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Introduction:

Algorithms and Merge Sort Algorithm:

An algorithm is a set of instructions or rules that a computer program follows to solve a problem or accomplish a task. An algorithm is designed to be efficient, which means that it can complete a task in a reasonable amount of time and with a minimal amount of resources.

One type of algorithm is the merge sort algorithm. Merge sort is a sorting algorithm that works by dividing an unsorted list into smaller, sorted lists, and then merging those lists together into a single, sorted list.

The merge sort algorithm works as follows:

1. Divide the unsorted list into n sublists, each containing one element (a list of one element is considered sorted).
2. Repeatedly merge sublists to produce new sorted sublists until there is only one sublist remaining. This will be the sorted list.

The merge operation combines two sorted sublists into a single sorted list. This operation is performed repeatedly until all sublists are merged into a single sorted list.

Merge sort is a highly efficient sorting algorithm, with a time complexity of O(n log n) in the worst-case scenario. It is widely used in computer science, particularly for large data sets, as it is stable (meaning it preserves the relative order of equal elements) and can easily be parallelized.

Purpose of Merge Sort Algorithms Visualization:

The purpose of visualizing Merge Sort algorithms is to provide a clear and intuitive understanding of how the algorithm works and how it sorts an array of elements.

Merge Sort is a popular sorting algorithm that works by dividing the input array into smaller sub-arrays, sorting each of these sub-arrays, and then merging them back together to produce a sorted output array. While this algorithm is highly efficient and widely used, it can be difficult to understand how it works and how it sorts the array, especially for those who are new to computer science or programming.

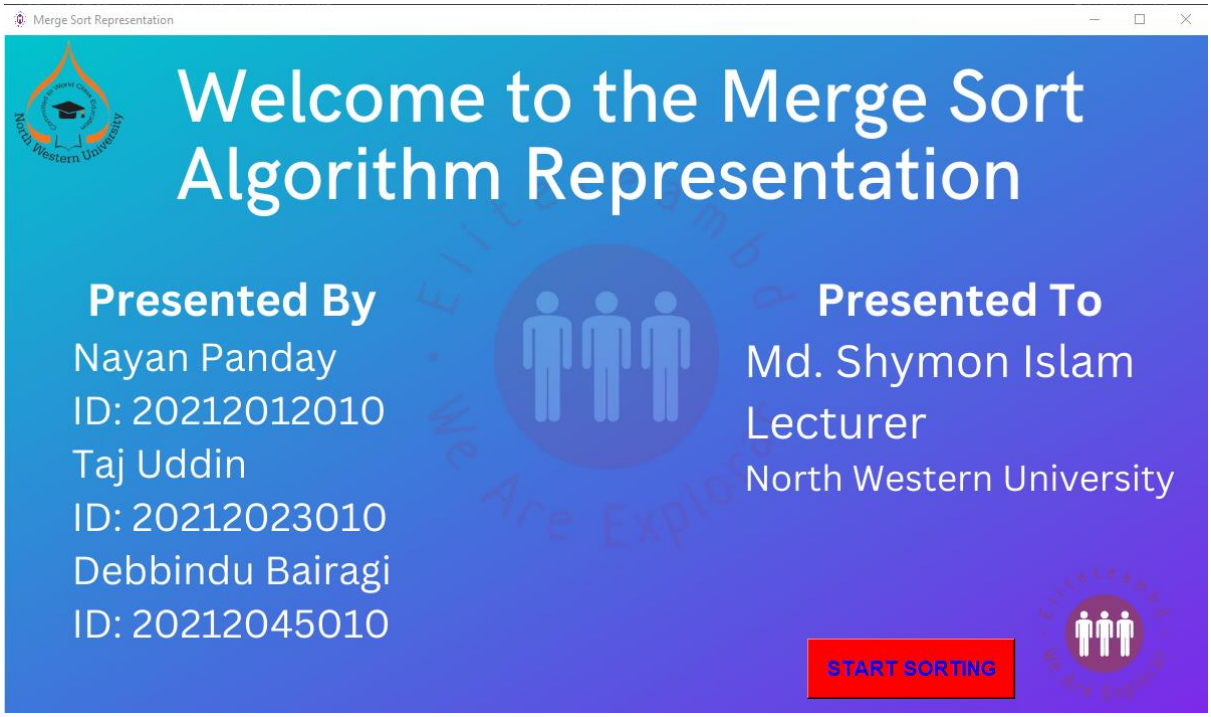
Visualizations can help to bridge this gap by showing the step-by-step process of how Merge Sort works. By visually representing the algorithm in action, individuals can better understand how it divides and sorts the array, and how it merges the sorted sub-arrays back together to produce the final output.

