

LaTeXPlained

A headstart to document
preparation system

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What is LaTeX?

LaTeX



- ▶ A text based software system for document preparation [1]
- ▶ Stimulates authors not to focus on the appearance
- ▶ Donald Knuth developed a typesetting system (*TeX*) while publishing second edition of *The Art of Computer Programming*
- ▶ Leslie Lamport created **LATEX** based on Knuth's TeX
- ▶ **LATEX** pronounced as («Lah-tech» or «Lay-tech»)

LaTeX advancements



LA T E X is popular for preparing academic documents [2].

LA T E X provides

- ▶ Better scientific typesetting (formula + algorithm + code)
- ▶ Portability / Machine and OS independent
- ▶ Automatic bibliographies
- ▶ Easy collaboration
- ▶ Version controlling

LaTeX bottlenecks



LA T E X is not a word processor (Microsoft Word, LibreOffice Writer) [3].

Using **L**A T E X can be stressful

- ▶ Learning curve
- ▶ Placing content
- ▶ BibTeX citation
- ▶ Compilation delay
- ▶ Less flexibility



Why to use LaTeX?

LaTeX Speciality



LATEX is superior choice in several scenarios [4, 5].

LATEX is preferred for

- ▶ Writing journal articles, the publishers ask for **LATEX** document
- ▶ Writing thesis report, the universities focus on uniform design
- ▶ Writing STEM assignments with formulas, algorithm, and codes
- ▶ Managing large bibliography automatically
- ▶ Using high quality figures
- ▶ Longevity of the document

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When to use LaTeX?

Paper/Report



A Privacy-preserving Mobile and Fog Computing Framework to Trace and Prevent COVID-19 Community Transmission

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Abstract. To slow down the spread of COVID-19, governments around the world are trying to identify infected people and to contain the virus by enforcing isolation. However, it is difficult to trace people who came into contact with an infected person, which causes widespread community transmission and mass infection. To address this problem, we develop an e-government mobile and fog computing framework that can trace positive and suspected cases nationwide using personal mobile devices and fog nodes, named Automatic Risk checker (ARC), while preserving user privacy. Each user's mobile device receives a Unique Encrypted Reference Code (UEBC) when registered in the central server and broadcasts the code using the Bluetooth Low Energy technology. Any mobile device within short distance can receive the UEBC and keeps a record of it up to the next 24 days. As the government maintains the database of server-generated UEBCs, the user mobile device can share the reference codes in the application cache without requiring further encryption. Additionally, the ARC's are placed at the entry points of buildings, which can immediately detect if there are positive or suspected cases nearby. If any cases are found, the ARC's broadcast precautionary messages to nearby people without revealing the identity of the infected person. This way, governments can let organizations continue their economic activities without complete lockdown. Besides, it becomes viable to identify superspreaders and to map the cluster of infected and suspected cases.

Keywords: COVID-19, Corona virus, Mobile Application, Data Privacy, Fog Computing, Community Transmission Prevention

1 Introduction

Governments around the world are seeking solutions to minimize the infected cases from COVID-19 pandemic by employing mobile application framework-based contact tracing [10,2]. Mobile apps can be helpful to trace both infected

ARC user's mobile device can receive the UEBC and keeps a record of it up to the next 24 days.

ARC's are placed at the entry points of buildings, which can immediately detect if there are positive or suspected cases nearby.

Counting Sort

Ahmedur Rahman Shovan (Blazer ID: ashovan)

1 Properties

Counting sort is a linear time sorting algorithm for n integer values ranging from 0 to $k \in \mathbb{N}$. It determines for each element x , the number of elements less than x . Then it utilizes this information to place x in its correct position. Counting sort is typically used to sort smaller integers with multiple counts where linear time complexity is needed. We discuss the properties of counting sort in the following sections.

1.1 Sort non-negative integers with known maximum value

Counting sort can only be used in a list of non-negative integers where the maximum value of the list is known. It can be applied if the list only contains values from 0, 1, ..., k range where k is the maximum value of the list.

1.2 No comparisons between elements

In the counting sort, no comparison between the input elements take place. It counts the number of elements less than x , and then places x after those numbers. Thus, it does not compare all the values like other quadratic or logarithmic time sorting algorithms.

1.3 Stable

Counting sort is a stable sorting algorithm. Numbers with the same value are placed in the same order in the output list as they appear in the input list.

2 Algorithm and complexity analysis

The counting sort algorithm is expressed in Algorithm 1.

