

## Analysis of Algorithms

### Question 1

What is time complexity of fun()?

```
int fun(int n)
{
    int count = 0;
    for (int i = n; i > 0; i /= 2)
        for (int j = 0; j < i; j++)
            count += 1;
    return count;
}
```

- A**  $O(n^2)$
- B**  $O(n \log n)$
- C**  $O(n)$
- D**  $O(n \log n \log n)$

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## Question 2

What is the time complexity of fun()?

```
int fun(int n)
{
    int count = 0;
    for (int i = 0; i < n; i++)
        for (int j = i; j > 0; j--)
            count = count + 1;
    return count;
}
```

- A** Theta (n)
- B** Theta (n<sup>2</sup>)
- C** Theta (n\*Logn)
- D** Theta (nLognLogn)

Discuss it

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### Question 3

The recurrence relation capturing the optimal time of the Tower of Hanoi problem with  $n$  discs is. (GATE CS 2012)

- A**  $T(n) = 2T(n - 2) + 2$
- B**  $T(n) = 2T(n - 1) + n$
- C**  $T(n) = 2T(n/2) + 1$
- D**  $T(n) = 2T(n - 1) + 1$

Discuss it

### Question 4

Let  $w(n)$  and  $A(n)$  denote respectively, the worst case and average case running time of an algorithm executed on an input of size  $n$ . which of the following is ALWAYS TRUE? (GATE CS 2012)

- (A)  $A(n) = \Omega(W(n))$
- (B)  $A(n) = \Theta(W(n))$
- (C)  $A(n) = O(W(n))$
- (D)  $A(n) = o(W(n))$

- A** A
- B** B
- C** C

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- ☐ 10GbE
- ☐ 40GbE
- ☐ InfiniBand
- ☐ Unsure

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- ☐ 8
- ☐ 12
- ☐ 16
- ☐ Unsure

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- ☐ Unsure

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- ☐ VMware
- ☐ Unsure

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### Question 5

Which of the following is not  $O(n^2)$ ?



$(15^{10}) * n + 12099$



$n^{1.98}$



$n^3 / (\sqrt{n})$



$(2^{20}) * n$

Discuss it

### Question 6

Which of the given options provides the increasing order of asymptotic complexity of functions  $f_1$ ,  $f_2$ ,  $f_3$  and  $f_4$ ?

$$f_1(n) = 2^n$$

$$f_2(n) = n^{(3/2)}$$

$$f_3(n) = n \log n$$

$$f_4(n) = n^{(\log n)}$$



$f_3, f_2, f_4, f_1$



$f_3, f_2, f_1, f_4$

**Sumit Khatri** this is the sorting technique which can work...

Insertion Sort · 7 hours ago

**Sumit Khatri** no, quick sort requires more swaps than...

Selection Sort · 7 hours ago

**Sumit Khatri** yes, it is the only sorting technique which...

Selection Sort · 7 hours ago

**Sudhakar Mishra** I think it should be  $2n + 1$

Data Structures | Binary Trees | Question 12 · 7 hours ago

**Sudhakar Mishra**  $(2n)! / ((n+1)! * n!)$

Data Structures | Binary Trees | Question 6 · 1 day ago

**Sudhakar Mishra** Always Y will be more than one because after...

Data Structures | Stack | Question 7 · 1 day ago

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**C**

f2, f3, f1, f4

**D**

f2, f3, f4, f1

**Discuss it****Question 7**

---

Consider the following program fragment for reversing the digits in a given integer to obtain a new integer. Let  $n = D_1D_2\dots D_m$

```
int n, rev;
rev = 0;
while (n > 0)
{
    rev = rev*10 + n%10;
    n = n/10;
}
```

The loop invariant condition at the end of the  $i$ th iteration is: (GATE CS 2004)

**A** $n = D_1D_2\dots D_{m-i}$  and  $rev = D_mD_{m-1}\dots D_{m-i+1}$ **B** $n = D_{m-i+1}\dots D_{m-1}D_m$  and  $rev = D_{m-1}\dots D_2D_1$ **C** $n \neq rev$ **D** $n = D_1D_2\dots D_m$  and  $rev = D_mD_{m-1}\dots D_2D_1$ **Discuss it****Question 8**

---

What is the time complexity of the below function?

```
void fun(int n, int arr[])
{
    int i = 0, j = 0;
    for(; i < n; ++i)
        while(j < n && arr[i] < arr[j])
            j++;
}
```

- A**  $O(n)$
- B**  $O(n^2)$
- C**  $O(n \log n)$
- D**  $O(n(\log n)^2)$

### Discuss it

#### Question 9

---

In a competition, four different functions are observed. All the functions use a single for loop and within the for loop, same set of statements are executed. Consider the following for loops:

- A) `for (i = 0; i < n; i++)`
- B) `for (i = 0; i < n; i += 2)`
- C) `for (i = 1; i < n; i *= 2)`
- D) `for (i = n; i > -1; i /= 2)`

If **n** is the size of input(positive), which function is most efficient(if the task to be performed is not an issue)?

- A
- B
- C
- D

Discuss it

#### Question 10

---

The following statement is valid.  $\log(n!) = \Theta(n \log n)$ .

- A True
- B False

Discuss it

#### Question 11

---

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

- A X will be a better choice for all inputs
- B X will be a better choice for all inputs except small inputs

**C**

X will be a better choice for all inputs except large inputs

**D**

Y will be a better choice for small inputs

**Discuss it**

### Question 12

---

What is the time complexity of Floyd–Warshall algorithm to calculate all pair shortest path in a graph with  $n$  vertices?

