DAA
QUIZ 1

QUESTION 1

Find the GCD of 124 and 32 using Euclid's Algorithm.

$$
\begin{aligned}
&GCD(124, 32) \\
&= GCD(32, 28) \\
&= GCD(28, 4) \\
&= GCD(4, 0) \\
&= 4
\end{aligned}
$$

QUESTION 2

What is the recurrence for the worst case of Quick Sort and what is the time complexity in Worst case?

1. Recurrence is $T(n) = T(n-2) + O(n)$ and time complexity is $O(n^2)$
2. **Recurrence is $T(n) = T(n-1) + O(n)$ and time complexity is $O(n^2)$**
3. Recurrence is $T(n) = 2T(n/2) + O(n)$ and time complexity is $O(n\log n)$
4. Recurrence is $T(n) = T(n/10) + T(9n/10) + O(n)$ and time complexity is $O(n\log n)$

QUESTION 3

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;
}
```

QUESTION 3

1. O(n^2)
2. O(nLogn)
3. **O(n)**
4. O(nLognLogn)

QUESTION 4

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;
}
```

QUESTION 4

1. Theta (n)
2. **Theta (n^2)**
3. Theta (n*Logn)
4. Theta (nLognLogn)

QUESTION 5

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

1. $T(n) = 2T(n-2) + 2$
2. $T(n) = 2T(n-1) + n$
3. $T(n) = 2T(n/2) + 1$
4. $T(n) = 2T(n-1) + 1$

QUESTION 6

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)

1. $A(n) \in \Omega(W(n))$
2. $A(n) \in \Theta(W(n))$
3. $A(n) \in O(W(n))$

QUESTION 7

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

1. (15^10) * n + 12099
2. n^1.98
3. n^3 / (sqrt(n))
4. (2^20) * n

QUESTION 8

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

1. `for(i = 0; i < n; i++)`
2. `for(i = 0; i < n; i += 2)`
3. `for(i = 1; i < n; i *= 2)`
4. `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)?

QUESTION 9

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

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

QUESTION 10

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);
}
```

QUESTION 10

1. O(2^n) for both fun1() and fun2()
2. **O(n) for fun1() and O(2^n) for fun2()**
3. O(2^n) for fun1() and O(n) for fun2()
4. O(n) for both fun1() and fun2()

QUESTION 11

