

# A Novel Sorting Method for Real and Integer Numbers: An Extension of Counting Sort



Kshitij Kala, Sandeep Kumar Budhani, Rajendra Singh Bisht, Dhanuli Kokil Bisht, Kuljinder Singh Bumrah

**Abstract:** *Sorting is an essential concept in the study of data structures. There are many sorting algorithms that can sort elements in a given array or list. Counting sort is a sorting algorithm that has the best time complexity. However, the counting sort algorithm only works for positive integers. In this paper, an extension of the counting sort algorithm is proposed that can sort real numbers and integers (both positive and negative).*

**Index Terms:** Counting Sort, Sorting, Algorithm.

## I. INTRODUCTION

In the field of computer science, **sorting** denotes the process of arranging items in a sequence ordered by a given criterion. A sorting procedure is a procedure that places elements of a list or array in a certain order. A capable sorting algorithm helps optimize the competence of other procedures, such as search and merge algorithms, which require input data in the form of sorted lists. In fact, **search preprocessing** is perhaps the single most important application of sorting algorithms. Sorting is also useful for **canonicalizing data** (i.e. converting it into a standard representation) and for producing human-readable output. Sorting algorithms function as a basic building block for a wide variety of applications, including problems of closest pair finding, element uniqueness, frequency distribution and selection. Commonly used sorting algorithms include **quick sort, counting sort, heap sort, bubble sort, selection sort, insertion sort, merge sort and radix sort.**

The efficiency of an algorithm is measured as a function of the computational cost it exacts on the system, in relations of its space and time complexity. **Time complexity** is a measure of the time it takes for an expression to be executed, as a function of the input size. It is generally expressed in **big O notation (O(n))**, a mathematical notation that is used to describe the limiting manners of a function when its argument tends towards a given value or infinity (asymptotic complexity). This representation describes functions according to their **growth rate**, or the rate at which the time taken to execute a function increases with increase in input size.

**Space complexity** is a measure of the volume of memory space mandatory to solve an instance of a problem, as a function of input size.

Manuscript published on 30 November 2019.

\* Correspondence Author (s)

Kshitij Kala, Student, GEHU, Bhatnagar Campus, Uttarakhand, India.  
Sandeep Kumar Budhani (Corresponding Author), Associate Professor, GEHU, Bhatnagar Campus, Uttarakhand, India. E-mail: sandeepbudhani77@gmail.com

Rajendra Singh Bisht, Research Scholar, GEU, Dehradun, India.  
Dhanuli Kokil Bisht, Student, GEHU, Bhatnagar Campus, Uttarakhand, India.

Kuljinder Singh Bumrah, Assistant Professor, GEHU, Dehradun, India.

© The Authors. Published by Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP). This is an open access article under the CC-BY-NC-ND license <http://creativecommons.org/licenses/by-nc-nd/4.0/>

It is also often expressed asymptotically in big O notation  $O(n)$ , where  $n$  is the input size in bytes.

Given below is a comparison of the space and time complexity of various popular sorting algorithms:

Algorithm	Best Case Complexity	Average Case Complexity	Worst Case Complexity	Space Complexity
Linear Search	$O(1)$	$O(n)$	$O(n)$	$O(1)$
Binary Search	$O(1)$	$O(\log n)$	$O(\log n)$	$O(1)$
Selection Sort	$O(n^2)$	$O(n^2)$	$O(n^2)$	$O(1)$
Insertion Sort	$O(n)$	$O(n^2)$	$O(n^2)$	$O(1)$
Heap Sort	$O(n \log n)$	$O(n \log n)$	$O(n \log n)$	$O(1)$
Quick Sort	$O(n \log n)$	$O(n \log n)$	$O(n^2)$	$O(\log n)$
Merge Sort	$O(n \log n)$	$O(n \log n)$	$O(n \log n)$	$O(n)$
Radix Sort	$O(n)$	$O(n)$	$O(n)$	$O(n)$
Counting Sort	$O(n)$	$O(n)$	$O(n)$	$O(n)$

Fig. 1.

In this paper, we will focus on a discussion of counting sort, a unique sorting algorithm. Unlike other sorting algorithms, it does not compare elements to arrange them in a particular order. We will test the working of the proposed extension of the counting sort algorithm with large data sets, and compare its space and time complexity with that of other popular sorting algorithms.

