DATA STRUCTURES & ALGORITHM

Marasigan, Vem Aiensi A.
1-BSCS-.2

Ma'am Mary Jane Lima
May 3, 2022

SOURCE CODE

```
package binary_Search_Tree;
import java.util.Scanner;
import java.util.concurrent.TimeUnit;

public class BSCS2_Marasigan_Binary
{
	public static void main(String[] args)
	{
		Tools.Head();
		Tools.OptionLoop();
		Tools.end();
	}
}

class Sort
{//I used quick sort because it's quick!
	static int[] array = {5, 3, 4, 1, 2}; // just an initialization
	Sort()
	{
		String decision = " ";
		if (Sorted(array, 0, array.length-1))
		{
			decision = "  Array is already sorted\n";
			Tools.Print(decision, 0, decision.length(), 20);
		}	//String, start, end, speed
		else
		{
			decision = "  Sorting really quick. Please wait...\n";
			Tools.Print(decision, 0, decision.length()-4, 20);
			Tools.Print(decision, decision.length()-4, decision.length(), 1000);
			quickSort(0, array.length-1);
		}
	}

	static void quickSort(int start, int end)
	{
		if (start<end)
		{
			Tools.PrintArray(array, start, end);
			//shows the elements that is currently being operated
		}

		if (start<end)
		{
			int spliter = split(start, end);
			quickSort(start, spliter-1);
			quickSort(spliter+1, end);
		}
	}

	static int split(int start, int end)
	{
		int pivot = array[start];
		int i = start+1, j=end;

		while (i<j)
		{//Ma'am's algorithm
			while(pivot >= array[i] && i < end)
				i++;

			while (pivot < array[j])
				j--;
```

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```
                if (i < j)
                        Swap(i, j);

                }
                if (array[j] < pivot)
                        Swap(j, start);

                return j;
        }

        static void Swap(int index1, int index2)
        {
                int swap = array[index1];
                array[index1] = array[index2];
                array[index2] = swap;
        }

        static boolean Sorted(int[] array, int start, int end)
        {
                for (; start < end; start++)
                {
                        if (array[start+1] < array[start] )
                        {
                                return false;//means it's not sorted yet
                        }
                }
                return true; //break
                /* Note: since this checker that is responsible for breaks is working properly
                I decided to replace the algorithm a little to make use of its effectiveness*/
        }
}

class Search
{
        static int[] array = { 5, 8, 6, 10, -1, 9}; //for testing purposes and initialization only
        static String answer = "  HISTORY: ";//records the events of recursion

        Search(int[] array)
        {
                Search.array = array;
        }
        static void number(int searchNum)
        {
                String find = "  Finding " + searchNum + "...\n";
                Tools.Print(find, 0,find.length()-4, 10);
                Tools.Print(find, find.length()-4,find.length(), 1000);
                binarySearch(searchNum, 0, array.length);
        }

        static void binarySearch(int number, int start, int end)
        {
                int range = end - start; //limits the range of search
                int add = range / 2;
                if (range%2 == 1)
                {//imitates the CEIL algorithm
                        add++;
                }

                int index = add+start-1;
                /*array starts at 0..n index must decrease by 1 because that's how array index works
                  this way elements, elements does not shift when array[index] < number to be searched */
                if (index < 0)
                {
                        answer += number +" not found";
                        //ends the method because there will be a time that the index is -1
```

```
                        //when both start and end becomes 0 during the recursion
                        //this happens when the number we are looking for is less than the first element
                        return;
                }

                Tools.PrintArray(array, index, index);
                if(array[index] == number)
                {//if element is found!
                        answer += number + " is found";
                        return;
                }

                answer += array[index] + ", ";
                if ( range == 1 && array[index] != number)
                {//if only 1 element remains and that element is not the number, (end)
                        answer += number +" not found";
                        return;
                }
                if (array[index] > number)
                {//look from start to end of the range (left side)
                        binarySearch( number, start, index);
                }
                else
                {//look from start to end of the range (right side)
                        binarySearch( number, index+1, end);
                }
        }
}

class Tools
{
        static Scanner in = new Scanner(System.in);
        //Main Tools
        static int[] CreateArray()
        {//this creates an array automatically without typing its size

