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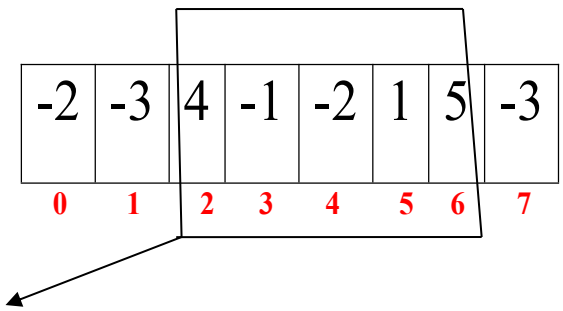
Algorithm Lab. Class Assignment-5

CSE Group 1

Date: - 6th August 2021

1. **Write a C program to find the sum of contiguous subarray within a one dimensional (1-D) array of numbers which has the largest sum. Find the time complexty of your program.**

Example



4 + (-1) + (-2) + 1 + 5 = 7

So the maximum contiguous subarray sum is 7

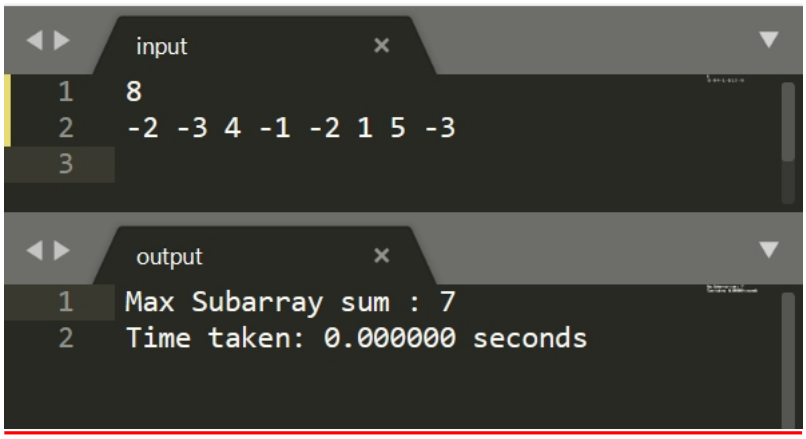
Program

```
// Author: Chaudhary Hamdan


#include <stdio.h>

#include <time.h>

#include <limits.h>

#include <stdlib.h>


#define sf(x)        scanf("%d", &x)

#define pf           printf

#define pfs(x)       printf("%d ", x)

#define pfn(x)       printf("%d\n", x)
```

```
#define pfc(x)          printf("%d, ", x)
#define F(i,x,y)        for(int i = x; i < y; i++)
#define FI(i,x,y,inc)   for(int i = x; i < y; i += inc)
#define RF(i,x,y)       for(int i = x; i >= y; i--)
#define pfarr(i,a,n)    for(int i = 0; i < n-1; i++) pfs(a[i]); pfn(a[n-1]);


void i_o_from_file() {


#ifndef ONLINE_JUDGE
    freopen("C:\\Users\\KIIT\\input", "r", stdin);
    freopen("C:\\Users\\KIIT\\output", "w", stdout);
#endif
}
int maxSum(int a[], int n) {
    int prev = INT_MIN, curr = 0;
    for (int i = 0; i < n; i++)
    {
        curr = curr + a[i];
        if (prev < curr)
            prev = curr;
        if (curr < 0)
            curr = 0;
    }
    return prev;
}
int main() {
    i_o_from_file();
    /* ******************************************** */
```

```
    int n;
    sf(n);

    int arr[n];
    F(i, 0, n) {
        sf(arr[i]);
    }

    time_t start, end;
    double time;
    start = clock();
    pf("Max Subarray sum : %d\n", maxSum(arr, n));
    end = clock();
    time = (end - start) * 1.0 / CLOCKS_PER_SEC;
    pf("Time taken: %f seconds", time);
    return 0;
}
```

Output



2. **Write a program to find out the largest difference between two elements A[i] and A[j] (A[j]-A[i]) of the array of integers A in O(n) time such that j > i. For example: Let A is an array of integers:**

int[] a = { 10, 3, 6, 8, 9, 4, 3 };

if i=1, j=3, then diff = a[j] – a[i] = 8 – 3 = 5

if i=4, j=6, then diff = a[j] – a[i] = 3 – 9 = -6

……

……

if i=1, j=4, then diff = a[j] – a[i] = 9 – 3 = 6

……

……

6 is the largest number between all the differences, that is the answer.

Find the time complexty of your program.