## II. WORKING OF COUNTING SORT ALGORITHM

Let us assume that an array  $A$  of size  $N$  is to be sorted.

Algorithm: CountingSort( $A, N, SortedA, Count, S$ )

//  $A$  is the array to be sorted

// The result is stored in SortedA

//  $N$  is the size of arrays  $A$  and SortedA

// Count is an array whose size is equal to the value of maximum element of  $A$ .

//  $S$  is the maximum element of array  $A$ .

// Each element of Count is initialized to 0

Step 1: Set  $i \leftarrow 0$

Step 2: Repeat this step while  $i < N$

a. Set  $Count[A[i]] \leftarrow Count[A[i]] + 1$

b. Set  $i \leftarrow i + 1$

End of Loop

Step 3: Set  $i \leftarrow 0$

Step 4: Set  $j \leftarrow 0$

Step 5: Repeat this step while  $i < S$ :

a. Repeat while  $Count[A[i]] > 0$ :

a. Set  $SortedA[j] \leftarrow A[i]$

b. Set  $j \leftarrow j + 1$

c. Set  $Count[A[i]] \leftarrow Count[A[i]] - 1$

End of Loop



# Novel Numbers Counting

**Daniela Niemeyer**



**Novel Numbers Counting :**

Yeah, reviewing a books **Novel Numbers Counting** could build up your close links listings. This is just one of the solutions for you to be successful. As understood, talent does not recommend that you have astounding points.

Comprehending as well as union even more than further will manage to pay for each success. next to, the revelation as with ease as keenness of this Novel Numbers Counting can be taken as well as picked to act.

<https://matrix.jamesarcher.co/public/uploaded-files/Documents/Electronics%20Repair%20Guide%20How%20To.pdf>

## **Table of Contents Novel Numbers Counting**

1. Understanding the eBook Novel Numbers Counting
  - The Rise of Digital Reading Novel Numbers Counting
  - Advantages of eBooks Over Traditional Books
2. Identifying Novel Numbers Counting
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Novel Numbers Counting
  - User-Friendly Interface
4. Exploring eBook Recommendations from Novel Numbers Counting
  - Personalized Recommendations
  - Novel Numbers Counting User Reviews and Ratings
  - Novel Numbers Counting and Bestseller Lists
5. Accessing Novel Numbers Counting Free and Paid eBooks
  - Novel Numbers Counting Public Domain eBooks
  - Novel Numbers Counting eBook Subscription Services

- Novel Numbers Counting Budget-Friendly Options
- 6. Navigating Novel Numbers Counting eBook Formats
  - ePub, PDF, MOBI, and More
  - Novel Numbers Counting Compatibility with Devices
  - Novel Numbers Counting Enhanced eBook Features
- 7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Novel Numbers Counting
  - Highlighting and Note-Taking Novel Numbers Counting
  - Interactive Elements Novel Numbers Counting
- 8. Staying Engaged with Novel Numbers Counting
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Novel Numbers Counting
- 9. Balancing eBooks and Physical Books Novel Numbers Counting
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Novel Numbers Counting
- 10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
- 11. Cultivating a Reading Routine Novel Numbers Counting
  - Setting Reading Goals Novel Numbers Counting
  - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Novel Numbers Counting
  - Fact-Checking eBook Content of Novel Numbers Counting
  - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
  - Utilizing eBooks for Skill Development
  - Exploring Educational eBooks
- 14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