**A**

$O(n^2 \log n)$

**B**

$\Theta(n^2 \log n)$

**C**

$O(n^3)$

**D**

$\Theta(n^3)$

**Discuss it**

### Question 13

---

Consider the following functions:

$$f(n) = 2^n$$

$$g(n) = n!$$

$$h(n) = n \log n$$

Which of the following statements about the asymptotic behavior of  $f(n)$ ,  $g(n)$ , and  $h(n)$  is true?

(A)  $f(n) = O(g(n))$ ;  $g(n) = O(h(n))$



(B)  $f(n) = \square(g(n))$ ;  $g(n) = O(h(n))$

(C)  $g(n) = O(f(n))$ ;  $h(n) = O(f(n))$

(D)  $h(n) = O(f(n))$ ;  $g(n) = \square(f(n))$

A

A

B

B

C

C

D

D

Discuss it

#### Question 14

---

In the following C function, let  $n \geq m$ .

```
int gcd(n, m)
{
    if (n % m == 0) return m;
    n = n % m;
    return gcd(m, n);
}
```

How many recursive calls are made by this function?

(A)  $\square(\log n)$

(B)  $\square(n)$

(C)  $\square(\log \log n)$

(D)  $\square(\sqrt{n})$

A

A

- ☒ B
- ☐ C
- ☐ D

Discuss it

### Question 15

---

Consider the following functions

$$f(n) = 3n^{\sqrt{n}}$$

$$g(n) = 2^{\sqrt{n} \log_2 n}$$

$$h(n) = n!$$

Which of

the following is true? (GATE CS 2000)

- (a)  $h(n)$  is  $O(f(n))$
- (b)  $h(n)$  is  $O(g(n))$
- (c)  $g(n)$  is not  $O(f(n))$
- (d)  $f(n)$  is  $O(g(n))$

- ☒ A
- ☐ B
- ☐ C

**D** d

Discuss it

### Question 16

Consider the following three claims I  $(n + k)^m = O(n^m)$ , where  $k$  and  $m$  are constants II  $2^{n+1} = O(2^n)$  III  $2^{2n+1} = O(2^{2n})$  Which of these claims are correct? (GATE CS 2003)

- A** I and II
- B** I and III
- C** II and III
- D** I, II and III

Discuss it

### Question 17

Let  $s$  be a sorted array of  $n$  integers. Let  $t(n)$  denote the time taken for the most efficient algorithm to determine if there are two elements with sum less than 1000 in  $s$ . Which of the following statements is true? (GATE CS 2000)

- a)  $t(n)$  is  $O(1)$
- b)  $n < t(n) < n^2$
- c)  $n \log_2 n < t(n) < n^2$
- d)  $t(n) = n^2$

**A** a

- B** b
- C** c
- D** d

Discuss it

### Question 18

---

Consider the following function

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

What is the returned value of the above function? (GATE CS 2013)

- (A)
- (B)
- (C)
- (D)

- A** A
- B** B

- C**
- D**

Discuss it

### Question 19

---

Consider the following two functions. What are time complexities of the functions?

```
int fun1(int n)
{
    if (n <= 1) return n;
    return 2*fun1(n-1);
}

int fun2(int n)
{
    if (n <= 1) return n;
    return fun2(n-1) + fun2(n-1);
}
```

- A**  $O(2^n)$  for both fun1() and fun2()
- B**  $O(n)$  for fun1() and  $O(2^n)$  for fun2()
- C**  $O(2^n)$  for fun1() and  $O(n)$  for fun2()
- D**  $O(n)$  for both fun1() and fun2()

Discuss it

### Question 20

---

Consider the following segment of C-code:

```
int j, n;  
j = 1;  
while (j <= n)  
    j = j*2;
```

The number of comparisons made in the execution of the loop for any  $n > 0$  is: Base of Log is 2 in all options.

- A**  $\text{CEIL}(\log n) + 1$
- B**  $n$
- C**  $\text{CEIL}(\log n)$
- D**  $\text{FLOOR}(\log n) + 1$

**Discuss it**

### Question 21

Consider the following C-program fragment in which  $i$ ,  $j$  and  $n$  are integer variables.

```
for (i = n, j = 0; i > 0; i /= 2, j += i);
```

Let  $\text{val}(j)$  denote the value stored in the variable  $j$  after termination of the for loop.

Which one of the following is true? (A)  $\text{val}(j) = \lfloor \log n \rfloor$  (B)  $\text{val}(j) = \lfloor \sqrt{n} \rfloor$  (C)  $\text{val}(j) = \lfloor n \rfloor$  (D)  $\text{val}(j) = \lfloor n \log n \rfloor$

- A** A
- B** B

- C
- D

Discuss it

### Question 22

---

The minimum number of comparisons required to find the minimum and the maximum of 100 numbers is \_\_\_\_\_.

- A 147.1 to 148.1
- B 145.1 to 146.1
- C 140 to 146
- D 140 to 148

Discuss it

### Question 23

---

Consider the following pseudo code. What is the total number of multiplications to be performed?

```
D = 2
for i = 1 to n do
  for j = i to n do
    for k = j + 1 to n do
      D = D * 3
```

A

Half of the product of the 3 consecutive integers.

B

One-third of the product of the 3 consecutive integers.

C

One-sixth of the product of the 3 consecutive integers.

D

None of the above.

### Discuss it

There are 23 questions to complete.

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