Algorithm 1 Counting sort algorithm

```
1: procedure COUNTINGSORT( $Input, k$ )
2:    $Count \leftarrow$  array of  $k + 1$  zeros
3:    $Output \leftarrow$  array of  $Input.length$  zeros
4:   for  $i \leftarrow 0$  to  $Input.length - 1$  do
5:      $Count[Input[i]] \leftarrow Count[Input[i]] + 1$ 
6:   end for
7:   for  $i \leftarrow 1$  to  $k$  do
8:      $Count[i] \leftarrow Count[i - 1] + Count[i]$ 
9:   end for
10:  for  $i \leftarrow Input.length - 1$  to 0 do
11:     $Output[Count[Input[i]] - 1] \leftarrow Input[i]$ 
12:     $Count[Input[i]] \leftarrow Count[Input[i]] - 1$ 
13:  end for
14:  return  $Output$ 
15: end procedure
```

As no comparisons are required in counting sort, it provides a linear time complexity. The best, average, and worst-case time complexity of counting sort is $O(k + n)$, where k is the maximum value of the input elements and n is the total number of input elements. The space complexity of counting sort is also $O(k + n)$, where k is the maximum value of the input elements and n is the total number of input elements. Thus, it shows worse space complexity than the logarithmic sorting algorithms. While counting sort is computationally better, it only is used to sort small integer values with known maximum value.

References

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Assignment



```
44 def display_downloaded_file_content(local_filename="aws_downloaded.txt"):
45     try:
46         print(f"Reading downloaded file: {local_filename}")
47         with open(local_filename) as fp:
48             for line in fp.readlines():
49                 print(line.strip())
50     except Exception as ex:
51         print("Error occurred:", str(ex))
52
53
54 def delete_s3_file_and_bucket(bucket_name="shovonassignment3",
55                               bucket_filename="shovon.txt"):
56     try:
57         s3_client = boto3.client('s3')
58         s3_client.delete_object(Bucket=bucket_name,
59                                Key=bucket_filename)
60         print(f"Deleted S3 file object: {bucket_filename}")
61         s3_client.delete_bucket(Bucket=bucket_name)
62         print(f"Deleted S3 bucket: {bucket_name}")
63     except ClientError as ex:
64         print("Error occurred while deleting file or bucket from s3:", str(
65             ex))
66     except Exception as ex:
67         print("Error occurred:", str(ex))
68
69 if __name__ == '__main__':
70     store_user_name_in_lowercase()
71     upload_to_s3()
72     download_from_s3()
73     display_downloaded_file_content()
74     delete_s3_file_and_bucket()
```

Figure 1 shows the output of the program that contains the downloaded file content.

```
Terminal: local ~ +
(venv) + s3_manipulation python s3_file_manipulation.py
Enter your full name: Ameer Rahman Shovan
Stored the name locally in shovon.txt
Uploaded the file to S3: shovonassignment3/shovon.txt
Downloaded the file shovonassignment3/shovon.txt from S3 and stored locally: aws_downloaded.txt
Reading downloaded file: aws_downloaded.txt
ameer rahman shovan
Deleted S3 file object: shovon.txt
Deleted S3 bucket: shovonassignment3
```

Figure 1: AWS S3 file upload and download demonstration

References

- [1] Dhruba Borthakur. The hadoop distributed file system: Architecture and design. *Hadoop Project Website*, 11(2007):21, 2007.
- [2] Mohammad Asif Khan, Zulfajar A Memon, and Sajid Khan. Highly available hadoop namenode architecture. In *2012 International Conference on Advanced Computer Science Applications (ACSAT)*, pages 167–172. IEEE, 2012.
- [3] Konstantin Shvachko, Haiyong Huang, Sanjay Radia, and Robert Chandra. The hadoop distributed file system. In *2010 IEEE 26th symposium on mass storage systems and technologies (MSST)*, pages 1–10. Ieee, 2010.

Algorithm 2 Search in skiplist

```
1: procedure SEARCHSKIPLIST( $x, L$ )
2:   node ←  $L$ 
3:   while node ≠ NULL & node.value ≠  $x$  do
4:     if node.next.value ≥  $x$  then
5:       node ← DOWN(node)
6:     else
7:       node ← node.next
8:     end if
9:   end while
10:  return node           ▷ Return the node, if it is null then the value is not found
11: end procedure
```

3.2 Example of skiplist

Skiplist has $n = 2^4$ number of elements with $\log n$ number of levels. The figure 1 shows a skiplist with 16 elements and four levels.