                String entry = in.nextLine();
                String stringArray[];
                stringArray = entry.split(" ");
                /*it uses a string and splits elements by spaces
                  which is then converted to an integer array*/

                int array[] = new int[stringArray.length];
                for (int count = 0; count < array.length; count++)
                {
                        array[count] = Integer.parseInt(stringArray[count]);
                }
                return array;
        }

        static void OptionLoop()
        {
                String phrase;
                char choice = 'y';

                while (recurse(choice))
                {
                        phrase = "\n  Please type the elements of the array: ";
                        Tools.Print(phrase, 0, phrase.length(), 10);
                        Sort.array = Tools.CreateArray();

                        new Sort();//checks if the array is sorted or not
                        int[] sorted_array = Sort.array;

                        Tools.PrintArray(sorted_array, 0, sorted_array.length-1);//Prints w/ style
```

```
                    new Search(sorted_array);
                    while (recurse(choice))
                    {
                            phrase = "\n  Please type the element to be Searched: ";
                            Tools.Print(phrase, 0, phrase.length(), 20);
                            Search.number(in.nextInt());
                            Tools.Print(Search.answer + "\n", 0, (Search.answer + "\n").length(), 20);

                            phrase = "  Do you want to search another element? [Y/N] ";
                            Tools.Print(phrase, 0, phrase.length(), 20);
                            choice = in.next().charAt(0);
                            Search.answer = "  HISTORY: "; //resets the answer
                    }

                    phrase = "  Do you want enter another array? [Y/N] ";
                    Tools.Print(phrase, 0, phrase.length(), 20);
                    choice = in.next().charAt(0);
                    in.nextLine();
            }
    }

    static boolean recurse(char choice)
    {
            boolean recurse = true;
            if (choice == 'y' || choice == 'Y')
                    return true;

            else if (choice == 'n' || choice == 'N')
                    return false;

            return recurse;
    }

    static void PrintArray(int[] array,int start, int end)
    {
            int count = 0;
            System.out.print("\t");
            for (; count < start; count++)
                    {
                    System.out.print("\t");
            }

            //prints roof depending on the elements within the range
            System.out.print(".");
            for (; count < end+1; count++)
            {
                    if(count<end)
                    {
                            System.out.print("--------");
                    }
                    else
                    {
                            System.out.print("-------.\n");
                    }
            }

            //prints the array and the separation of the elements within the range
            System.out.print("\t");
            for (count = 0; count < start; count++)
            {
                    System.out.print(array[count] + "\t");
            }
            System.out.print("|");
            for (; count < end+1; count++)
```

```
            {
                System.out.print(array[count] + "\t");
            }
            System.out.print("|");
            for (; count < array.length; count++)
            {
                System.out.print(array[count] + "\t");
            }
            System.out.println();

            System.out.print("\t");
            for (count= 0; count < start; count++)
            {
                System.out.print("\t");
            }
            System.out.print("""");

            //prints floor
            for (; count < end+1; count++)
            {
                if(count<end)
                {
                    System.out.print("--------");
                }
                else
                {
                    System.out.print("-------'");
                }
            }