Visualizations can also be interactive, allowing users to change the size and contents of the input array and observe how the algorithm responds. This can provide a hands-on learning experience that can help individuals better grasp the core concepts behind Merge Sort and other sorting algorithms. Overall, Merge Sort visualizations can be a valuable tool for teaching, learning, and understanding this important algorithm.

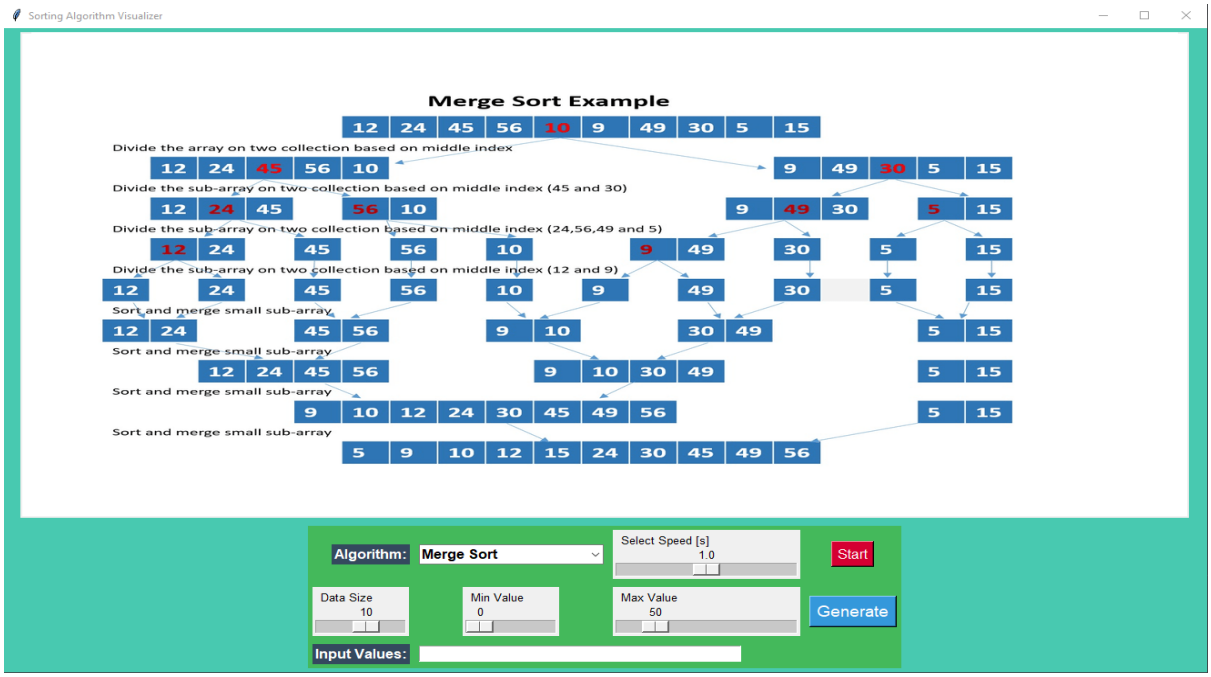
Working Principle

Landing Page:

This is the landing page of our program when we first run the code.

