

DOCUMENT FOR SOFTWARE DEVELOPMENT

LIFE CYCLE

a. Problem specification

- The challenges I faced while developing the project to compare sorting and searching algorithms.
- The major one was turning complicated concepts into codes and to create user-friendly interface, tracing comparisons during sorting.
- To handle the larger datasets as the size of the data given was 1000.
- I made it easier by breaking down the algorithms into smaller and more understandable steps.
- Ensuring correctness in both linear search on the original unsorted list and binary search on the sorted list after sorting could be challenging.
- The transition from an unsorted to a sorted list.
- Striving for accuracy in understanding and implementing each search method is essential for user comprehension.
- Organizing and managing different search algorithms in the code for straightforward comparison and analysis could be challenging in terms of structure and clarity.
- I developed the project which can be used in very easy way I have created a menu where the user can select any datatype, and any algorithms from the given data and it provides with accurate information.
- Also dealing with potential exceptions when reading from a file, such as file not found, file format issues, or reading errors.

b. Software Specifications:

CS401prj Constructor: Initializes the GUI components. Creates a frame, buttons, and menus for user interaction. Defines menu items for selecting data type, searching algorithms, and sorting algorithms. Adds action listeners to handle user selections.

actionPerformed Method: Handles button clicks and menu item selections. Determines user selections and initiates corresponding algorithms. Calls specific algorithms based on the selected data type and algorithm. Displays the result of algorithm execution.

Algorithms Invocation Methods:

LinearSearchInt.start() and Similar Methods: Initiates the execution of linear search algorithms for different data types. Generates a random target value or data. Calls the respective linear search algorithm for integers, doubles, or strings.

BinarySearchInt.start() and Similar Methods: Initiates the execution of binary search algorithms for different data types. Generates a random target value or data. Calls the respective binary search algorithm for integers, doubles, or strings.

Sorting Algorithms Invocation Methods: Initiates the execution of various sorting algorithms for different data types. Calls the respective sorting algorithm based on user selections.

main Method: Entry point for the program. Creates an instance of the CS401prj class to start the GUI.

Utility Method:

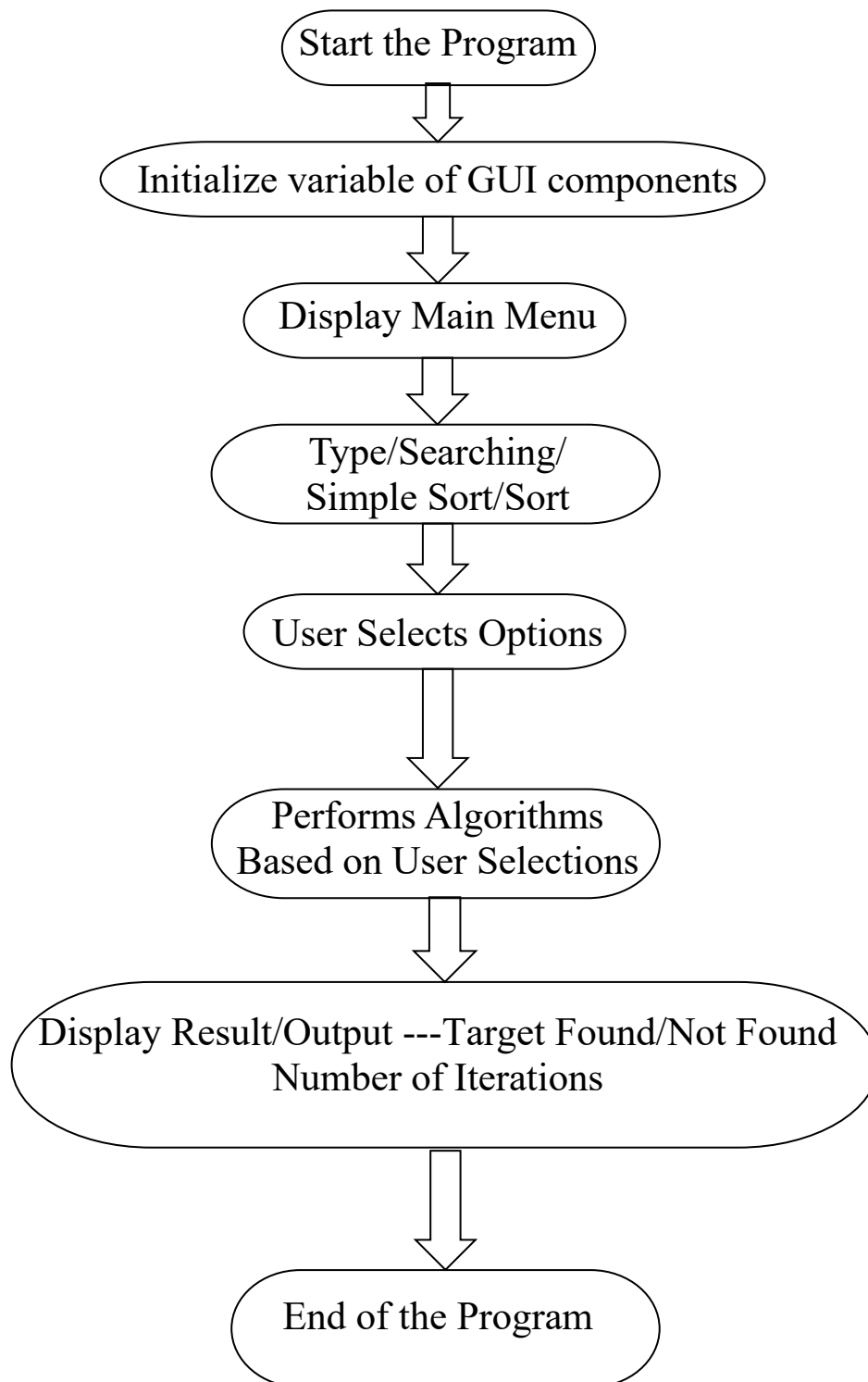
getRandomString Method: Generates a random string of a specified length. Constructs a random string using characters from the alphabet.

File Handling: Reads values from files.

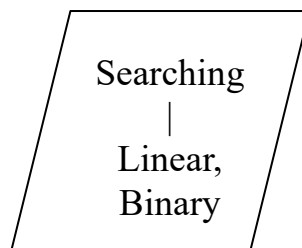
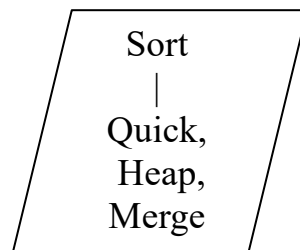
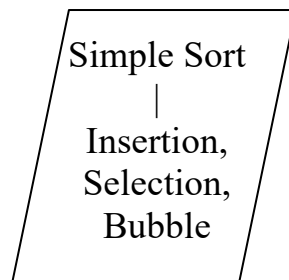
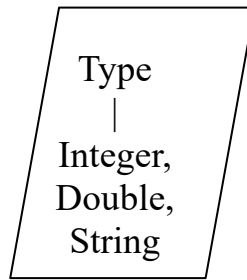
System.out.println Statements: Displays the original and sorted arrays, the target value, result index, whether the target is found, and the number of iterations.

IterationCountVariable: Keeps track of the number of iterations (comparisons). Incremented in each iteration of the binary search loop.

FLOWCHART FOR SORTING AND SEARCHING ALGORITHMS



Flowchart for Menu-



OPERATIONAL DOCUMENT:

How to run the Program:

After successfully running the code in Eclipse.

Extract the file from Eclipse and save it as JAR file.

Save the JAR file on your local computer/directory.

Open the Command Prompt on the same directory and type the command. `Java -jar Project.jar`

Then there will be a menu to select the datatype, simple sort, searching, sort.

In datatype user can choose integer, double, string.