            Tools.Print("\n", 0, 1, 500); //just a small delay
        }

        static void Print(String text, int start, int end, int speed)
        {
            try
            {
                for (int count = start; count<end; count++)
                {
                    System.out.print(text.charAt(count));
                    TimeUnit.MILLISECONDS.sleep(speed);
                }
            }
            catch (Exception e) { }
        }
        //Design tools
        static void Head()
        {
            String note = "        .-[ Note ]--------------------------------------------------.\n"
                        + "        |   Please enter all elements in one line only. Press space   |\n"
                        + "        |   after entering an element for entering the next element.  |\n"
                        + "        |            Just like: 5 4 3 9 2 1 90 -10 34 40              |\n"
                        + "        |   Please follow the way of entering elements for correct    |\n"
                        + "        |                  data processing -_-                        | \n"
                        + "        '------------------------------------------------------------'\n";
            String arrow ="                                                    .\r\n"
                        + "                                                        .\r\n"
                        + "                                                    .  '\r\n"
                        + "                                                 .:'\r\n"
                        + "                                               ::.\r\n"
                        + "                                             :.::\r\n"
                        + "                                           ::::.\r\n"
                        + "                                        :::::\r\n"
                        + "                                      :::::\r\n"
                        + "                                     :::::\r\n"
```

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```
                                        + "                                  :::::\r\n"
                                        + "                                  :::::\r\n"
                                        + "                                .::::::..\r\n"
                                        + "                                ':::::'\r\n"
                                        + "                                  ':'\r\n";
                String bst =  "  .-----------------------------------\\\ /-----------------------------------.\n"
                                        + " |                                                /\\|\\/\\\           |\r\n"
                                        + " |     .__________________________________________..                _)    (__
|\r\n"
                                        + " |    /    W E L C O M E    T O      //              \\_     _/ _        |\r\n"
                                        + " |    '================================="                          )    \\_/ \\
|\r\n"
                                        + " |                                                  \\/\\ \\/   /        |\r\n"
                                        + " |  ____________.__                                    /        \\       |\r\n"
                                        + " |  \\_______    \\__| _____ ______ ________ ____.__.          /\\|\\/\\     /\\|\\/\\
|\r\n"
                                        + " |    |    -  _/  |/    \\\\__  \\\\_  __ <   | |        _)    (    _)    (__    |\r\n"
                                        + " |    |    __  \\  |    |  \\/ __ \\|  | \\/\\____  |        \\_               _/    |\r\n"
                                        + " |    |_______ /__|____| (_____  /__|   / _____|          )    \\\          \\     |\r\n"
                                        + " |            \\/        \\/     \\/          \\/\\/\\|\\/      /\\|\\/     |\r\n"
                                        + " |  ____________                    .__            /\\/\\\ ._._/       /\\  |\r\n"
                                        + " |    /  ______/ _____ ______ ________  _____ |  |__          )/)/ | |         )/  |\r\n"
                                        + " |    \\_____  \\_/ __ \\\\__  \\\\_  __ \\_/ ___\\|  | \\\              |_|           |\r\n"
                                        + " |    /       \\  ___/ / __ \\|  | \\/\\  \\___|   Y  \\\            |-|           |\r\n"
                                        + " |   /_________ /\\\____  >_____ /__|    \\\____  >___|  /            | |           |\r\n"
                                        + " |           \\/     \\/     \\/           \\/     \\/           |_|           |\n"
                                        + " '---------------------------------------------- BY: VEM AIENSI MARASIGAN ^._.^ --
'\r\n";

        //prints note ( w/ manual delay manipulation)
        Print(note, 0, 252, 20);
        Print(note, 252, 276, 300);
        Print(note, 276, note.length()-5, 20);
        Print(note, note.length()-5, note.length(), 1000);

        //Prints arrow
        Print(arrow, 0, arrow.length(), 1);

        //Printing Binary Search logo (Note* this is manual tweaking)
        int count = 0;
        for (int line = 1; line<21; line++, count += 82)
        {
                Print(bst, count, 82*line, 0);
                Print(" ", 0, 1, 150);//delay
        }
}

static void end()
{
        String end = "\n\n\n\n\n\n\n\n\n\n\n\n\n"
                        + "\t            *     ,1111111.           *\r\n"
                        + "\t                 11111111111    .\r\n"
                        + "\t                111111111111\r\n"
                        + "\t      *         111111111111\r\n"
                        + "\t                111111111111\r\n"
                        + "\t                '11111111111'\r\n"
                        + "\t                 '1111111'      *\r\n"
                        + "\t           |\\___/|      -\r\n"
                        + "\t           )     (             .              '\r\n"
                        + "\t          =\\     /=\r\n"
                        + "\t            )===(       *\r\n"
                        + "\t           /     \\\r\n"
                        + "\t           |     |\r\n"
                        + "\t          /       \\\r\n"
                        + "\t          \\       /\r\n"
```

