

# **Software Systems Lab: OutLab**

## **Advanced L<sup>A</sup>T<sub>E</sub>X**

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## 1 Do this

- L<sup>A</sup>T<sub>E</sub>X typesets a file of text using the TEX program.
- L<sup>A</sup>T<sub>E</sub>X is widely used in academia for the communication and publication of scientific documents in many fields, including mathematics, physics, computer science, statistics, economics and political science.
- L<sup>A</sup>T<sub>E</sub>X can be used as a standalone document preparation system or as an intermediate format.
- **Have used renewcommand for the bullets to be bigger.**
- look at the item separation space, and change it accordingly

I L<sup>A</sup>T<sub>E</sub>X typesets a file of text using the TEX program.

II L<sup>A</sup>T<sub>E</sub>X is widely used in academia for the communication and publication of scientific documents in many fields, including mathematics, physics, computer science, statistics, economics and political science.

III L<sup>A</sup>T<sub>E</sub>X can be used as a standalone document preparation system or as an intermediate format.

IV L<sup>A</sup>T<sub>E</sub>X is intended to provide a high-level language that accesses the power of TeX in an easier way for writers.

- (a) L<sup>A</sup>T<sub>E</sub>X typesets a file of text using the TEX program.
- (b) L<sup>A</sup>T<sub>E</sub>X is widely used in academia for the communication and publication of scientific documents in many fields, including mathematics, physics, computer science, statistics, economics and political science.

## 2 Mathematical Formulas and notations

### 2.1 Equation Array

$$\cos^3\theta + \sin^3\theta = (\cos\theta + \sin\theta)(\cos^2\theta - \cos\theta\sin\theta + \sin^2\theta) \quad (1)$$

$$= (\cos\theta + \sin\theta)(1 - \cos\theta\sin\theta) \quad (2)$$

$$= (\cos\theta + \sin\theta)(1/2)(2 - 2\cos\theta\sin\theta) \quad (3)$$

$$= (1/2)(\cos\theta + \sin\theta)(2 - \sin(2\theta)) \quad (4)$$

### 2.2 Propositional Formulae using Various Operators

$$(\exists x)(\varphi(x) \wedge \psi(x)) \longleftrightarrow ((\exists x)\varphi(x) \wedge (\exists x)\psi(x))$$

$$((\forall x)\varphi(x) \wedge (\forall x)\psi(x)) \longrightarrow (\forall x)(\varphi(x) \wedge \psi(x))$$

$$(\exists x)(\varphi(x) \wedge \psi(x)) \longrightarrow ((\exists x)\varphi(x) \wedge (\exists x)\psi(x))$$

### 2.3 Alphabets

Binary Operators:	$\times \otimes \oplus \cup \cap$
Relation Operators:	$\subset \supset \subseteq \supseteq < >$
Others:	$\int \oint \Sigma \Pi$

### 2.4 Mathematical Formulas

$$1. \int_a^b x^3 dx = \frac{1}{4}x^4 \Big|_a^b$$

$$2. \frac{\pi}{4} = 4 \sum_{n=0}^{\infty} \frac{(-1)^n}{(2n+1)5^{2n+1}} - \sum_{n=0}^{\infty} \frac{(-1)^n}{(2n+1)239^{2n+1}}$$

$$3. \pi = \frac{3\sqrt{3}}{4} - 24 \sum_{n=0}^{\infty} \frac{\frac{(2n)!}{(n)!}}{2n+1(2n+1)4^{2n+1}}$$

$$4. \frac{1}{\pi} = \frac{2\sqrt{2}}{9801} \sum_{n=0}^{\infty} \frac{(4n)!(1103 + 26390n)}{(n)!^4 396^{4n}}$$

$$5. \sum_{i=1}^{\lfloor \frac{n}{2} \rfloor} \binom{x_{i,i+1}^{i^2}}{\lfloor \frac{i+3}{3} \rfloor} \frac{\sqrt{\mu(i)^{\frac{3}{2}}(i^2-1)}}{\sqrt[3]{\rho(i)-2} + \sqrt[3]{\rho(i)-1}}$$