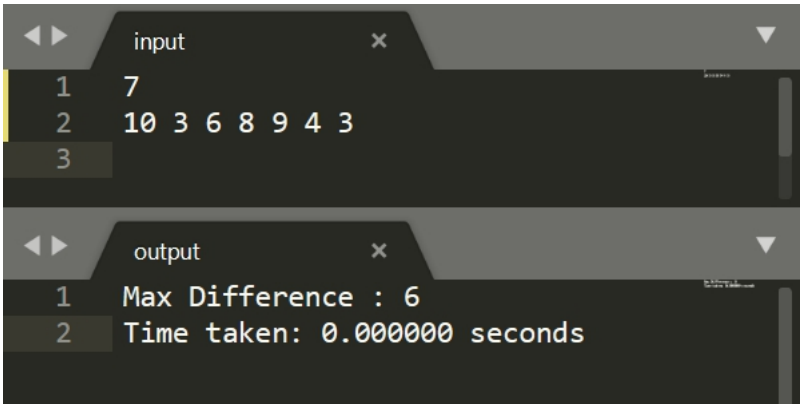
Program

```
// Author: Chaudhary Hamdan


#include <stdio.h>

#include <time.h>

#include <limits.h>

#include <stdlib.h>


#define sf(x)          scanf("%d", &x)

#define pf             printf

#define pfs(x)         printf("%d ", x)

#define pfn(x)         printf("%d\n", x)

#define pfc(x)         printf("%d, ", x)

#define F(i,x,y)       for(int i = x; i < y; i++)

#define FI(i,x,y,inc)   for(int i = x; i < y; i += inc)
```

```
#define RF(i,x,y)       for(int i = x; i >= y; i--)
#define pfarr(i,a,n)    for(int i = 0; i < n-1; i++) pfs(a[i]); pfn(a[n-1]);



void i_o_from_file() {


#ifndef ONLINE_JUDGE
    freopen("C:\\Users\\KIIT\\input", "r", stdin);
    freopen("C:\\Users\\KIIT\\output", "w", stdout);
#endif
}


int maxDiff(int a[], int n)
{
    int max = INT_MIN, c;


    F(i, 0, n) {
        F(j, i + 1, n) {
            c = a[j] - a[i];
            max = (c > max) ? c : max;
        }
    }
    return max;
}
int main() {


    i_o_from_file();
    /* ******************************************** */
```

```
    int n;
    sf(n);

    int arr[n];
    F(i, 0, n) {
        sf(arr[i]);
    }

    time_t start, end;
    double time;
    start = clock();
    pf("Max Difference : %d\n", maxDiff(arr, n));
    end = clock();
    time = (end - start) * 1.0 / CLOCKS_PER_SEC;

    pf("Time taken: %f seconds", time);

    return 0;
}
```

Output



3. Find the GCD and LCM of n numbers where (n>=2).

Program

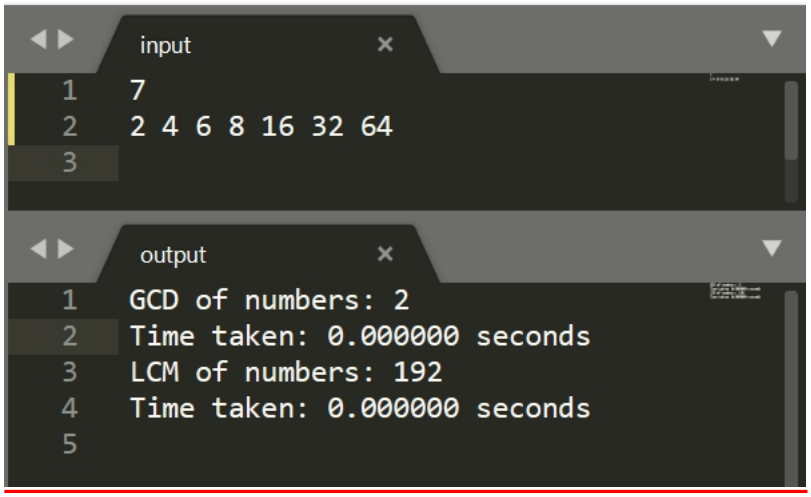
```
// Author: Chaudhary Hamdan


#include <stdio.h>

#include <time.h>

#include <limits.h>

#include <stdlib.h>


#define sf(x)          scanf("%d", &x)

#define pf             printf

#define pfs(x)         printf("%d ", x)

#define pfn(x)         printf("%d\n", x)

#define pfc(x)         printf("%d, ", x)

#define F(i,x,y)       for(int i = x; i < y; i++)

#define FI(i,x,y,inc)   for(int i = x; i < y; i += inc)

#define RF(i,x,y)       for(int i = x; i >= y; i--)

#define pfarr(i,a,n)    for(int i = 0; i < n-1; i++) pfs(a[i]); pfn(a[n-1]);



void i_o_from_file() {


#ifndef ONLINE_JUDGE

    freopen("C:\\Users\\KIIT\\input", "r", stdin);

    freopen("C:\\Users\\KIIT\\output", "w", stdout);

#endif

}
```

```
int gcd(int a, int b)
{
    if (b == 0)
        return a;
    return gcd(b, a % b);

}

int lcm(int a, int b) {
    return (a * b / gcd(a, b));
}

int GCDN(int a[], int n) {

    int gcd_ = a[0];
    F(i, 1, n) {
        gcd_ = gcd(gcd_, a[i]);
    }

    return gcd_;

}

int LCMN(int a[], int n) {

    int lcm_ = a[0];

    F(i, 1, n) {
```

```
            lcm_ = lcm(lcm_, a[i]);

    }
    return lcm_;

}




int main() {

    i_o_from_file();

    /* ******************************************** */

    int n;
    sf(n);

    int arr[n];
    F(i, 0, n) {
            sf(arr[i]);
    }

    time_t start, end;
    double time;
    start = clock();
    pf("GCD of numbers: %d\n", GCDN(arr, n));
    end = clock();
```

```
    time = (end - start) * 1.0 / CLOCKS_PER_SEC;
    pf("Time taken: %f seconds\n", time);

    start = clock();
    pf("LCM of numbers: %d\n", LCMN(arr, n));
    end = clock();
    time = (end - start) * 1.0 / CLOCKS_PER_SEC;
    pf("Time taken: %f seconds\n", time);

    return 0;
}
```