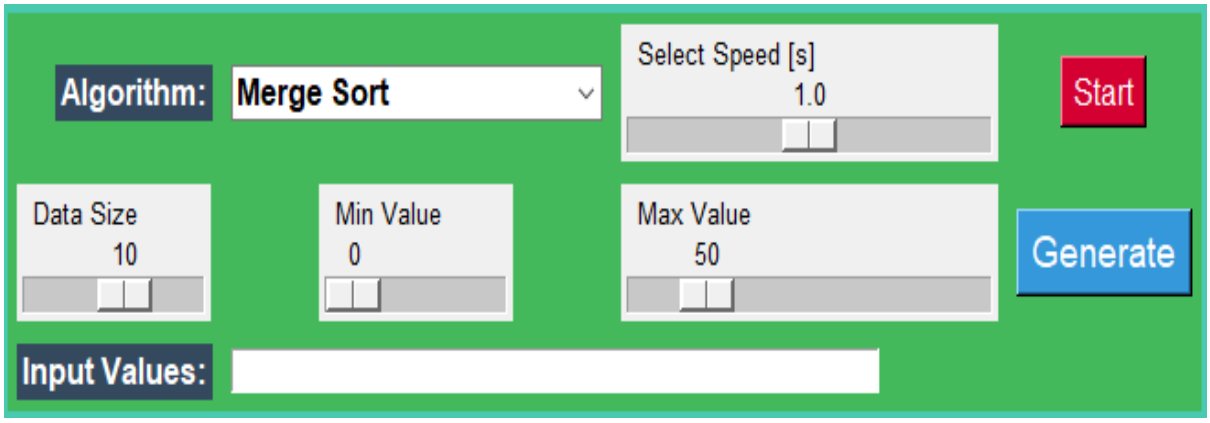


Interactive Button: After Clicking the 'START SORTING' button this screen appears.

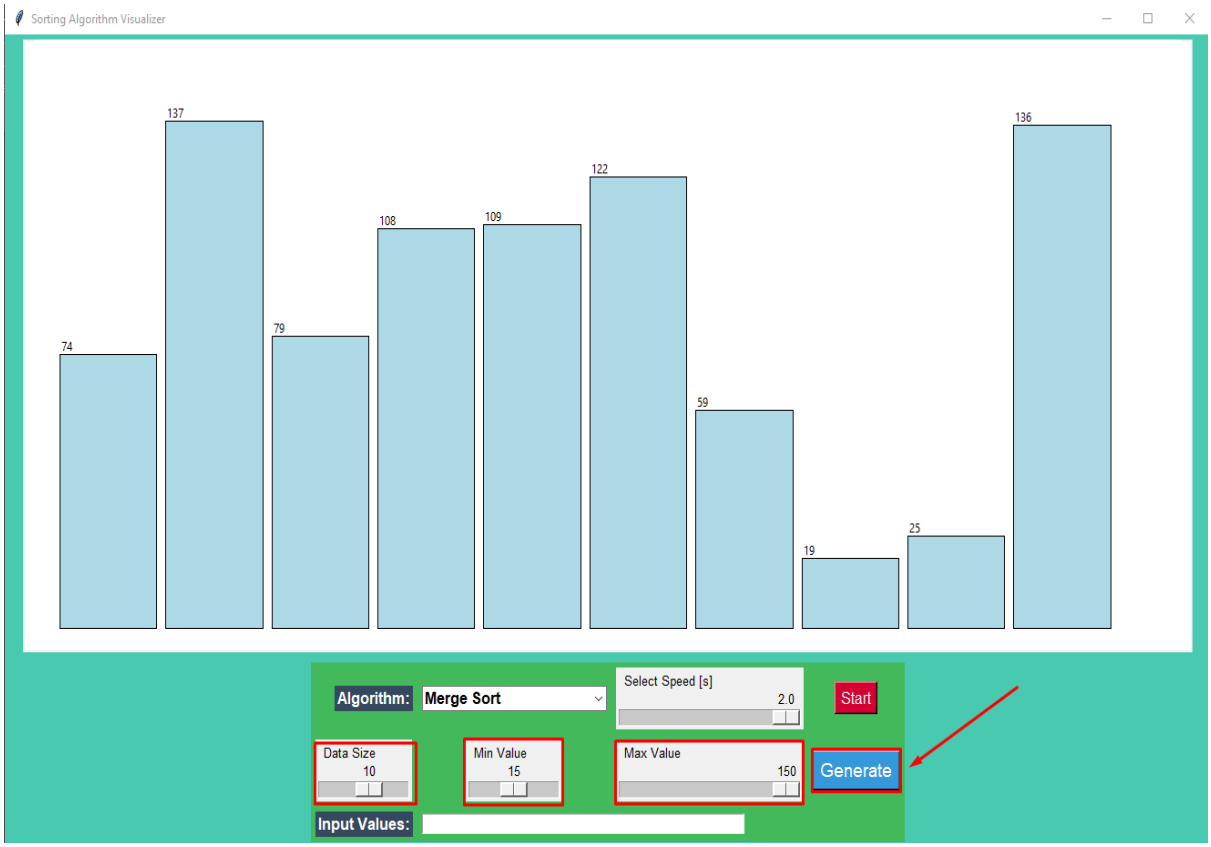


Explanation: Now we saw the landing page of a user interface where we can take input from the user. Also showing a picture of Merge Sort Algorithm.