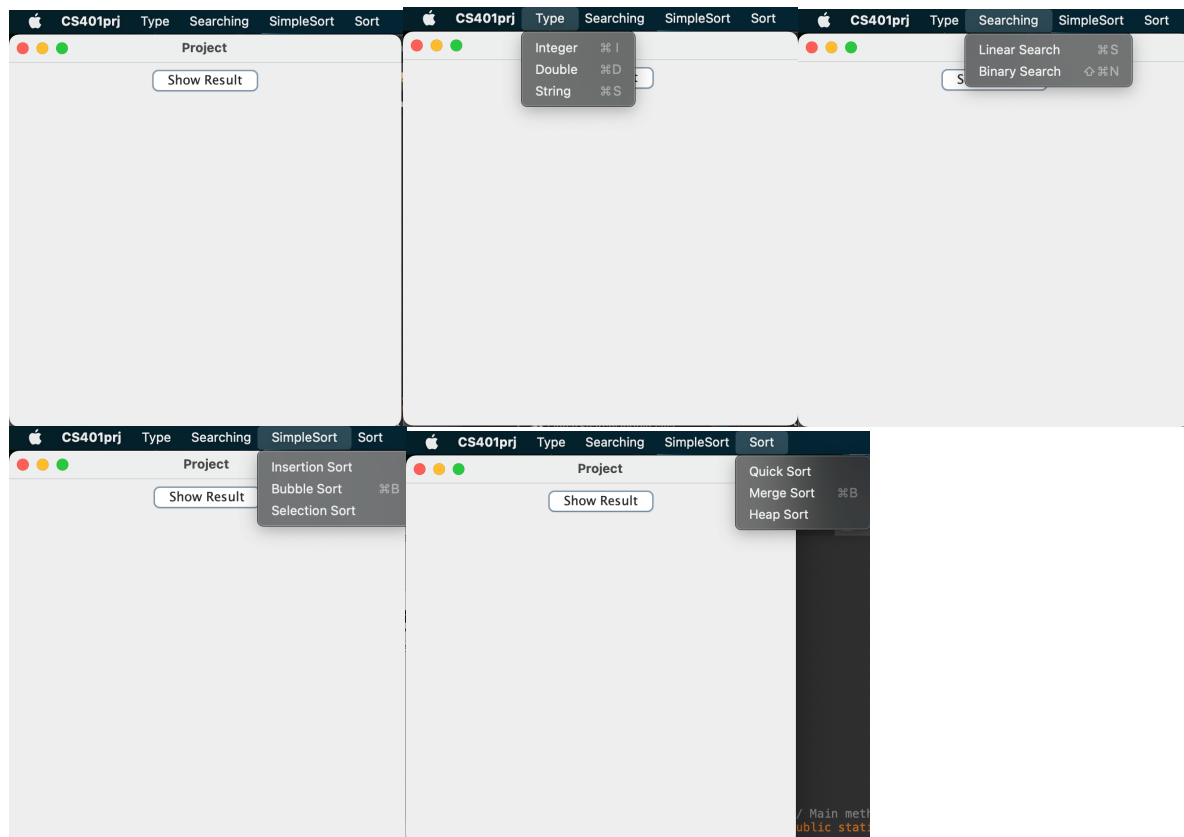
In simple sort user can choose Insertion, Selection, Bubble.

In sort user can choose Quick, Heap and Merge.

In searching user can choose Linear, Binary Search.

Now user can select preferred sorting and Searching algorithms.

Below is the image of how it's done ----



Output in Command Prompt:

Sorting Algorithms:

```
Problems Javadoc Declaration Console X
CS401prj [Java Application] /Users/mani/.p2/pool/plugins/org.eclipse.justj.openjdk.hotspot.jre.full.macosx.x86_64_17.0.9.v20231028-0858/jre/bin
Integer
Insertion Sort
Quick Sort
Show Result
Original List: [171, 458, 602, 20, 891, 75, 108, 203, 183, 488, 160, 570, 851, 589, 92, 988, 990, 802, 619]
Comparisons (Insertion Sort): 244660

Sorted List (Algorithm 1): [0, 1, 4, 5, 8, 8, 8, 10, 11, 13, 14, 14, 15, 19, 20, 21, 22, 23, 25, 26, 27, 27, 28, 31, 31]
Original Array: [171, 458, 602, 20, 891, 75, 108, 203, 183, 488, 160, 570, 851, 589, 92, 988, 990, 802, 619]
Sorted Array: [0, 1, 4, 5, 8, 8, 8, 10, 11, 13, 14, 14, 15, 19, 20, 21, 22, 23, 25, 26, 27, 27, 28, 31, 31]
Number of Iterations: 11457
```

```
Problems Javadoc Declaration Console X
CS401prj [Java Application] /Users/mani/.p2/pool/plugins/org.eclipse.justj.openjdk.hotspot.jre.full.macosx.x86_64_17.0.9.v20231028-0858/jre/bin
Integer
Bubble Sort
Quick Sort
Show Result
Original List: [171, 458, 602, 20, 891, 75, 108, 203, 183, 488, 160, 570, 851, 589, 92, 988, 990, 802, 619]
Comparisons (Bubble Sort): 499500

Sorted List (Algorithm 1): [0, 1, 4, 5, 8, 8, 8, 10, 11, 13, 14, 14, 15, 19, 20, 21, 22, 23, 25, 26, 27, 27, 28, 31, 31]
Original Array: [171, 458, 602, 20, 891, 75, 108, 203, 183, 488, 160, 570, 851, 589, 92, 988, 990, 802, 619]
Sorted Array: [0, 1, 4, 5, 8, 8, 8, 10, 11, 13, 14, 14, 15, 19, 20, 21, 22, 23, 25, 26, 27, 27, 28, 31, 31]
Number of Iterations: 11457
```

```
Problems Javadoc Declaration Console X
CS401prj [Java Application] /Users/mani/.p2/pool/plugins/org.eclipse.justj.openjdk.hotspot.jre.full.macosx.x86_64_17.0.9.v20231028-0858/jre/bin
Integer
Selection Sort
Quick Sort
Show Result
Original List: [171, 458, 602, 20, 891, 75, 108, 203, 183, 488, 160, 570, 851, 589, 92, 988, 990, 802, 619]
Comparisons (Selection Sort): 499500

Sorted List (Algorithm 1): [0, 1, 4, 5, 8, 8, 8, 10, 11, 13, 14, 14, 15, 19, 20, 21, 22, 23, 25, 26, 27, 27, 28, 31, 31]
Original Array: [171, 458, 602, 20, 891, 75, 108, 203, 183, 488, 160, 570, 851, 589, 92, 988, 990, 802, 619]
Sorted Array: [0, 1, 4, 5, 8, 8, 8, 10, 11, 13, 14, 14, 15, 19, 20, 21, 22, 23, 25, 26, 27, 27, 28, 31, 31]
Number of Iterations: 11457
```

Searching Algorithms:

```
Problems Javadoc Declaration Console X
CS401prj [Java Application] /Users/mani.p2/pool/plugins/org.eclipse.justj.openjdk.hotspot.jre.full.macosx.x86_64_17.0.9.v20231028-0858/jre/bin
Integer
Linear Search
Quick Sort
Show Result
Original Array: [171, 458, 602, 20, 891, 75, 108, 203, 183, 488, 160, 570, 851, 589, 92, 988, 990, 802, 6
Target Value: 11
Target found at index 377
Number of Iterations: 378
Original Array: [171, 458, 602, 20, 891, 75, 108, 203, 183, 488, 160, 570, 851, 589, 92, 988, 990, 802, 6
Sorted Array: [0, 1, 4, 5, 8, 8, 8, 10, 11, 13, 14, 14, 15, 19, 20, 21, 22, 23, 25, 26, 27, 27, 28, 31, 3
Number of Iterations: 11457
```

```
Problems Javadoc Declaration Console X
CS401prj [Java Application] /Users/mani.p2/pool/plugins/org.eclipse.justj.openjdk.hotspot.jre.full.macosx.x86_64_17.0.9.v20231028-0858/jre/bin
Integer
Binary Search
Quick Sort
Show Result
Original Array: [171, 458, 602, 20, 891, 75, 108, 203, 183, 488, 160, 570, 851, 589, 92, 988, 990, 802, 6
Sorted Array: [0, 1, 4, 5, 8, 8, 8, 10, 11, 13, 14, 14, 15, 19, 20, 21, 22, 23, 25, 26, 27, 27, 28, 31, 3
Number of Iterations: 11457
|
```