Output



4. Consider an n × n matrix A = (a_{ij}), each of whose elements a_{ij} is a nonnegative real number, and suppose that each row and column of A sums to an integer value. We wish to replace each element a_{ij} with either $\lceil a_{ij} \rceil$ or $\lfloor a_{ij} \rfloor$ without disturbing the row and column sums. Here is an example:

$$\begin{pmatrix} 10.9 & 2.5 & 1.3 & 9.3 \\ 3.8 & 9.2 & 2.2 & 11.8 \\ 7.9 & 5.2 & 7.3 & 0.6 \\ 3.4 & 13.1 & 1.2 & 6.3 \end{pmatrix} \rightarrow \begin{pmatrix} 11 & 3 & 1 & 9 \\ 4 & 9 & 2 & 12 \\ 7 & 5 & 8 & 1 \\ 4 & 13 & 2 & 6 \end{pmatrix}$$

Write a program by defining an user defined function that is used to produce the rounded matrix as described in the above example. Find out the time complexity of your algorithm/function.

Program

```
// Author: Chaudhary Hamdan


#include <stdio.h>

#include <time.h>

#include <limits.h>

#include <stdlib.h>


#define sf(x)          scanf("%d", &x)

#define pf             printf

#define pfs(x)         printf("%d ", x)

#define pfn(x)         printf("%d\n", x)

#define pfc(x)         printf("%d, ", x)

#define F(i,x,y)       for(int i = x; i < y; i++)

#define FI(i,x,y,inc)   for(int i = x; i < y; i += inc)

#define RF(i,x,y)       for(int i = x; i >= y; i--)

#define pfarr(i,a,n)    for(int i = 0; i < n-1; i++) pfs(a[i]); pfn(a[n-1]);
```

```
void i_o_from_file() {
#ifndef ONLINE_JUDGE
    freopen("C:\\Users\\KIIT\\input", "r", stdin);
    freopen("C:\\Users\\KIIT\\output", "w", stdout);
#endif
}
int main() {


    i_o_from_file();
    /* ******************************************** */
    int n;
    sf(n);
    float arr[10][10];
    float a[10][10];
    F(i, 0, n) {
        F(j, 0, n) {
            scanf("%f", &arr[i][j]);
            a[i][j] = arr[i][j] - (int)(arr[i][j]);
        }
    }
    float row[n], col[n];
    F(i, 0, n) {
        float s = 0.0;
        F(j, 0, n) {
            s += a[i][j];
        }
        row[i] = s;
    }
```

```
F(j, 0, n) {
        float s = 0.0;
        F(i, 0, n) {
                s += (arr[i][j] - (int)(arr[i][j]));
        }
        col[j] = s;
}
for (int i = 0; i < n; i++) {
        for (int j = 0; j < row[i]; j++) {
                if (col[j] == 0) {
                        a[i][j] = 0;
                        continue;
                }
                a[i][j] = 1;
                col[j]--;
        }
}
for (int i = 0; i < n; i++) {
        for (int j = 0; j < col[i]; j++) {
                if (row[j] == 0) {
                        a[j][i] = 1;
                        continue;
                }
                a[j][i] = 0;
                row[j]--;
        }
}
```

```
    pf("Rounded up matrix :\n");

    F(i, 0, n) {
        F(j, 0, n) {
            pf("%d ", (int)(arr[i][j]) + (int)(a[i][j]));
        }
        pf("\n");
    }

    return 0;
}
```

Output