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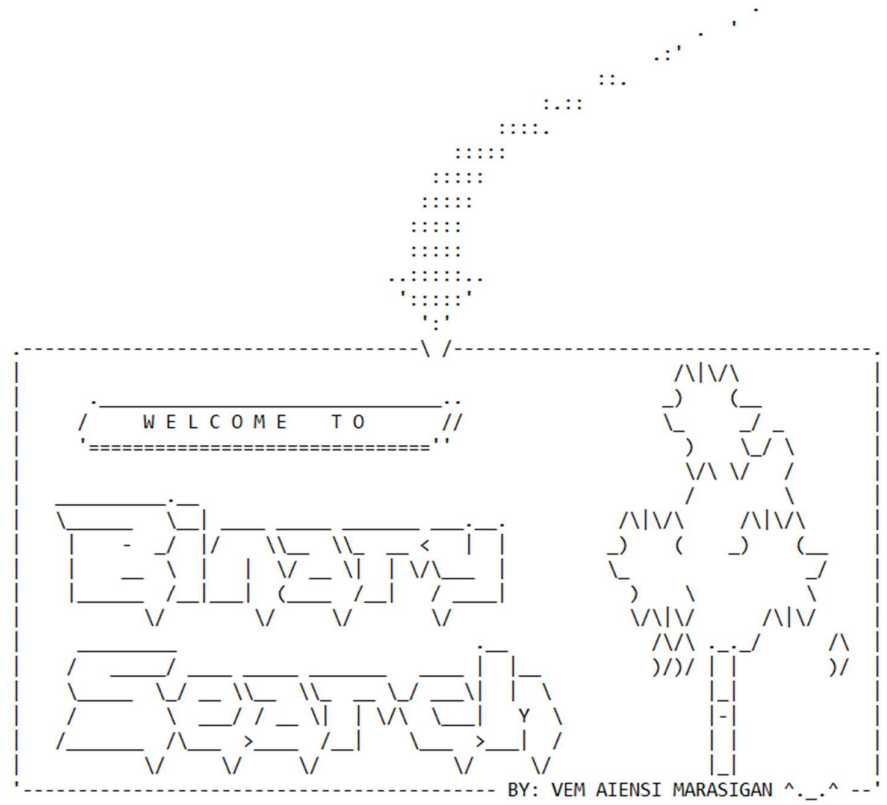
```
                + "\t   _/\\_/\\_/\\__  _/_/\\_/\\_/\\_/\\_/\\_/\\_/\\_/\\_/\\_\r\n"
                + "\t  | | | |( ( | | | | | | | | |\r\n"
                + "\t  | | | | ) ) | | | THANK YOU PO | |  |\r\n"
                + "\t  | | | |(_( | | | | | | | | |  |\r\n"
                + "\t  | | | | | | BY: VEM AIENSI MARASIGAN |\r\n"
                + "\t  | | | | | | | | | | | | | | |\n"
                + "\n\n\n\n\n\n\n\n\n\n";

        String credits = "\t            ASCII arts are from: \n"
                + "\t http://user.xmission.com/~emailbox/ascii_cats.html\n"
                + "\t         and patorjk.com/software/taag";

        Print(end, 0, end.length(), 5);
        Print(credits, 0, credits.length(), 30);
    }
}
```

SCREENSHOTS OF OUTPUT

```
.-[ Note ]-----------------------------------------------------.
|   Please enter all elements in one line only. Press space   |
|   after entering an element for entering the next element.  |
|             Just like: 5 4 3 9 2 1 90 -10 34 40             |
|   Please follow the way of entering elements for correct    |
|                    data processing -_-                      |
'-------------------------------------------------------------'
```




```
Please type the elements of the array: 93 17 20 77 65 26 32 55 44 54
```

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```
Sorting really quick. Please wait...
.-------------------------------------------------------------------------------.
|93     17      20      77      65      26      32      55      44      54      |
'-------------------------------------------------------------------------------'

.-----------------------------------------------------------------------.
|54     17      20      77      65      26      32      55      44      |93
'-----------------------------------------------------------------------'

.---------------------------------------.
|26     17      20      44      32      |54     65      55      77      93
'---------------------------------------'

.---------------.
|20     17      |26     44      32      54      65      55      77      93
'---------------'