Figure 1: Example of skiplist with 16 elements

4 Solution to Question 4

Question:

1. Question 29.1-4 of the Cormen book
2. Question 29.1-5 of the Cormen book

4.1 Solution to Question 29.1-4 of the Cormen book

Given linear program,

$$\begin{aligned} & \text{Minimize} \\ & 2x_1 + 7x_2 + x_3 \\ & \text{Subject to} \\ & x_1 - x_2 = 7 \\ & 3x_1 + x_2 \geq 24 \\ & x_2 \geq 0 \\ & x_3 \leq 0 \end{aligned}$$

We are going to convert it into standard form in the following sections.

CV/Resume



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Education	PhD(Student) (Fall 2021 - Present) Department of Computer Science, The University of Alabama at Birmingham, Birmingham, AL, United States. Master of Science in Information Technology(Thesis Group) (2018) Institute of Information Technology, Jahangirnagar University, Bangladesh. CGPA: 3.67 (in the scale of 4.00), research covers 31.35% of total credit. Bachelor of Science in Information Technology (2016) Institute of Information Technology, Jahangirnagar University, Bangladesh. CGPA: 3.73 (in the scale of 4.00).
Research Interest	High Performance Computing Data Visualization Cloud Computing Software Engineering
Bibliometrics	Journal Article: 2, Conference Papers: 5 Citations: 63, h-index: 3 This bibliometric information was retrieved from Google Scholar Profile on 02/04/2022.
Journal Articles	[22] Darshan Shingra Chaudhary, Sazhosh Kumar Karthikeyan, Praveen Kumar Korla, Hetalben Patel, Ahmedur Rahman Shovon , Muzammad Athar, George J Netto, Zhaohui S Qiu, Siddharth Kumar, Upender Manoo, Chai J Creighton, and Sreenivasaraya Viswanath. "JALCAN: An update to the integrated cancer data analysis platform". In: <i>Neoplasia</i> . doi: 10.1016/j.neo.2022.01.001. Impact Factor: 5.71, Q1 Journal. [21] Md Whaiduzzaman, Md. Razon Hossain, Ahmedur Rahman Shovon , Shanto Roy, Aron Laszlo, Rajkumar Buxya, and Alistair Barros. "A Privacy-preserving Mobile and Fog Computing Framework to Trace and Prevent COVID-19 Community Transmission". In: <i>IEEE Journal of Biomedical and Health Informatics (J-BHI)</i> . doi: 10.1109/JBHI.2020.3029066. Impact Factor: 5.22, Q1 Journal.
Conference Papers	[C5] Md Whaiduzzaman, Alistair Barros, Ahmedur Rahman Shovon , Md Razon Hossain, and Colin Fidge. "A Resilient Fog-IoT Framework for Seamless Microservice Execution". In: <i>IEEE International Conference on Services Computing (SCC) - 2021</i> , pp. 213-221. doi: 10.1109/SCC52864.2021.00034. [C4] Md Shafiqur Raza, Md Khalidul Bahamon, Mahomed Alam Raza, Ahmedur Rahman Shovon , Md Jaze Alam Adnan, Koushik Chaudhri Howlader, and M Shamim Kaiser. "COVID-19: Update, Forecast and Assistant-An Interactive Web Portal to Provide Real-Time Information and Forecast COVID-19 Cases in Bangladesh". In: <i>International Conference on Information and Communication Technology for Sustainable Development (ICICT4SD) - 2021</i> , pp. 456-460. doi: 10.1109/ICICT4SD50815.2021.9306786

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EXPERIENCE

Assistant Programmer
Department of Information & Communication Technology
June 2019 - Ongoing | Sylhet, Bangladesh
Ministry of Posts, Telecommunications and Information Technology, Bangladesh

Software Engineer

Cofalo
December 2017 - Ongoing | Dhaka, Bangladesh
I am a consultant to NHST Media Group. Our team is continuously developing and maintaining five publications of this Norwegian media conglomerate. We follow agile methodologies to carry out the tasks in a disciplined manner.
• Mostly working with Python (Django, Django REST Framework), Java(Spring (ReactJS) and various CI/CD tools to automate application deployment process.

Software Engineer

Cofalo
October 2016 - November 2017 | Dhaka, Bangladesh
• Worked on the development of an Education as a Service(EaaS) application.
• Additionally, I developed real time fingerprint based attendance system with instant messaging service.

Freelancer

Upwork
April 2015 - Present | Dhaka, Bangladesh
• Working on a contractual basis, I am involved in web and data driven application development.
• I have developed custom plugins and data scrapers as per clients' requirements.

