Practice Questions on Time Complexity Analysis

Difficulty Level : Easy • Last Updated : 21 Dec, 2022

Prerequisite: Analysis of Algorithms

1. What is the time, and space complexity of the following code:

CPP

```
int a = 0, b = 0;
for (i = 0; i < N; i++) {
    a = a + rand();
}
for (j = 0; j < M; j++) {
    b = b + rand();
}
```

```
a = 0
b = 0
for i in range(N):
  a = a + random()

for i in range(M):
  b= b + random()
```

Options:

1. O(N * M) time, O(1) space
2. O(N + M) time, O(N + M) space
3. O(N + M) time, O(1) space
4. O(N * M) time, O(N + M) space

Output:

```
3. O(N + M) time, O(1) space
```

Explanation: The first loop is O(N) and the second loop is O(M). Since **N** and **M** are **independent variables**, so we can't say which one is the leading term. Therefore **Time complexity** of the given problem will be **O(N+M).**

Since variables size does not depend on the size of the input, therefore **Space Complexity** will be **constant or O(1)**

2. What is the time complexity of the **following code:**

CPP

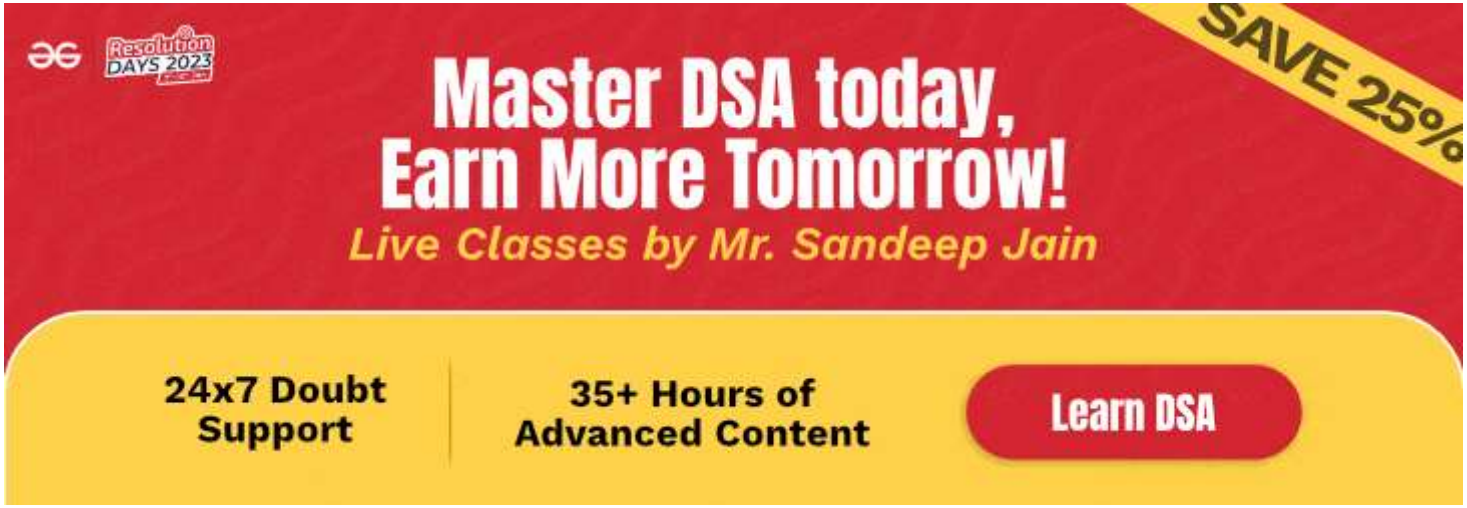
```cpp
int a = 0;
for (i = 0; i < N; i++) {
```

```
}
```

Python3

```
a = 0;
for i in range(N):
  for j in reversed(range(i,N)):
    a = a + i + j;
```

Options:



3. O(N * Sqrt(N))
4. O(N*N)

Output:

```
4. O(N*N)
```

Explanation:

The above code runs total no of times

= N + (N – 1) + (N – 2) + ... 1 + 0

= N * (N + 1) / 2

= 1/2 * N^2 + 1/2 * N

O(N^2) times.