Output in Eclipse:

Sorting

```
C:\Windows\System32\cmd.exe - java -jar project.jar
Microsoft Windows [Version 10.0.19044.2605]
(c) Microsoft Corporation. All rights reserved.

C:\Users\91939\OneDrive\Desktop\siri\Project>java -jar project.jar
Integer
Insertion Sort
Quick Sort
Show Result
Original List: [171, 458, 602, 20, 891, 75, 108, 203, 183, 488, 160, 570, 851, 589, 92, 988, 990, 802, 619, 692, 339, 388, 566, 807, 109, 664, 299, 832, 28, 515, 116, 319, 476, 505, 595, 615, 468, 248, 689, 866,
980, 272, 54, 108, 519, 497, 618, 673, 136, 817, 362, 308, 937, 728, 382, 909, 839, 954, 504, 117, 786, 553, 855, 249, 552, 245, 273, 241, 632, 785, 407, 260, 764, 802, 210, 58, 887, 142, 371, 429, 590, 479, 44
0, 845, 916, 571, 547, 767, 390, 33, 212, 849, 13, 178, 511, 428, 513, 330, 184, 263, 698, 57, 411, 460, 522, 459, 280, 729, 743, 264, 923, 45, 700, 576, 994, 68, 719, 431, 895, 529, 557, 209, 901, 399, 354, 794
4, 422, 317, 869, 188, 229, 772, 229, 310, 440, 270, 124, 470, 557, 60, 114, 411, 188, 35, 670, 937, 210, 85, 591, 89, 751, 464, 354, 924, 687, 677, 52, 517, 127, 87, 494, 560, 547, 101, 442, 563, 308, 38, 917, 5
5, 36, 792, 205, 123, 63, 925, 537, 381, 927, 755, 239, 77, 615, 230, 760, 313, 420, 909, 344, 991, 436, 749, 66, 962, 486, 278, 280, 315, 161, 56, 944, 891, 889, 121, 843, 787, 435, 558, 623, 921, 42, 363, 764,
415, 874, 225, 115, 865, 10, 563, 681, 267, 783, 789, 108, 733, 27, 194, 5, 244, 436, 552, 483, 918, 728, 98, 912, 881, 942, 170, 229, 640, 745, 377, 377, 419, 14, 132, 326, 346, 140, 172, 748, 687, 723, 27, 36
7, 645, 636, 182, 396, 640, 537, 689, 193, 226, 684, 680, 242, 879, 932, 661, 95, 470, 975, 952, 330, 589, 253, 731, 479, 8, 678, 404, 493, 989, 907, 937, 529, 279, 752, 781, 481, 684, 443, 540, 934, 941, 398, 9
93, 642, 555, 745, 620, 633, 576, 400, 525, 917, 385, 980, 563, 961, 630, 420, 743, 407, 130, 77, 252, 421, 818, 168, 677, 329, 165, 271, 487, 310, 419, 348, 690, 239, 71, 552, 721, 752, 946, 392, 203, 43, 82, 6
71, 958, 936, 376, 220, 600, 934, 163, 107, 313, 558, 478, 114, 344, 256, 613, 778, 704, 525, 959, 453, 198, 786, 96, 774, 810, 742, 702, 4, 192, 939, 110, 193, 874, 392, 11, 39, 796, 423, 226, 178, 763, 130, 68
4, 345, 178, 497, 417, 483, 726, 317, 596, 727, 450, 258, 695, 426, 352, 554, 471, 830, 951, 927, 655, 386, 773, 690, 395, 822, 206, 956, 662, 638, 372, 100, 809, 856, 817, 293, 703, 820, 791, 546, 399, 352
633, 217, 431, 237, 922, 922, 145, 345, 251, 807, 877, 690, 947, 113, 595, 711, 222, 709, 19, 166, 976, 856, 574, 342, 209, 908, 75, 896, 819, 169, 756, 414, 259, 841, 266, 455, 577, 313, 995, 782, 760, 926, 22
3, 414, 54, 85, 139, 47, 124, 497, 816, 287, 242, 62, 549, 882, 539, 340, 756, 385, 686, 447, 188, 980, 349, 590, 283, 396, 531, 307, 900, 385, 253, 679, 649, 842, 986, 309, 919, 445, 867, 672, 124, 182, 374, 480
353, 161, 191, 272, 535, 229, 773, 919, 86, 400, 219, 764, 607, 961, 338, 937, 964, 470, 395, 240, 294, 338, 803, 522, 996, 610, 192, 873, 269, 277, 704, 71, 278, 862, 920, 539, 544, 991, 442, 797, 936, 804, 4
48, 846, 458, 97, 724, 602, 568, 344, 250, 75, 627, 739, 485, 459, 589, 562, 590, 46, 565, 450, 116, 801, 457, 155, 245, 419, 370, 971, 946, 174, 513, 588, 712, 530, 295, 71, 483, 111, 635, 52, 477, 980, 204, 0
156, 921, 554, 8, 50, 983, 866, 760, 454, 45, 61, 609, 831, 618, 206, 550, 249, 133, 812, 733, 896, 602, 596, 993, 769, 767, 441, 701, 489, 471, 941, 202, 404, 967, 401, 266, 695, 643, 143, 195, 314, 190, 118