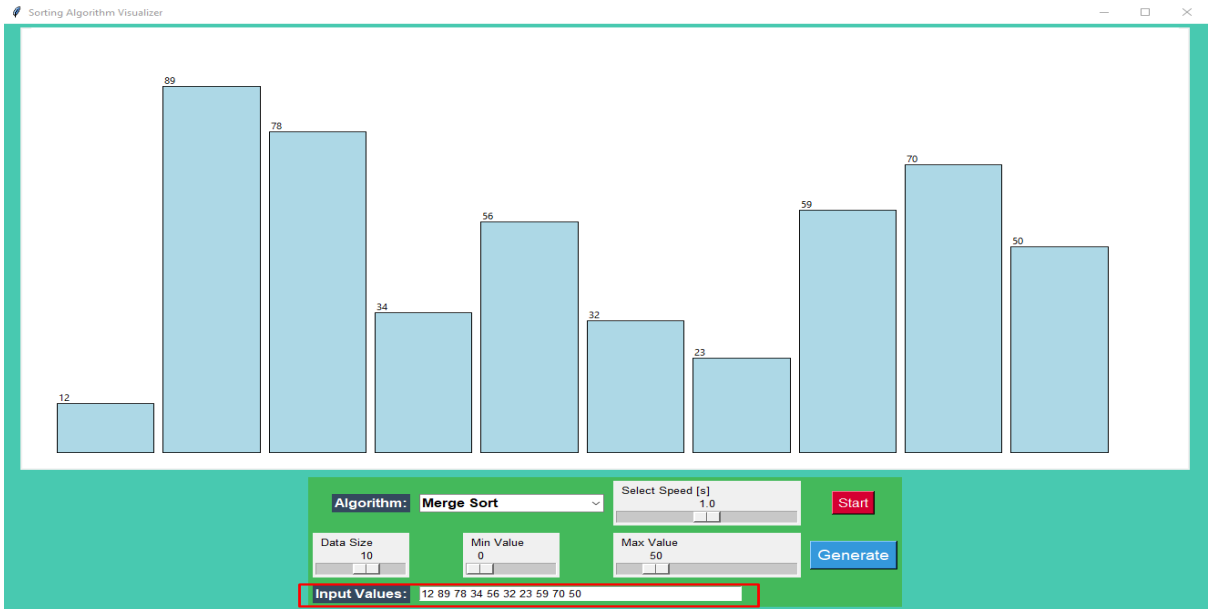
Input Control Panel: In this picture we can see that there are two types of user input called Random input generators & manually input integer values divided by space.



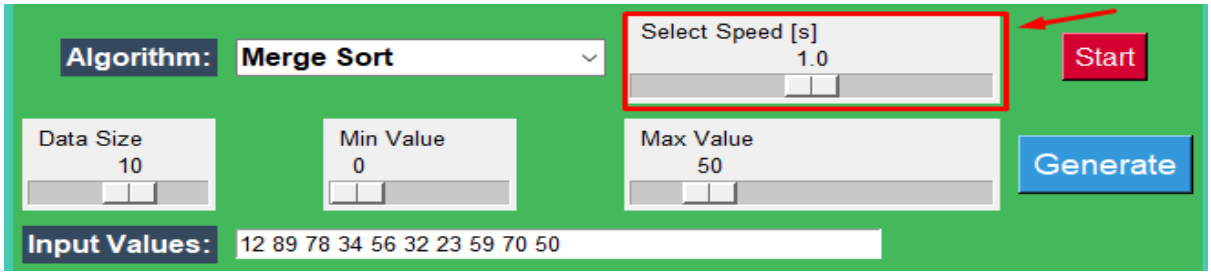
How to Use:



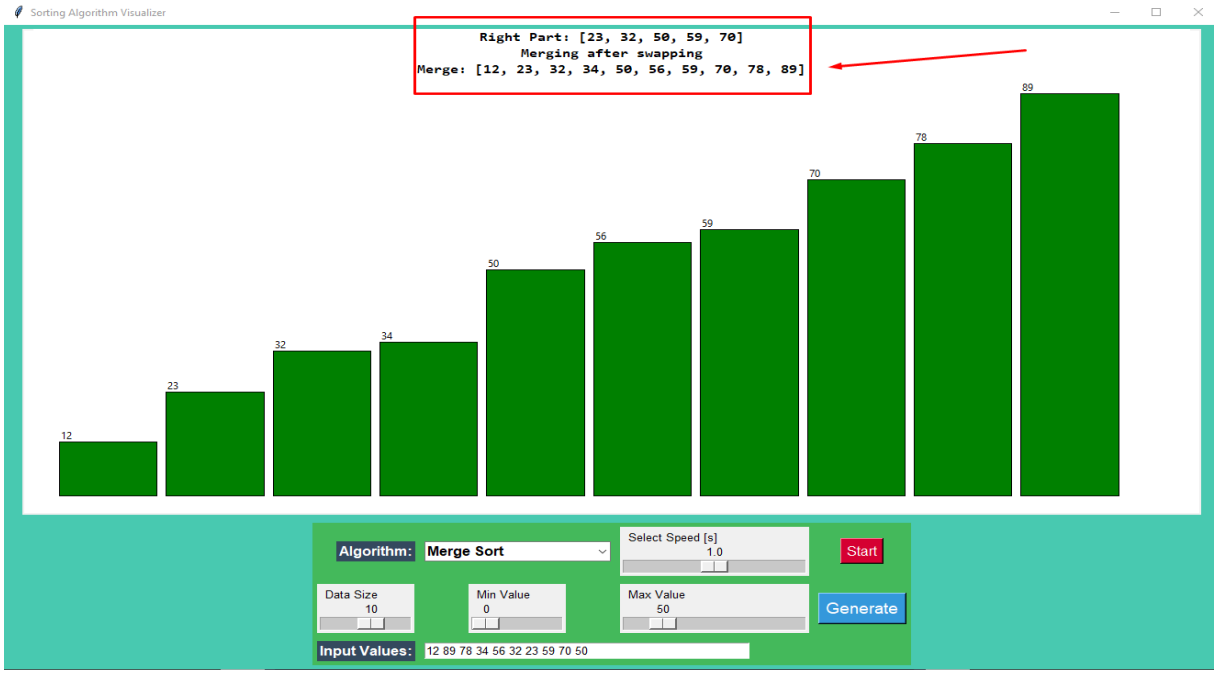
Input: Dragging the Slider (Data Size, Min Value, Max Value), We can change the Data Size, Min Value & Max Value of the input. Also Using the Input Values textbox, we can manually input the integers.



Speed Control: To control the speed of our algorithm we change the select speed slider. If we want the sorting in a slower manner, then we increase the slider or vice versa.



Sorting & Animation: Click on the "Start" button to begin the animation.



When the Sorting is finished. We can see a lists box animation top of the screen.

```
Right Part: [23, 32, 50, 59, 70]
Merging after swapping
Merge: [12, 23, 32, 34, 50, 56, 59, 70, 78, 89]
```

This List box is showing every iteration of the sorting.

Conclusion:

In conclusion, Merge Sort algorithm visualizations are an effective way to understand how this popular sorting algorithm works. By visually representing the algorithm's steps and processes, these visualizations can provide a clear and intuitive understanding of how Merge Sort sorts an array of elements.

Some of the benefits of Merge Sort algorithm visualizations include:

Improving comprehension: Visualizations can help individuals better grasp the core concepts behind Merge Sort and how it sorts an array of elements.

Enabling interactive learning: Interactive visualizations can provide a hands-on learning experience, allowing users to change the size and contents of the input array and observe how the algorithm responds.

Enhancing teaching and learning: Merge Sort algorithm visualizations can be an effective tool for teaching and learning, particularly for individuals who are new to computer science or programming.

Overall, Merge Sort algorithm visualizations can be a valuable resource for anyone looking to learn or teach this important algorithm.