EDUCATION

MSc in Information Technology
Jahangirnagar University
2015 - 2016 | CGPA: 3.67(4.00)

BSc in Information Technology
Jahangirnagar University
2011 - 2015 | CGPA: 3.73(4.00)

ACHIEVEMENTS

- IEEE Xtreme**
Achieved 7th position in IEEE Xtreme Programming Contest 2015 among 2477 teams.
- Programming Contest**
Achieved 1st position in Inter University Programming Contest (IUPC) 2015.
- Problem Solving**
Solved over 700 problems in UVA, Codeforces & Hackerrank.
- Community Contribution**
Gained 5000+ reputation in Stack Overflow.

SKILLS

Python ●●●●●
JavaScript ●●●●●
HTML & CSS ●●●●●
PHP ●●●●●
MySQL ●●●●●
GIT ●●●●●
Linux ●●●●●
Java ●●●●●
MongoDB ●●●●●
AWS ●●●●●

RESEARCH INTEREST

Cloud Computing
Artificial Intelligence

LANGUAGE

Bangla ●●●●●
English ●●●●●

Cover Letter/Presentation



LEADERSHIP ACTIVITY

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With a passion for serving the programmer community, I joined the Programmers' Planet, a CS students club during the BSc program. I was responsible for undertaking programming tutorials for competitive programmers and arranging programming contests on both onsite and online platforms. Eventually, these activities drove me to join a larger organization called IEEE Student Branch, Jahangirnagar University. After working as a member for a year for the IEEE SB JU, I was promoted to become the organization's webmaster. As the webmaster, I consulted the organization's alumni and advisors and then developed its website from scratch. In 2015, I got the opportunity to serve in Bangladesh Electronics Olympiad, a national electronics competition for undergraduate students, as a technical committee member. Additionally, working as a teaching assistant for a year helped me to grow my managerial abilities. These all administrative and developer related activities improved my communication skills along with the practical development skills.

The organizational skill I achieved from IEEE SB JU events' active participation inspired me to become the final year group project team leader. We collaboratively developed "Easy C" (a learning platform), presented the finished product to the examination board, and achieved the highest grade point. Because I was performing well as the team lead, I was selected as the team leader for the IEEE Xplore Programming Competition 9.0. I decided to try solving the hardest problems from the very beginning of the 24-hour contest, and eventually, we were able to gain partial scoring for those problems. This crucial decision secured our team the 7th position among 2,477 teams globally. While working as a research assistant at Mobile Cloud Computing and Big Data Research Group (MCCBD), I led a small team to set up a local cloud ecosystem in the lab and continued our research on cloud computing, software engineering, and machine learning.

I have been working in different multinational software development teams for more than three years, and I feel the importance of becoming a good team player. As a software engineer and researcher, I clearly understand the gap between the current research work and fundamental development techniques. I found many cases to invoke machine learning techniques to improve software engineering practices for development cost and time optimization. Early bug detection, anti-pattern detection during development, and post-deployment analysis are few places where state-of-the-art research works are still needed. I gathered the real-world scenario in the software industry while achieving 800k+ reputation in Stackoverflow, the largest and most-trusted online community.

My leadership ability, professional experiences, and organizational skills assisted me in becoming a proactive team member over the years. I am confident that I can grow both as a team leader and researcher if I get the opportunity of doing a Ph.D. in an institution of the highest caliber like Rice University.

LVB
THE UNIVERSITY OF
ALABAMA AT BIRMINGHAM

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How to use LaTeX?

TeX Distributions



LATEX is not a stand-alone program. To use **LATEX**, any of the TeX distributions are required.

Windows

- ▶ [MiKTeX](#)
- ▶ [Tex Live](#)

Linux

- ▶ [Tex Live](#)

Mac

- ▶ [Mac Tex](#)

Online

- ▶ [Overleaf](#)
- ▶ [ShareLaTeX](#)
- ▶ [Papeeria](#)

Learn LaTeX



LATEX has tons of commands. You do not need to memorize all of them.

Start using **LATEX** to learn it

- ▶ [Learn LaTeX in 30 minutes](#)
- ▶ [Overleaf tutorials](#)
- ▶ [How to Write a Thesis in LaTeX \(Part 1\): Basic Structure](#)
- ▶ [Creating a document in LaTeX](#)
- ▶ [Shanto Roy's LaTeX articles](#)


LaTeX Tips



LA \TeX requires patience.

To utilize **L**A \TeX






- ▶ Use templates: Reduces learning curve and helps organizing document
- ▶ Use packages: Reduces learning curve and helps organizing document
- ▶ Create custom command (iff package is not found)
- ▶ Use [Google Scholar](#) / [IEEE Xplore](#) / [Semanticscholar](#) for BibTeX citation
- ▶ Structure the contents to increase flexibility

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Ready to try LaTeX?

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