235, 453, 989, 853, 922, 883, 735, 413, 979, 772, 787, 683, 490, 116, 286, 246, 833, 105, 368, 354, 933, 74, 153, 897, 369, 962, 941, 617, 23, 692, 521, 361, 142, 633, 392, 644, 477, 252, 143, 320, 778, 663, 282
769, 31, 430, 193, 759, 929, 537, 450, 758, 647, 880, 364, 555, 852, 854, 949, 772, 616, 552, 977, 928, 73, 239, 823, 518, 858, 625, 682, 522, 61, 917, 241, 466, 826, 293, 963, 886, 732, 102, 251, 246, 844, 31
5, 595, 510, 541, 640, 368, 924, 347, 154, 722, 513, 224, 684, 518, 126, 372, 596, 682, 270, 873, 68, 21, 849, 393, 260, 240, 434, 228, 908, 733, 918, 225, 255, 274, 724, 840, 836, 410, 260, 26, 414, 585, 8, 790
107, 637, 735, 330, 554, 22, 296, 113, 581, 668, 772, 774, 118, 965, 156, 558, 382, 645, 201, 171, 329, 998, 987, 35, 317, 79, 417, 587, 888, 25, 591, 433, 233, 180, 646, 421, 311, 223, 229, 387, 173, 260, 389
567, 865, 222, 930, 486, 665, 464, 413, 453, 579, 99, 974, 904, 31, 803, 543, 953, 165, 918, 972, 202, 34, 483, 663, 858, 320, 771, 296, 128, 723, 654, 801, 919, 224, 758, 687, 542, 304, 64, 332, 147, 994, 220
426, 587, 79, 481, 66, 504, 287, 501, 826, 128, 769, 865, 557, 286, 255, 286, 989, 617, 672, 878, 171, 979, 887, 57, 591, 93, 704, 818, 651, 569, 411, 133, 1, 946, 601, 183, 598, 621, 43, 610, 926, 685, 715, 9
08, 294, 555, 330, 259, 960, 944, 96, 863, 41, 37, 113, 195, 447, 902, 525, 994, 726, 595, 96, 562, 137, 575, 528, 592, 134, 874, 942, 672, 818, 150, 331, 358, 836, 503, 731, 950, 230, 118, 735, 260, 765, 235, 1
24, 545, 994, 788, 640, 411, 416, 470, 631, 840, 174, 614, 927, 119, 207, 765, 474, 807, 660, 838, 301, 356, 239, 197, 160, 436, 226, 478, 338, 819, 804, 15, 427, 263, 430, 787, 939, 699, 895, 996, 242, 331, 58,
508, 231, 769, 109, 288, 812, 816, 432, 702, 695, 299, 434, 57]
Comparisons (Insertion Sort): 244660

Sorted List (Algorithm 1): [0, 1, 4, 5, 8, 8, 8, 10, 11, 13, 14, 15, 16, 18, 20, 21, 22, 23, 25, 26, 27, 27, 28, 31, 31, 33, 34, 35, 35, 36, 37, 38, 39, 41, 42, 43, 43, 45, 45, 46, 47, 48, 50, 52, 52, 54, 54, 55, 56
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194, 194, 195, 195, 197, 197, 198, 198, 198, 201, 202, 203, 203, 204, 205, 206, 207, 208, 209, 210, 212, 217, 218, 219, 220, 220, 222, 222, 223, 223, 224, 224, 225, 225, 226, 226, 226, 228, 229, 229, 229, 229, 230
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70, 470, 470, 471, 471, 474, 476, 477, 477, 478, 478, 479, 479, 481, 481, 483, 483, 483, 485, 485, 486, 487, 488, 489, 490, 490, 491, 493, 494, 497, 497, 497, 501, 501, 503, 504, 504, 505, 508, 510, 511, 511, 511, 513, 513, 513, 518, 518, 519, 521, 522, 522, 522, 525, 525, 525, 528, 529, 529, 530, 534, 535, 537, 537, 537, 539, 539, 540, 541, 542, 543, 544, 546, 546, 547, 547, 549, 551, 552, 552, 552, 552, 553, 554
554, 555, 555, 555, 557, 557, 557, 558, 558, 558, 560, 562, 562, 563, 563, 563, 565, 566, 567, 568, 569, 570, 571, 574, 575, 576, 576, 577, 579, 585, 587, 587, 588, 589, 589, 590, 590, 591, 591, 591, 592, 595, 595, 595, 595, 596, 596, 596, 598, 598, 600, 601, 602, 602, 602, 603, 604, 604, 606, 607, 610, 610, 610, 613, 614, 615, 615, 616, 617, 618, 619, 621, 623, 625, 627, 627, 628, 631, 632, 633, 633, 633, 633, 635, 636, 638, 638, 640, 640, 642, 643, 644, 645, 646, 647, 649, 649, 651, 654, 655, 657, 660, 661, 662, 663, 663, 664, 665, 666, 670, 671, 671, 672, 672, 673, 677, 677, 678, 679, 680, 681, 682, 682, 684, 685, 6
```