```
int Trial (int a, int b, int c)
{
    if ((a >= b) && (c < b) return b;
    else if (a>=b) return Trial(a, c, b);
    else return Trial(b, a, c);
}
```

What does the function "trial" compute? – Median of the three numbers

QUESTION 12

Let $T(n)$ be a function defined by the recurrence $T(n) = 2T(n/2) + \sqrt{n}$ for $n \geq 2$ and $T(1) = 1$ Which of the following statements is TRUE?

1. $T(n) = \theta(\log n)$
2. $T(n) = \theta(\sqrt{n})$
3. $T(n) = \theta(n)$
4. $T(n) = \theta(n \log n)$

QUESTION 13

Arrange the following functions in increasing asymptotic order:

A. n^1/3

B. e^n

C. n^7/4

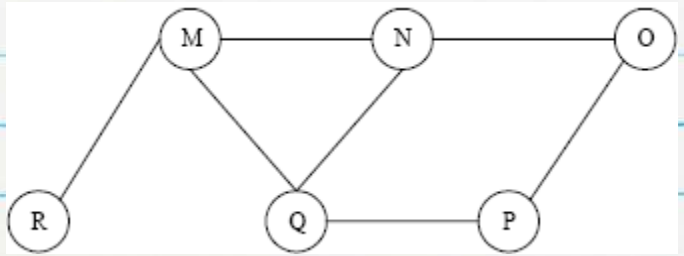
D. n log^9n

E. 1.0000001^n

1. A, D, C, E, B
2. D, A, C, E, B
3. A, C, D, E, B
4. A, C, D, B, E

QUESTION 14

The Breadth First Search algorithm has been implemented using the queue data structure. One possible order of visiting the nodes of the following graph is



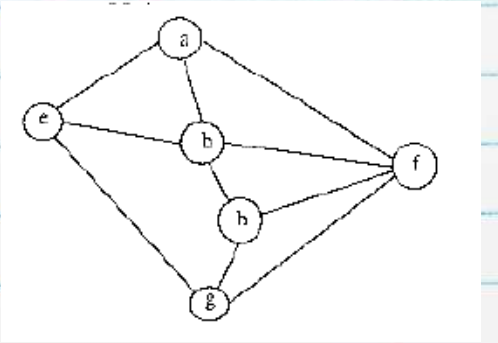
1. MNOPQR
2. NQMPOR
3. QMNPRO
4. QMNPOR

QUESTION 15

Let G be an undirected graph. Consider a depth-first traversal of G, and let T be the resulting depth-first search tree. Let u be a vertex in G and let v be the first new (unvisited) vertex visited after visiting u in the traversal. Which of the following statements is always true? (GATE CS 2000)

1. {u,v} must be an edge in G, and u is a descendant of v in T
2. {u,v} must be an edge in G, and v is a descendant of u in T
3. If {u,v} is not an edge in G then u is a leaf in T
4. If {u,v} is not an edge in G then u and v must have the same parent in T

QUESTION 16



Among the following sequences:

(I) a b e g h f (II) a b f e h g

(III) a b f h g e (IV) a f g h b e

Which are depth first traversals of the above graph?

1. I, II and IV only
2. I and IV only
3. II, III and IV only
4. I, III and IV only

QUESTION 17

Given two vertices in a graph s and t, which of the two traversals (BFS and DFS) can be used to find if there is path from s to t?

1. Only BFS
2. Only DFS
3. Both BFS and DFS
4. Neither BFS nor DFS

QUESTION 18

Which of the following condition is sufficient to detect cycle in a directed graph?

1. There is an edge from currently being visited node to an already visited node.
2. There is an edge from currently being visited node to an ancestor of currently visited node in DFS forest.
3. Every node is seen twice in DFS.
4. None of the above

QUESTION 19

If the DFS finishing time f[u] > f[v] for two vertices u and v in a directed graph G, and u and v are in the same DFS tree in the DFS forest, then u is an ancestor of v in the depth first tree.

1. True
2. False

QUESTION 20

Let G be a graph with n vertices and m edges. What is the tightest upper bound on the running time on Depth First Search of G? Assume that the graph is represented using adjacency matrix.

1. $O(n)$
2. $O(m+n)$
3. $O(n^2)$
4. $O(mn)$

QUESTION 21

What is the best time complexity of bubble sort?

1. N^2
2. NlogN
3. N
4. N(logN)^2

QUESTION 22

Suppose we are sorting an array of eight integers using quicksort, and we have just finished the first partitioning with the array looking like this:

2 5 1 7 9 12 11 10

Which statement is correct?

1. The pivot could be either the 7 or the 9.
2. The pivot could be the 7, but it is not the 9
3. The pivot is not the 7, but it could be the 9
4. Neither the 7 nor the 9 is the pivot.

QUESTION 23

Compute 1201 * 2430 by the Karatsuba Algorithm.

QUESTION 24

Write an algorithm to find all the substrings beginning with m and ending with n in the given string.

QUESTION 24

```
//ALGORITHM Substring(String[0...n-1], startChar, endChar)
//This algorithm returns the number of substrings in the given string that start
with the startChar and end with endChar
//Input: The String of length 'n', the starting character of the substring and the
ending character of the substring
//Output: The number of substrings that start with startChar and end with
endChar
for i <- 0 to n-2 do
        if String[i] == startChar do
                for j <- i+1 to n do
                        if String[j] == endChar do
                                cnt++
return cnt
```

QUESTION 25

Consider the following code snippet. Determine the basic operation and the number of times the basic operation is executed.

```
for ( i = 0 ; i < n ; i++ )
{
        for ( j = 0 ; j < i ; j++ )
        {
                m = m + j;
        }
}
```

Answer: theta(n^2)

QUESTION 26

Write an algorithm to check if the given integer is a palindrome or not.

```
ALGORITHM PalindromeChecking(m)
//Determines if the given number is a palindrome
//Input: An integer m
//Output: 1 if the number is a palindrome, 0 if not
num <- m
while num != 0 do
        rem <- num % 10
        num <- num / 10
        rev <- rev * 10 + rem
if m == rev
        return 1
else
        return 0
```

QUESTION 27

What is the asymptotic relationship between:
lg n^lg 17 VS lg 17^lg n ?

1. (lg 17^lg n) is Ω (lg n^lg 17)
2. (lg 17^lg n) is Θ (lg n^lg 17)
3. (lg 17^lg n) is O (lg n^lg 17)

QUESTION 28

Give an example for the following:

a) Function which grows in linear time - $10n$

b) Function which grows in exponential time – 4^n

c) Function which grows in polynomial time – $3n^2 + 10n$

d) Function which grows in constant time - 480