secundū species suas. Factū ē ita. Et
fecit deus bestias terre iuxta species su-
as: iumenta et omne reptile terre in ge-
nere suo. Et vidit deus q̄ esset bonū:
et ait. Faciamꝰ hominē ad ymaginē et
similitudinē nostrā. et p̄sit piscibꝫ maris
et volatilibꝫ celi. et bestijs. uniuerseq; terre:
omnīq; reptili q̄ mouet̄ in terra. Et crea-
uit deus hominē ad ymaginē et simi-
litudinē suam: ad ymaginem dei creā-
uit illū: masculū et femināā creauit eos.

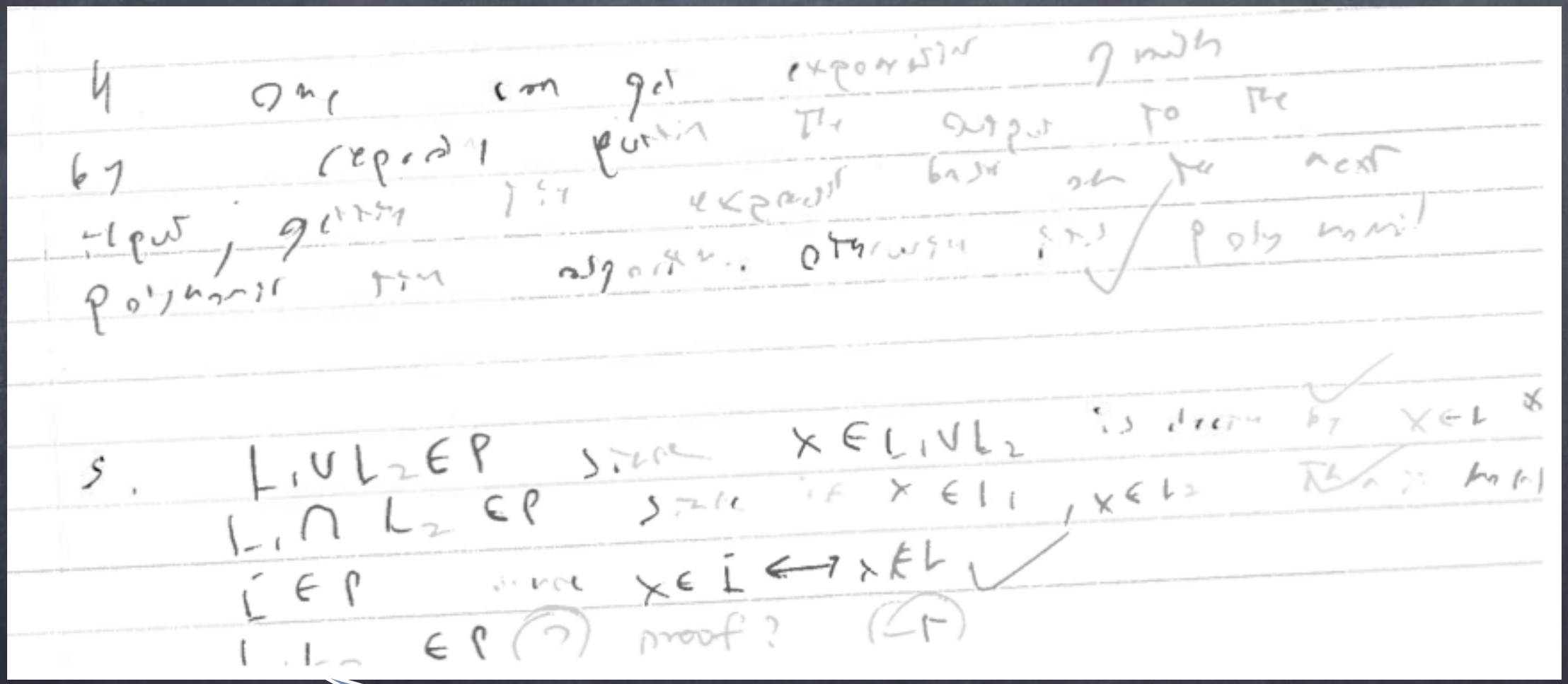
Fast Forward to 1974



- Academic books often a mix of handwritten symbols (e.g. formulas) and typeset symbols.
- Note the arrows...

Fast Forward to 2011

(Homework Submission)



The scan is a faithful reproduction of the submission! It remains a mystery how the TA was able to read it.

