Hash Sort

Hash sort is a non-comparison sorting algorithm that uses array index to sort an input array.

It is efficient in terms of time (after exceeding a certain input size) but not efficient in terms of space.

Time Complexity: O(n)

Here n being the largest value in the input array.

Space Complexity: O(n)

Here n also being the largest value in the input array.

Working

1. Find the largest positive integer and lowest negative integer (if any).

2. Initialize two auxiliary hash arrays of size N1 = largest positive value and N1 = - (lowest negative value).

3. Start a linear loop and if positive number is found then increase the index of that value in pos[N1] and in neg[N2] for negative numbers.

4. Print all the non-zero index of the hash arrays.

Algorithm

1. Hashsort(A,n)

2. N1 = 0, N2 =0

3. For i = 0 to n-1

    If(A[i] is smaller than N2 and negative)

        N2 = A[i]

    If(A[i] is bigger than N1 and positive)

        N1 = A[i]

4. pos[N1+1], neg[-(N2)+1]

5. for i = 0 to n-1

    If(A[i] >= 0)

        pos[A[i]] += 1

    if(A[i]<0)

        neg[-(A[i])] += 1

6. for i = -(N2) to 0

    If(neg[i] > 0)

        for j = 0 to neg[i] -1 //dependent loop, won't cause O(n^2)

            print(-i)

7. 6. for i = 0 to N1

    If(pos[i] > 0)

        for j = 0 to pos[i] -1 //dependent loop, won't cause O(n^2)

            print(i)

8. End

C++ Program to implement Hashsort

```
#include <bits/stdc++.h>
using namespace std;

void Hashsort(int A[], int n){
	int N1 = 0, N2 = 0;

	for(int i=0;i<n;++i){
		if(A[i]>N1 and A[i] >=0){
			N1 = A[i];
		}
		if(A[i] < N2 and A[i]<0){
			N2 = A[i];
```

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            }
        }

        int pos[N1+1]={}, neg[-(N2)+1]={};

        for(int i=0;i<n;++i){
            if(A[i]>=0){
                pos[A[i]]++;
            }
            else if(A[i]<0){
                neg[-A[i]]++;
            }
        }

        for(int i=-N2;i>=0;--i){
            for(int j=0;j<neg[i];++j){
                cout<<-i<<" ";
            }
        }
        for(int i=0;i<=N1;++i){
            for(int j=0;j<pos[i];++j){
                cout<<i<<" ";
            }
        }

}

int main(){
        int n; cin>>n;
        int A[n];
        for(int i=0;i<n;++i){
            cin>>A[i];
```

```
        }


        Hashsort(A,n);
}
```