6. 
$$\lim_{(\nu, \nu') \rightarrow (0, 0)} \frac{H(z + \nu) - H(z + \nu') - BH(z)(\nu - \nu')}{\|\nu - \nu'\|}$$
7. 
$$\det \mathbf{K}(t = 1, t_1, \dots, t_n) = \sum_{I \in n} (-1)^{|I|} \prod_{i \in I} t_i \prod_{j \in I} (D_j + \lambda_j t_j) \det \mathbf{A}^{(\lambda)}(\bar{I} | \bar{I}) =$$
  
0
- $$\frac{4}{\pi^4} = \frac{4\sqrt{2}}{\pi} \sum_{n=0}^{\infty} \frac{(2n)!}{6^{4n}}$$

## 3 Quotation and Citation

### 3.1 Quotation

The margins of the quotation environment are indented on both the left and the right. The text is justified at both margins. Leaving a blank line between text produces a new paragraph. The package **csquotes** offers a multilingual solution to quotations, with integration to citation mechanisms offered by BibTeX. This package allows one for example to switch languages and quotation styles according to babel language selections.

“Unlike the quote environment, each paragraph is indented normally. It’s important to remark that even if you are typing quotes on English there are different quotation marks used in English (UK) and English (US).”

### 3.2 Citation

Latex [1] is a document preparation system for typesetting program. It is used to create different types of document structures. A Latex file (.tex) is created using any text editor (vim, emacs, gedit, etc.). There are also many LaTeX IDEs like Kile, TexStudio, etc.. The Latex code is then compiled which creates a standard (.pdf) file. Thus, the presentation of the document does not change on different machines.

Type style [2] is used to indicate logical structure. Emphasized text appears in italic style type and input in typewriter style. Type style is specified by three components: shape, series, and family

There are two ways of producing a bibliography [3]. You can either produce a bibliography by manually listing the entries of the bibliography or producing it automatically using the BibTeX program of LaTeX. The bibliography style can be declared with bibliographystyle command, which may be issued anywhere after the preamble. The style is a file with .bst extension that determines how bibliography entries will appear at the output, such as if they are sorted or not, or how they are labeled etc. The extension .bib is not written explicitly. There are many standard bibliography style files.

Two of them that are compatible with IIT thesis manual are plain.bst and alpha.bst. They are part of the LaTeX package; a student does not need to download it. The plain.bst and alpha.bst styles are explained below. The symbols in a math formula fall into different classes that correspond more or less to the part of speech each symbol would have if the formula were expressed in words. Certain spacing and positioning cues are traditionally used for the different symbol classes to increase the readability of formulas.

[4]

My citations are in proper order as per references ref1, ref2, ref3, and ref4.

## 4 Algorithm and Pseudo code

### 4.1 Listing

---

```
//Breadth First Search Function
void BFS(list<long long int> queue , long long int length){
    long long int v;
    if(queue.empty())
        return;
    list<long long int>::iterator i;
    list<long long int> queue_temp;
    while(!queue.empty()){
        v=queue.front();
        queue.pop_front();
        for(i=adj[v].begin(); i!=adj[v].end(); i++){
            if(!pro_ver[*i]){
                result[*i]=length;
                queue_temp.push_back(*i);
                pro_ver[*i]=true;
                adj[*i].remove(v);
            }
        }
    }
    BFS(queue_temp , length+1);
}
```

---

## 4.2 Verbatim

```
//Breadth First Search Function
void BFS(list<long long int> queue , long long int length){
    long long int v;
    if(queue.empty())
        return;
    list<long long int>::iterator i;
    list<long long int> queue_temp;
    while(!queue.empty()){
        v=queue.front();
        queue.pop_front();

        for(i=adj[v].begin(); i!=adj[v].end(); i++){
            if(!pro_ver[*i]){
                result[*i]=length;
                queue_temp.push_back(*i);
                pro_ver[*i]=true;
                adj[*i].remove(v);
            }
        }
    }
    BFS(queue_temp , length+1);
}
```