Late 70's: Don Knuth invents TeX

2 Features

Both TEX and LATEX allow for àçčéñts, and excel at typesetting mathematical equations, in-line or displayed on a line by itself. For instance, an article on quadratics may need

$$ax^2 + bx + c = 0 \implies x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} ,$$

or an article on complex analysis may include $e^{i\theta} = \cos\theta + i\sin\theta$.

Knuth

- Don Knuth illustrates the mathematical typesetting with TeX by writing the bible of computer programming:
- Four volumes published so far:

1984: LaTeX

- In 1984, Leslie Lamport writes the markup language LaTeX that makes TeX particularly easy to use.
- Key feature: The document is organized according to its structure
  (e.g. Title, Chapter, Sections, etc.)
- The language is easy to learn
- Available on virtually all computing platforms

LaTeX

- Computer programmers will feel right at home: The document is produced by a program.
- The language can be customized with macros
- Typesetting of formulas is easy: Once you understand the main features, most formulas are quickly written in LaTeX
- Much faster than any formula editor

Structure of a LaTeX Document

```
\documentclass{article}
% macro definitions
\begin{document}
% text comes here
\end{document}
```

Comments begin with %

Commands start with \

LaTeX Example

```
\documentclass[12pt]{article}
\usepackage{amsmath}
\title{\LaTeX}
\date{}
\begin{document}
  \maketitle
  \LaTeX{} is a document preparation system for the \TeX{}
  typesetting program. It offers programmable desktop publishing
  features and extensive facilities for automating most aspects of
  typesetting and desktop publishing, including numbering and
  cross-referencing, tables and figures, page layout, bibliographies,
  and much more. \LaTeX{} was originally written in 1984 by Leslie
  Lamport and has become the dominant method for using \TeX; few
  people write in plain \TeX{} anymore. The current version  is
  \LaTeXe.

  % This is a comment; it will not be shown in the final output.
  % The following shows a little of the typesetting power of LaTeX:
  \begin{align}
    E &= mc^2                                    \\
    m &= \frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}}
  \end{align}
\end{document}
```

LaTeX

LaTeX is a document preparation system for the TeX typesetting program. It offers programmable desktop publishing features and extensive facilities for automating most aspects of typesetting and desktop publishing, including numbering and cross-referencing, tables and figures, page layout, bibliographies, and much more. LaTeX was originally written in 1984 by Leslie Lamport and has become the dominant method for using TeX; few people write in plain TeX anymore. The current version is LaTeX 2_ε.

$$E = mc^2 \tag{1}$$

$$m = \frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}} \tag{2}$$

Emphasizing Text

```
This is a \textbf{bold} text \\
This is a \textit{text} in italics \\
This is a \textsl{slanted} text
```

This is a **bold** text
This is a *text* in italics
This is a *slanted* text

Inline Mathematics

```
You can write a text and within the
text you can have inline mathematical
formulas, such as $\sqrt{x^2+1}$, that
are simply enclosed in single dollar
signs.
```

You can write a text and within the text you can have inline mathematical formulas, such as $\sqrt{x^2+1}$, that are simply enclosed in single dollar signs.

Displayed Mathematics

```
Important equations can be set in double
dollar signs, for example
$$ y = \sqrt{x^2+1}, $$
and will be displayed as a centered equation.
```

Important equations can be set in double dollar signs, for example

$$y = \sqrt{x^2 + 1},$$

and will be displayed as a centered equation.

Numbering Equations

```
A numbered equation
\begin{equation}\label{eqn}
z^2 = x^2 + y^2.
\end{equation}
It follows from equation (\ref{eqn})
that ...
```

A numbered equation

$$z^2 = x^2 + y^2. \tag{1}$$

It follows from equation (??) that ...

Run LaTeX twice to resolve references

Compiling LaTeX Documents

- Suppose you have written a LaTeX document, say homework.tex
- Compiling the document, typesetting, and creating a pdf file:
  pdflatex homework.tex
- View your document homework.pdf with some pdf viewer (e.g., ghostview homework.pdf, preview homework.pdf, ...)

LaTeX Distributions

- Windows: MikTeX
- Mac: MacTeX
- Unix: Tex Live
- Further information: http://www.ctan.org/
- Already installed on linux.cse.tamu.edu

Homework

- Our problem sets will be assigned using a LaTeX file, say hw1.tex
- The file will typically contain 10 problems
- You add the solutions, your name, and all the resources that you have used
- Submit your homework solution to ecampus: hw1.tex and hw1.pdf (BOTH!!!)