                .---------------.
17      20      26      |44     32      |54     65      55      77      93
                '---------------'

                                        .-----------------------.
17      20      26      32      44      54      |65     55      77      |93
                                        '-----------------------'

.-------------------------------------------------------------------------------.
|17     20      26      32      44      54      55      65      77      93      |
'-------------------------------------------------------------------------------'

Please type the element to be Searched: 54
Finding 54...
                        .-------.
17      20      26      32      |44     |54     55      65      77      93
                        '-------'

                                        .-------.
17      20      26      32      44      54      55      |65     |77     93
                                        '-------'

                                .-------.
17      20      26      32      44      |54     |55     65      77      93
                                '-------'

HISTORY: 44, 65, 54 is found
Do you want to search another element? [Y/N] y


Please type the element to be Searched: 20
Finding 20...
                        .-------.
17      20      26      32      |44     |54     55      65      77      93
                        '-------'

                .-------.
17      |20     |26     32      44      54      55      65      77      93
                '-------'

HISTORY: 44, 20 is found
Do you want to search another element? [Y/N] y

Please type the element to be Searched: 93
Finding 93...
                        .-------.
17      20      26      32      |44     |54     55      65      77      93
                        '-------'

                                        .-------.
17      20      26      32      44      54      55      |65     |77     93
                                        '-------'

                                                .-------.
17      20      26      32      44      54      55      65      |77     |93
                                                '-------'

                                                        .-------.
17      20      26      32      44      54      55      65      77      |93     |
                                                        '-------'

HISTORY: 44, 65, 77, 93 is found
Do you want to search another element? [Y/N] y
```

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```
Please type the element to be Searched: 32
Finding 32...
                                  .-------.
      17      20      26      32  |44     |54      55      65      77      93
                                  '-------'
              .-------.
      17      |20     |26      32      44      54      55      65      77      93
              '-------'
                      .-------.
      17      20      |26     |32      44      54      55      65      77      93
                      '-------'
                                  .-------.
      17      20      26      32  |44     |54      55      65      77      93
                                  '-------'
HISTORY: 44, 20, 26, 32 is found
Do you want to search another element? [Y/N] y

Please type the element to be Searched: -1
Finding -1...
                                  .-------.
      17      20      26      32  |44     |54      55      65      77      93
                                  '-------'
              .-------.
      17      |20     |26      32      44      54      55      65      77      93
              '-------'
      .-------.
      |17     |20      26      32      44      54      55      65      77      93
      '-------'
HISTORY: 44, 20, 17, -1 not found
Do you want to search another element? [Y/N] Y

Please type the element to be Searched: 19
Finding 19...
                                  .-------.
      17      20      26      32  |44     |54      55      65      77      93
                                  '-------'
              .-------.
      17      |20     |26      32      44      54      55      65      77      93
              '-------'
      .-------.
      |17     |20      26      32      44      54      55      65      77      93
      '-------'
HISTORY: 44, 20, 17, 19 not found
Do you want to search another element? [Y/N] y


Please type the element to be Searched: 31
Finding 31...
                                  .-------.
      17      20      26      32  |44     |54      55      65      77      93
                                  '-------'
              .-------.
      17      |20     |26      32      44      54      55      65      77      93
              '-------'
                      .-------.
      17      20      |26     |32      44      54      55      65      77      93
                      '-------'
                                  .-------.
      17      20      26      32  |44     |54      55      65      77      93
                                  '-------'
HISTORY: 44, 20, 26, 32, 31 not found
Do you want to search another element? [Y/N] Y
```

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```
Please type the element to be Searched: 55
Finding 55...
      17      20      26      32      .-------.      55      65      77      93
                                      |44     |54
                                      '-------'
      17      20      26      32      44      54      55      .-------.      93
                                                              |65     |77
                                                              '-------'
      17      20      26      32      44      .-------.      55      65      77      93
                                              |54     |55
                                              '-------'
      17      20      26      32      44      54      .-------.      65      77      93
                                                      |55     |65
                                                      '-------'
HISTORY: 44, 65, 54, 55 is found
Do you want to search another element? [Y/N] y