3. What is the time complexity of the **following code:**

CPP

```
int i, j, k = 0;
for (i = n / 2; i <= n; i++) {
    for (j = 2; j <= n; j = j * 2) {
        k = k + n / 2;
    }
}
```

```
k = 0;
for i in range(n//2,n):
  for j in range(2,n,pow(2,j)):
        k = k + n / 2;
```

Options:

1. O(n)
2. O(N log N)
3. O(n^2)
4. O(n^2Logn)

Output:

```
2. O(nLogn)
```

Explanation: If you notice, j keeps doubling till it is less than or equal to n. Several times, we can double a number till it is less than n would be log(n).

Let's take the examples here.

for n = 16, j = 2, 4, 8, 16

for n = 32, j = 2, 4, 8, 16, 32

So, j would run for O(log n) steps.

4. What does it mean when we say that an algorithm X is asymptotically more efficient than Y?

Options:

1. X will always be a better choice for small inputs
2. X will always be a better choice for large inputs
3. Y will always be a better choice for small inputs
4. X will always be a better choice for all inputs

Output:

```
2. X will always be a better choice for large inputs
```

larger than a value n0 where n0 > 0.

5. What is the time complexity of the **following code:**

CPP

```cpp
int a = 0, i = N;
while (i > 0) {
    a += i;
    i /= 2;
}
```

Python3

```python
a = 0
i = N
while (i > 0):
  a += i
  i //= 2
```

Options:

3. O(N / 2)
4. O(log N)

Output:

```
4. O(log N)
```

Explanation: We have to find the smallest x such that '(N / 2^x)< 1 OR 2^x > N'
x = log(N)

6. Which of the following best describes the useful criterion for comparing the efficiency of algorithms?

1. Time
2. Memory
3. Both of the above
4. None of the above

```
3. Both of the above
```

Explanation: Comparing the efficiency of an algorithm depends on the time and memory taken by an algorithm. **The algorithm which runs in lesser time and** takes less memory even for a large input size is considered a more efficient algorithm.

1. By counting the number of algorithms in an algorithm.
2. By counting the number of primitive operations performed by the algorithm on a given input size.
3. By counting the size of data input to the algorithm.
4. None of the above

2. By counting the number of primitive operations performed by the algorithm on a given input size.

8. What will be the time complexity of the following code?

Javascript

```
for(var i=0;i<n;i++)
    i*=k
```

C++

```
for(int i=0;i<n;i++){
  i*=k;
}
```

Python3

```
# code
for i in range(n):
```

1. O(n)
2. O(k)
3. $O(\log_k n)$
4. $O(\log_n k)$

Output:

3. $O(\log_k n)$

Explanation: Because loops for the k^{n-1} times, so after taking log it becomes $\log_k n$.

9. What will be the time complexity of the following code?

Javascript

```
var value = 0;
for(var i=0;i<n;i++)
    for(var j=0;j<i;j++)
    value += 1;
```

C++

```
int value = 0;
for(int i=0;i<n;i++)
    for(int j=0;j<i;j++)
```

Python3

```
value = 0;
for i in range(n):
  for j in range(i):
    value=value+1
```

1. n
2. (n+1)
3. n(n-1)
4. n(n+1)

Output:

```
3. n(n-1)
```

Explanation: First for loop will run for (n) times and another for loop will be run for (n-1) times as the inner loop will only run till the range i which is 1 less than n , so overall time will be n(n-1).

10. Algorithm A and B have a worst-case running time of O(n) and O(logn), respectively. Therefore, algorithm B always runs faster than algorithm A.

1. True
2. False

Explanation: The Big-O notation provides an asymptotic comparison in the running time of algorithms. For $n < n^0$, algorithm A might run faster than algorithm B, for instance.

Next

Sample Practice Problems on Complexity Analysis of Algorithms

1. Sample Practice Problems on Complexity Analysis of Algorithms
2. Asymptotic Analysis (Based on input size) in Complexity Analysis of Algorithms
3. Time Complexity and Space Complexity
4. Time Complexity Analysis | Tower Of Hanoi (Recursion)
5. Step Count Method for Time Complexity Analysis
6. What are Asymptotic Notations in Complexity Analysis of Algorithms
7. How to Analyse Loops for Complexity Analysis of Algorithms
8. Complexity Analysis of Binary Search
9. Complexity analysis of various operations of Binary Min Heap
10. Prune-and-Search | A Complexity Analysis Overview

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