Sorting arrays into ascending or descending order, and printing the odd and even elements separately.

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Abstract

In this paper we have devised an algorithm to sort an array and print the odd and even elements separately.

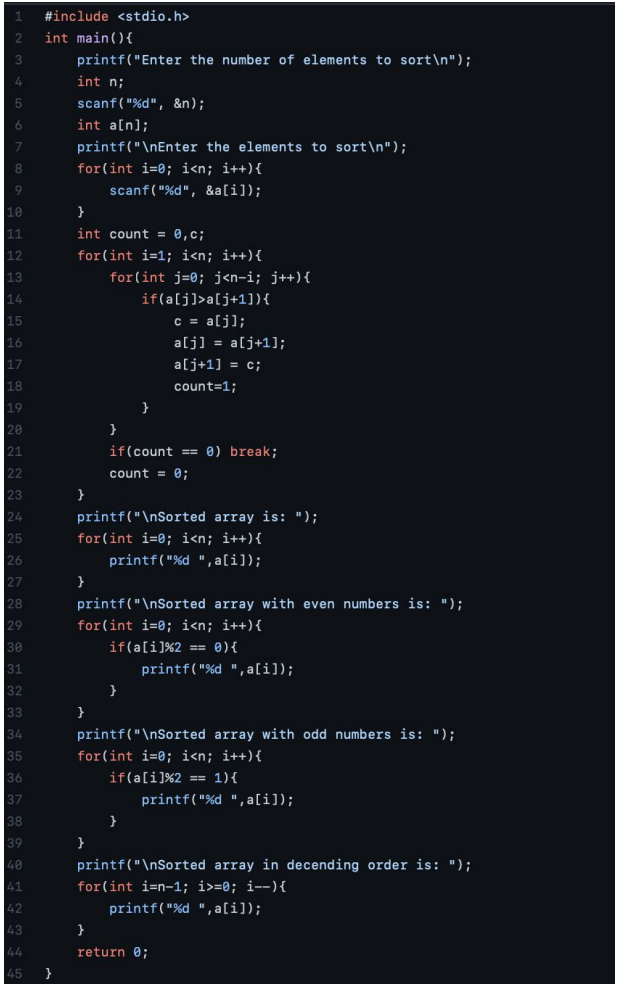
Algorithm Design

- Suppose we iterate over the array and apply swap operation over two adjacent elements if the element with higher index is smaller than the element with lower index.
- We will perform such swap n-1 times.
- This will bubble up at least one element to its designated position.
- So we will do these set of operations, n times to ensure every element is at its designated position.
- But we don't need to perform n-1 swaps every loop as with every loop atleast one element bubbles to its correct position

- So, if we already have ran such sets of swaps i times, i elements at least would be at their designated position.
- So we will only run this loop n-i-1 times after, i^{th} set of swaps.
- So we will iterate over $\sum_{i=1}^{n}(n-1-i) = \frac{n^2}{2} - 3\frac{n}{2}$ times.
- Also if the array contains already sorted elements, we will check if any swaps are taking place, if not then we will terminate the loop.
- We will print odd and even elements by traversing the sorted loop and checking if the element is odd or even.
- Also we will print the arrays in descending fashion by reverting the loop of indices from n-1 to 0, where n is the size of the array.

This is the code for the problem.

Made in c



```c
#include <stdio.h>
int main(){
    printf("Enter the number of elements to sort\n");
    int n;
    scanf("%d", &n);
    int a[n];
    printf("\nEnter the elements to sort\n");
    for(int i=0; i<n; i++){
        scanf("%d", &a[i]);
    }
    int count = 0,c;
    for(int i=1; i<n; i++){
        for(int j=0; j<n-i; j++){
            if(a[j]>a[j+1]){
                c = a[j];
                a[j] = a[j+1];
                a[j+1] = c;
                count=1;
            }
        }
        if(count == 0) break;
        count = 0;
    }
    printf("\nSorted array is: ");
    for(int i=0; i<n; i++){
        printf("%d ",a[i]);
    }
    printf("\nSorted array with even numbers is: ");
    for(int i=0; i<n; i++){
        if(a[i]%2 == 0){
            printf("%d ",a[i]);
        }
    }
    printf("\nSorted array with odd numbers is: ");
    for(int i=0; i<n; i++){
        if(a[i]%2 == 1){
            printf("%d ",a[i]);
        }
    }
    printf("\nSorted array in decending order is: ");
    for(int i=n-1; i>=0; i--){
        printf("%d ",a[i]);
    }
    return 0;
}
```

Input

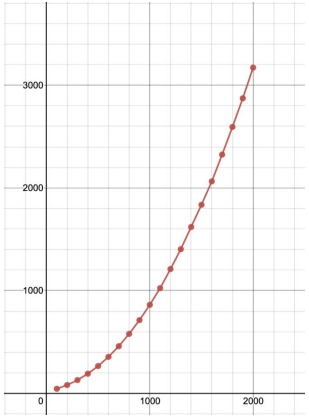
```
Enter the number of elements to sort
4

Enter the elements to sort
3 2 4 1
```

Output

```
Sorted array is: 1 2 3 4
Sorted array with even numbers is: 2 4
Sorted array with odd numbers is: 1 3
Sorted array in decending order is: 4 3 2 1
```

Time complexity of the Algorithm

As we know we iterate, $\sum_{i=1}^{n}(n-1-i)=\frac{n^2}{2}-3\frac{n}{2}$ times. Would expect the runtime graph of the loop to look something like x^2 graph.



This is the graph of t x 10^-7 vs n.

This looks pretty similar to the graph of x^2. As the highest degree element in the polynomial equation of n vs t is n^2

Conclusion

Bubble sort is an effective way to sort an array, it has time dependency of n^2.

References

- https://www.geeksforgeeks.org
- https://stackoverflow.com

The end