Please type the element to be Searched: 56
Finding 56...
      17      20      26      32      .-------.      55      65      77      93
                                      |44     |54
                                      '-------'
      17      20      26      32      44      54      55      .-------.      93
                                                              |65     |77
                                                              '-------'
      17      20      26      32      44      .-------.      55      65      77      93
                                              |54     |55
                                              '-------'
      17      20      26      32      44      54      .-------.      65      77      93
                                                      |55     |65
                                                      '-------'
HISTORY: 44, 65, 54, 55, 56 not found
Do you want to search another element? [Y/N] Y

Please type the element to be Searched: 91
Finding 91...
      17      20      26      32      .-------.      55      65      77      93
                                      |44     |54
                                      '-------'
      17      20      26      32      44      54      55      .-------.      93
                                                              |65     |77
                                                              '-------'
      17      20      26      32      44      54      55      65      .-------.      .-------.
                                                                      |77     |93     |
                                                                      '-------'      '-------'
      17      20      26      32      44      54      55      65      77      .-------.
                                                                              |93     |
                                                                              '-------'
HISTORY: 44, 65, 77, 93, 91 not found
Do you want to search another element? [Y/N] y

Please type the element to be Searched: 1000
Finding 1000...
      17      20      26      32      .-------.      55      65      77      93
                                      |44     |54
                                      '-------'
      17      20      26      32      44      54      55      .-------.      93
                                                              |65     |77
                                                              '-------'
      17      20      26      32      44      54      55      65      .-------.      .-------.
                                                                      |77     |93     |
                                                                      '-------'      '-------'
      17      20      26      32      44      54      55      65      77      .-------.
                                                                              |93     |
                                                                              '-------'
HISTORY: 44, 65, 77, 93, 1000 not found
Do you want to search another element? [Y/N] Y
```

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```
Please type the element to be Searched: 54
Finding 54...
      17      20      26      32      .-------.
                                      |44     |54      55      65      77      93
                                      '-------'

                                                      .-------.
      17      20      26      32      44      54      55      |65     |77      93
                                                      '-------'

                                              .-------.
      17      20      26      32      44      |54     |55      65      77      93
                                              '-------'

HISTORY: 44, 65, 54 is found
Do you want to search another element? [Y/N] N
Do you want enter another array? [Y/N] Y

Please type the elements of the array: 1 4 6 7 12 13 15 18 19 20 22 24
Array is already sorted
      .-----------------------------------------------------------------------------------------------.
      |1      4       6       7       12      13      15      18      19      20      22      24      |
      '-----------------------------------------------------------------------------------------------'

Please type the element to be Searched: 20
Finding 20...
      1       4       6       7       12      .-------.
                                              |13     |15      18      19      20      22      24
                                              '-------'

                                                              .-------.
      1       4       6       7       12      13      15      18      |19     |20      22      24
                                                              '-------'

                                                                      .-------.
      1       4       6       7       12      13      15      18      19      20      |22     |24
                                                                      '-------'

                                                              .-------.
      1       4       6       7       12      13      15      18      19      |20     |22      24
                                                              '-------'

HISTORY: 13, 19, 22, 20 is found
Do you want to search another element? [Y/N] Y

Please type the element to be Searched: -20
Finding -20...
      1       4       6       7       12      .-------.
                                              |13     |15      18      19      20      22      24
                                              '-------'

                      .-------.
      1       4       |6      |7       12      13      15      18      19      20      22      24
                      '-------'

      .-------.
      |1      |4      6       7       12      13      15      18      19      20      22      24
      '-------'
HISTORY: 13, 6, 1, -20 not found
Do you want to search another element? [Y/N] Y

Please type the element to be Searched: 4
Finding 4...
      1       4       6       7       12      .-------.
                                              |13     |15      18      19      20      22      24
                                              '-------'

                      .-------.
      1       4       |6      |7       12      13      15      18      19      20      22      24
                      '-------'

      .-------.
      |1      |4      6       7       12      13      15      18      19      20      22      24
      '-------'

              .-------.
      1       |4      |6       7       12      13      15      18      19      20      22      24
              '-------'

HISTORY: 13, 6, 1, 4 is found
Do you want to search another element? [Y/N] Y
```

