

Algorithms

CSE 2415

Md. Hasan

April 2024

Introduction

Algorithm is a sequence of steps / step-by-step procedure to solve a problem.

Properties of Algorithm:

- Specific input
- Specific output
- Definiteness
- Finiteness
- Effectiveness

Time and Space Complexity

Examples:

Algorithm:

```
int i, j;
for(i = 0; i < n; i++){
    for(j = 0; j < n; j++)
        printf(" %d ", i+j);
}
```

space complexity

cost	repeat	total
1	1	1
1+1+1	1+(n+1)+n	2n+2
1+1+1	(1+(n+1)+n)+n	2n ² +2n
1	n ²	n ²

F(n)= 3n² + 3n + 1
TC -> O(n²)

Space complexity

cost	repeat	total
i= 4	1	4
j= 4	1	4
n= 4	1	4

S(n)= 12
SC -> O(1)

Algorithm:

```
int i, j, n, A[i][j], B[i][j], C[i][j];
for(i = 0; i < n; i++){
    for(j = 0; j < n; j++)
        C[i][j] = A[i][j] + B[i][j];
}
```

space complexity

cost	repeat	total
1	1	1
1+1+1	1+(n+1)+n	2n+2
1+1+1	n+n(n+1)+n ²	2n ² +2n
1	n ²	n ²

Space complexity

cost	repeat	total
i=4	1	4
j=4	1	4
n=4	1	4
A[] []	4*n*n	4n ²
B[] []	4*n*n	4n ²
C[] []	4*n*n	4n ²

F(n)= 3n² + 4n + 3
TC -> O(n²)

S(n)= 12n² + 12
SC -> O(n²)

Algorithm:

```
int i, n;
for(i = 0; i < n; i++)
    printf(" %d ", 2*i);
```

space complexity

cost	repeat	total
1	1	1
1+1+1	1+(n/2)+1+(n/2)	n+2
1	n/2	n/2

Space complexity

cost	repeat	total
i=4	1	4
n=4	1	4

F(n)= (3n/2) + 3
TC -> O(n)

S(n)= 8
SC -> O(1)