Microsoft Windows [Version 10.0.19044.2965]
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[illegible][illegible]

Microsoft Windows [Version 10.0.19044.2965]
(c) Microsoft Corporation. All rights reserved.

[illegible][illegible]

Searching

 C:\Windows\System32\cmd.exe - java -jar project.jar

Microsoft Windows [Version 10.0.19044.2965]
(c) Microsoft Corporation. All rights reserved.

C:\Users\91939\OneDrive\Desktop\isri\Project>java -jar project.jar

Integer

Linear Search

Quick Sort

Show Result


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Microsoft Windows [Version 10.0.19044.2965]
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Integer

Binary Search

Quick Sort

Show Result

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Project Management

The Project Initialization and Planning it took me about 4 hours to project objectives and requirements and understanding it. To outline what the project is and its needs.

Implementing Sorting Algorithms

for Simple sort I took about 5 hours as I separated each sorting --Selection Sort, Insertion Sort, or Bubble Sort. For $O(N\log^2 N)$ sorting algorithm Quick Sort, Merge Sort, or Heap Sort I took 5-6 hours.

Test the sorting algorithms around 3 hours.

Integration of Sorting Algorithms and to Combine sorting algorithms into the main program and Enable users to select sorting algorithms for 4 hours.

To Implementing Searching Algorithms and all its functions it took me around 4 hours and to implement and test the searching for linear and binary it took me more.

I used some functions where it allows user to choose specific algorithms and datatypes where it took me 3 hours.

After all the coding part and error checking it took me extra 2 hours.

Finally, the documentation part took me 3 hours.