DATA STRUCTURES & ALGORITHM

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```
Please type the element to be Searched: 18
Finding 18...
      1       4       6       7       12      .-------.
                                              |13     |15      18      19      20      22      24
                                              '-------'
                                                              .-------.
      1       4       6       7       12      13      15      18      |19     |20      22      24
                                                              '-------'
                                              .-------.
      1       4       6       7       12      13      |15     |18      19      20      22      24
                                              '-------'
                                                              .-------.
      1       4       6       7       12      13      15      |18     |19      20      22      24
                                                              '-------'
HISTORY: 13, 19, 15, 18 is found
Do you want to search another element? [Y/N] Y

Please type the element to be Searched: 25
Finding 25...
      1       4       6       7       12      .-------.
                                              |13     |15      18      19      20      22      24
                                              '-------'
                                                              .-------.
      1       4       6       7       12      13      15      18      |19     |20      22      24
                                                              '-------'
                                                                                      .-------.
      1       4       6       7       12      13      15      18      19      20      |22     |24
                                                                                      '-------'
                                                                                              .-------.
      1       4       6       7       12      13      15      18      19      20      22      |24     |
                                                                                              '-------'
HISTORY: 13, 19, 22, 24, 25 not found
Do you want to search another element? [Y/N] Y

Please type the element to be Searched: 20
Finding 20...
      1       4       6       7       12      .-------.
                                              |13     |15      18      19      20      22      24
                                              '-------'
                                                              .-------.
      1       4       6       7       12      13      15      18      |19     |20      22      24
                                                              '-------'
                                                                                      .-------.
      1       4       6       7       12      13      15      18      19      20      |22     |24
                                                                                      '-------'
                                                                              .-------.
      1       4       6       7       12      13      15      18      19      |20     |22      24
                                                                              '-------'
HISTORY: 13, 19, 22, 20 is found
Do you want to search another element? [Y/N] N
Do you want enter another array? [Y/N] n
```

DATA STRUCTURES & ALGORITHM

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Ma'am Mary Jane Lima
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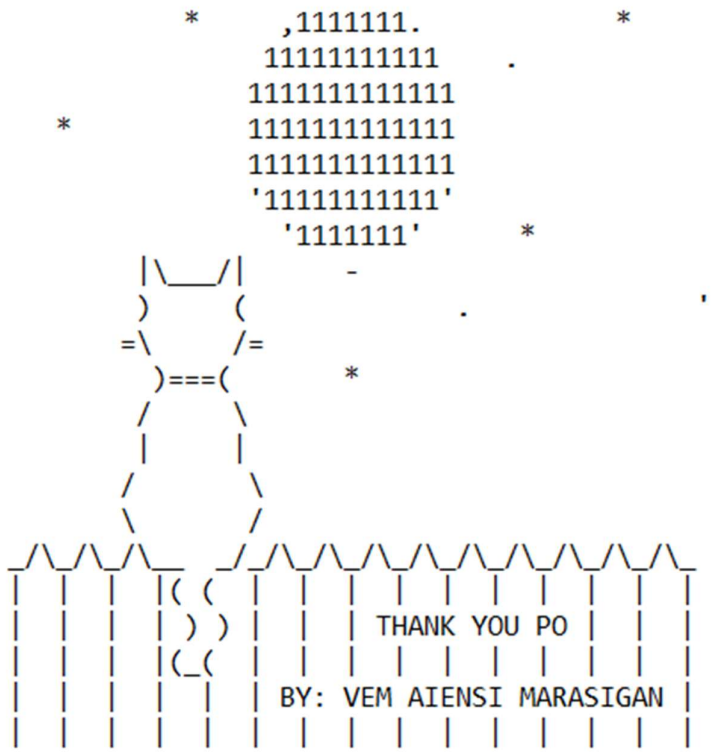

ASCII arts are from:
http://user.xmission.com/~emailbox/ascii_cats.html
and patorjk.com/software/taag

Running Video:
https://drive.google.com/file/d/1DzxErJ8a066_JL9U9sr0F31mtvK75bSG/view?usp=sharing