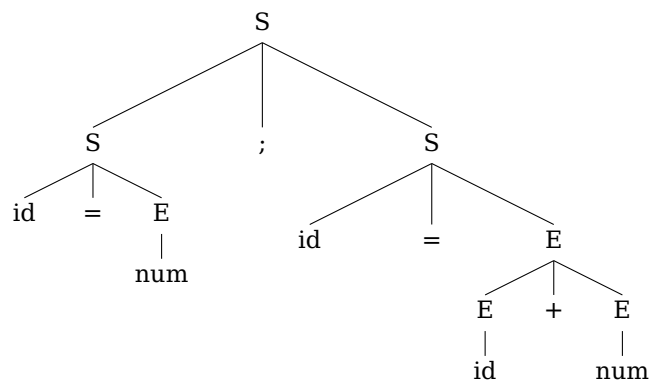
### 4.3 Algorithmic

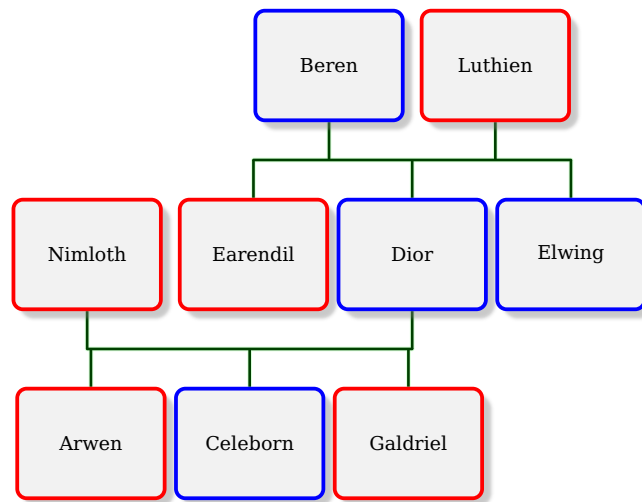
**Input:** A graph *Graph* and a starting vertex *root* of *Graph*  
**Output:** All vertices's reachable from *root* labeled as explored.

```
1 Breadth-First-Search(Graph, root):  
2   for each node n in Graph : do  
3     |   n.distance = INFINITY  
4     |   n.parent = NIL  
5   end  
6   create empty queue Q  
7   root.distance = 0  
8   Q.enqueue(root)  
9   while Q is not empty do  
10    |   current = Q.dequeue()  
11    |   for each node n that is adjacent to current do  
12    |     |   if n.distance == INFINITY then  
13    |     |     |   n.distance = current.distance + 1  
14    |     |     |   n.parent = current  
15    |     |     |   Q.enqueue(n)  
16    |     |   end  
17    |   end  
18 end
```

**Algorithm 1:** Breadth-First-Search

## 5 Tree





## 6 Exotic Features

### 6.1 Epigraph Style

#### Chapter 1: Theory of life

*"Failure will never overtake me if  
my determination to succeed is  
strong enough."*

---

*Og Mandino*

## 6.2 Minipage

*L<sup>A</sup>T<sub>E</sub>X* typesets a file of text using the *TEX* program and the *L<sup>A</sup>T<sub>E</sub>X* "macropackage" for *TEX*. That is, it processes an input file containing the text of a document with interspersed commands that describe how the text should be formatted. *L<sup>A</sup>T<sub>E</sub>X* files are plain text that can be written in any reasonable editor. In the *L<sup>A</sup>T<sub>E</sub>X* input file, a command name starts with a followed by either (a) a string of letters or (b) a single non-letter. Arguments contained in square brackets, *[ ]*, are optional while arguments contained in braces, *{ }*, are required. *L<sup>A</sup>T<sub>E</sub>X* is case sensitive. Enter all commands in lowercase unless explicitly directed to do otherwise.

## 7 Bibliography

### References

- [1] Firuza Aibara. LaTeX - Fundamental Research Group - IIT Bombay.  
<http://www.it.iitb.ac.in/frg/wiki/index.php/LaTeX/>, 2016.
- [2] Leslie Lamport. *Latex*. Addison-Wesley, 1994.
- [3] Helmut Kopka and Patrick W Daly. A guide to latex, 1995.
- [4] Michael Downes. *Short math guide for LATEX*. American Mathematical Society, 2002.