Frequency Count method :-

This Method is usefull for finding the time complexity of algorithms.

ex:- algorithm sum (A, n)

A	1	8	2	3	2
	0	1	2	3	4

A = array
n = 5

```
sum (A, n)
{
  S = 0            --> 1
  for (i=0; i<n; i++)   --> n+1
    S = S + A[i];   --> n time
  }
  return s;        --> 1
}
```

i<n

i = 0 T
i = 1 T
i = 2 T
i = 3 T
i = 5 < F

n+1 times exiting

1
n+1
n
1

$2n+3 = f(n) \rightarrow O(n)$

Space & variable

$A \rightarrow n$

$n \rightarrow 1$

$s \rightarrow 1$

$i \rightarrow 1$

$S(n) = n+3$ → polynomial $O(n)$

---

ex:- (2) finding the sum of two Matrices

Algorithm Add(A, B, n)

{

for ($i=0$; $i<n$; $i++$) → $n+1$

$\xrightarrow{n+1}$

whatever inside a for loop runs (n) times

{

for ($j=0$; $j<n$; $j++$) → $(n) \times (n+1)$

$\xrightarrow{n+1}$

same inside for loop (n) times

{

$c[i,j] = A[i,j] + B[i,j]$

} $(n) \times (n)$

}

}

$(n+1)$

$n \times (n+1)$

$n \times n$

time Complexity → $f(n) = 2n^2 + 2n + 1$ → $O(n^2)$

Space Complexity :- Variables are used in code.

A, B, C → they are matrices

They are two dimensional 2D array

A, B, C, n, i, j

$n \times n$

$A = n^2$ $\quad n = 1$
$B = n^2$ $\quad j = 1$
$C = n^2$ $\quad i = 1$

n, i, j → they are scalar variables, simple variables

$A = n^2$
$B = n^2$
$C = n^2$
$n = 1$
$i = 1$
$j = 1$

Space function $S(n) = 3n^2 + 3$ → degree for n^2

$O(n^2)$

Time and Space complexity for this code is

Time = $O(n^2)$

Space = $O(n^2)$

Algorithm multiply (A, B, n)

```
{
for (i=0; i<n; i++) → n+1
                  n+1
{
   for (j=0; j<n; j++) → n*(n+1)
                  n+1
   {
       C[i,j] = 0; → n*n

       for (k=0; k<n; k++) → n*(n+1)*n
                    n+1
       {
           C[i,j] = C[i,j] + A[i,j] *
                            B[k,j];
                     → n*n*n
       }
   }
}
}
```

Time Complexity :

n+1

n*(n+1)

n*n

n*n.(n+1)

n*n*n

$2n^3 + 3n^2 + 2n + 1$

T/C ⟹ $O(n^3)$ degree

Space Complexity:

Variables

A ⟹ n^2

B ⟹ n^2

C → n^2

n ⟹ 1

i ⟹ 1

j ⟹ 1

k ⟹ 1

$3n^2 + 4$

$O(n^2)$ space/c

T/C = $O(n^3)$

S/C = $O(n^2)$