### **Novel Numbers Counting Introduction**

In the digital age, access to information has become easier than ever before. The ability to download Novel Numbers Counting has revolutionized the way we consume written content. Whether you are a student looking for course material, an avid reader searching for your next favorite book, or a professional seeking research papers, the option to download Novel Numbers Counting has opened up a world of possibilities. Downloading Novel Numbers Counting provides numerous advantages over physical copies of books and documents. Firstly, it is incredibly convenient. Gone are the days of carrying around heavy textbooks or bulky folders filled with papers. With the click of a button, you can gain immediate access to valuable resources on any device. This convenience allows for efficient studying, researching, and reading on the go. Moreover, the cost-effective nature of downloading Novel Numbers Counting has democratized knowledge. Traditional books and academic journals can be expensive, making it difficult for individuals with limited financial resources to access information. By offering free PDF downloads, publishers and authors are enabling a wider audience to benefit from their work. This inclusivity promotes equal opportunities for learning and personal growth. There are numerous websites and platforms where individuals can download Novel Numbers Counting . These websites range from academic databases offering research papers and journals to online libraries with an expansive collection of books from various genres. Many authors and publishers also upload their work to specific websites, granting readers access to their content without any charge. These platforms not only provide access to existing literature but also serve as an excellent platform for undiscovered authors to share their work with the world. However, it is essential to be cautious while downloading Novel Numbers Counting . Some websites may offer pirated or illegally obtained copies of copyrighted material. Engaging in such activities not only violates copyright laws but also undermines the efforts of authors, publishers, and researchers. To ensure ethical downloading, it is advisable to utilize reputable websites that prioritize the legal distribution of content. When downloading Novel Numbers Counting , users should also consider the potential security risks associated with online platforms. Malicious actors may exploit vulnerabilities in unprotected websites to distribute malware or steal personal information. To protect themselves, individuals should ensure their devices have reliable antivirus software installed and validate the legitimacy of the websites they are downloading from. In conclusion, the ability to download Novel Numbers Counting has transformed the way we access information. With the convenience, cost-effectiveness, and accessibility it offers, free PDF downloads have become a popular choice for students, researchers, and book lovers worldwide. However, it is crucial to engage in ethical downloading practices and prioritize personal security when utilizing online platforms. By

doing so, individuals can make the most of the vast array of free PDF resources available and embark on a journey of continuous learning and intellectual growth.

### **FAQs About Novel Numbers Counting Books**

How do I know which eBook platform is the best for me? Finding the best eBook platform depends on your reading preferences and device compatibility. Research different platforms, read user reviews, and explore their features before making a choice. Are free eBooks of good quality? Yes, many reputable platforms offer high-quality free eBooks, including classics and public domain works. However, make sure to verify the source to ensure the eBook credibility. Can I read eBooks without an eReader? Absolutely! Most eBook platforms offer web-based readers or mobile apps that allow you to read eBooks on your computer, tablet, or smartphone. How do I avoid digital eye strain while reading eBooks? To prevent digital eye strain, take regular breaks, adjust the font size and background color, and ensure proper lighting while reading eBooks. What the advantage of interactive eBooks? Interactive eBooks incorporate multimedia elements, quizzes, and activities, enhancing the reader engagement and providing a more immersive learning experience. Novel Numbers Counting is one of the best book in our library for free trial. We provide copy of Novel Numbers Counting in digital format, so the resources that you find are reliable. There are also many Ebooks of related with Novel Numbers Counting . Where to download Novel Numbers Counting online for free? Are you looking for Novel Numbers Counting PDF? This is definitely going to save you time and cash in something you should think about.

### **Find Novel Numbers Counting :**

**electronics repair guide how to**

**viral TikTok book paperback**

*international bestseller BookTok trending*

[ebook positive psychology guide](#)

*reference language learning manual*

**gothic fantasy ultimate guide**

*language learning manual international bestseller*

[myth retelling novel quick start](#)

[quick start myth retelling novel](#)

[gothic fantasy stories](#)

[cybersecurity basics stories](#)

[public speaking skills guide blueprint](#)

**woodworking manual ultimate guide**

**novel public speaking skills guide**

**social media literacy quick start**

### **Novel Numbers Counting :**

Instructor's Resource Manual to Accompany Information ... Instructor's Resource Manual to Accompany Information Technology for the Health Professions, 3rd Edition [Lillian Burke, Barbara Weill] on Amazon.com. Information Technology for the Health Professions ... Information Technology for the Health Professions-Instructor's Resource Manual with Test Bank and Power Point Lecture CD-ROM ; Publisher. Pearson Prentice Hall. Health Information Technology (Instructor's Resource Manual) Health Information Technology (Instructor's Resource Manual) - Softcover ; Featured Edition. ISBN 10: ISBN 13: 9781416023166. Publisher: Saunders, 2007 Component 6: Health Management Information Systems ... .. Instructors This Instructor Manual is a resource for instructors using this component. ... Resource Center for Health Information Technology under Contract No. Online Store - My ACHE Price: ; ISBN:9781640551916 ; Number of pages:465 ; Edition: 9 ; Year published:2021 ; Print date:2020-08-01T00:00:00. Health Information Management & Technology Library Guide Aug 31, 2023 — Health information technology (health IT) makes it possible for health care providers to better manage patient care through secure use and ... Health Information Technology and Management - TCC OER ... A free course from Carnegie Mellon University that offers an overview of healthcare, health information technology, and health information management systems. Faculty Resource Manual Shall provide information to the General Faculty regarding activities of the Faculty Senate. ... Director of Information Technology. Of the four (4) faculty, one ... Health Information Technology | Health Sciences The Health Information Technology Associate in Science (A.S.) degree at Valencia College is a two-year program with online courses that prepares you to go ... I Can Save the Ocean!: The Little Green... by Inches, Alison It is a story of a green monster who finds trash on the beach and looks at the consequences of it while he goes into the water. Although my son has a very short ... I Can Save the Ocean! | Book by Alison Inches, Viviana ... I Can Save the Ocean! by Alison Inches - Max the Little Green Monster is a cute, furry green monster that loves the outdoors, especially the beach! I Can Save the Ocean!: The Little Green Monster Cleans ... I Can Save the Ocean is a children's picture book by Alison Inches the follows Little Green Monsters that love the beach. Max and his friends don't like ... 10 Ways You Can Help Save the Oceans 1. Demand plastic-free alternatives · 2. Reduce your carbon footprint · 3. Avoid ocean-harming products · 4. Eat sustainable

seafood · 5. Vote on ocean issues · 6. "I Can Save the Ocean" - Free stories online. Create books ... Hello my name is Sara and I can't wait to go surfing and snorkeling. This summer we are going to Australia to visit my best friend Ruby. She moved awa... 5 reasons you should care about our ocean Our ocean is in serious trouble. Heating, pollution, acidification, and oxygen loss pose serious threats to the health of the ocean and to all living beings ... How can you help our ocean? - National Ocean Service 10 Ways to Help Our Ocean ; 1. Conserve Water. Use less water so excess runoff and wastewater will not flow into the ocean. 2. Reduce Pollutants ; 4. Shop Wisely. 10 Amazing Organizations Fighting to Save Our Oceans One of the best ways you can contribute to marine conservation is by joining one of these groups and donating to the cause. Here is a list of what we think are ... Thai Radical Discourse by Craig J. Reynolds | Paperback Thai Radical Discourse by Craig J. Reynolds | Paperback Thai Radical Discourse: The Real Face of Thai Feudalism ... Discussing imperialism, feudalism, and the nature of power, Reynolds argues that comparisons between European and Thai premodern societies reveal Thai social ... Thai Radical Discourse: The Real Face of Thai Feudalism Today by CJ Reynolds · 2018 · Cited by 159 — Discussing imperialism, feudalism, and the nature of power, Reynolds argues that comparisons between European and Thai premodern societies ... Thai Radical Discourse: The Real Face of Thai Feudalism ... Discussing imperialism, feudalism, and the nature of power, Reynolds argues that comparisons between European and Thai premodern societies reveal Thai social ... Thai radical discourse : the real face of Thai feudalism today Discussing imperialism, feudalism, and the nature of power, Reynolds argues that comparisons between European and Thai premodern societies reveal Thai social ... The Real Face Of Thai Feudalism Today by Craig Reynolds Discussing imperialism, feudalism, and the nature of power, Reynolds argues that comparisons between European and Thai premodern societies reveal Thai social ... Thai Radical Discourse: The Real Face of Thai Feudalism Today Using Jit Poumisak's The Real Face of Thai Feudalism Today (1957), Reynolds both rewrites Thai history and critiques relevant historiography. Thai Radical Discourse: The Real Face of Thai Feudalism ... by S Wanthana · 1989 — Thai Radical Discourse: The Real Face of Thai Feudalism Today. By Craig J. Reynolds. Ithaca, N.Y.: Cornell University Southeast Asia Program, 1987. Pp. 186. Thai Radical Discourse: The Real Face of Thai Feudalism ... Discussing imperialism, feudalism, and the nature of power, Reynolds argues that comparisons between European and Thai premodern societies reveal Thai social ...