Question 1.

Which of the given options provides the increasing order of asymptotic complexity of functions f1, f2, f3 and f4?

f1(n) = 2^n

f2(n) = n^(3/2)

f3(n) = nLogn

f4(n) = n^(Logn)

Answer:

- f3, f2, f1, f4
- f2, f3, f1, f4
- f2, f3, f4, f1
- f3, f2, f4, f1

Question 2.

Consider the following program that attempts to locate an element x in a sorted array a[ ] using binary search. Assume N>1. The program is erroneous. Under what conditions does the program fail?

```
var i,j,k: integer; x: integer;
a: array; [1....N] of integer;
begin i:= 1; j:= N;
repeat
k:(i+j) div 2;
if a[k] < x then i:= k
else j:= k
until (a[k] = x) or (i >= j);

if (a[k] = x) then
writeln ('x is in the array')
else
writeln ('x is not in the array')
end;
```

Answer:

- x is the last element of the array a[]
- x is greater than all elements of the array a[]
- Both of the Above
- x is less than the last element of the array a[]

Question 3.
Which of the following data structures is best suited for efficient implementation of priority queue?

Answer:

- Array
- Linked list
- Heap
- Stack

Question 4.
Heap allocation is required for languages that

Answer:

- use dynamic scope rules
- support dynamic data structures
- support recursion
- support recursion and dynamic data structures

Question 5.
A graph is said to be _____ if the vertices can be split into two sets V1 and V2 such there are no edges between two vertices of V1 or two vertices of V2.

Answer:

- Partite
- Bipartite
- Rooted
- Bisects

Question 6.
Select the appropriate code for the recursive Tower of Hanoi problem.(n is the number of disks)

Answer: Marks: 1

- public void solve(int n, String start, String auxiliary, String end) { if (n == 1) { System.out.println(start + " -> " + end); } else { solve(n - 1, start, end, auxiliary); System.out.println(start + " -> " + end); solve(n - 1, auxiliary, start,
- public void solve(int n, String start, String auxiliary, String end) { if (n == 1) { System.out.println(start + " -> " + end); } else { solve(n - 1, auxiliary, start, end); System.out.println(start + " -> " + end); } }
- public void solve(int n, String start, String auxiliary, String end) { if (n == 1) { System.out.println(start + " -> " + end); } else { System.out.println(start + " -> " + end); solve(n - 1, auxiliary, start, end); } }
- public String reverse(String input) { for (int i = 0; i < input.length(); i++) { stk.push(input.charAt(i)); } String rev = ""; while (!stk.isEmpty()) { rev = rev + stk.pop(); stk.pop(); } return rev; }

Question 7.
Let s be a sorted array of n integers. Let t(n) denote the time taken for the most efficient algorithm to determined if there are two elements with sum less than 1000 in s. which of the following statements is true?

Answer: Marks: 1

- t (n) is 0 (1)
- n < t (n) < n log2n
- n log2n < t (n) < nC2
- t (n) = nC2

Question 8.
What will be the correct sequence of insertion for the following k-d tree?

Answer:

- (30,40),(5,25),(70,70),(10,12),(50,30),(35,45)
- (40,30),(5,25),(12,10),(70,70),(30,50),(45,35)
- (30,40),(5,25),(10,12),(70,70),(50,30),(35,45)
- (40,30),(25,5),(12,10),(70,70),(50,30),(45,35)

Question 9.
For a graph with E edges and V vertices what is the time complexity of Dijkstra algorithm using array as data structure for storing non-finalized vertices. Graph is undirected and represented as adjacency list?

Answer: Marks: 1

- O(VE)
- O(ElogV)
- O(V^2)
- O(E^2log V)

Question 10.
What will be the output of the following code?

```
void func(char* str2, char* str1)
{
int m = strlen(str2);
int n = strlen(str1);
for (int i = 0; i <= n - m; i++)
{
int j;


for (j = 0; j < m; j++)
if (str1[i + j] != str2[j])
break;

if (j == m)
cout << i << endl;
}
}

int main()
{
char str1[] = "1253234";
char str2[] = "323";
func(str2, str1);
return 0;
}
```

Answer:

- 1
- 3
- 4
- 2

Question 11.
When the function given below is executed:

```
int f(int n)
{
static int i = 1;
if (n >= 5)
return n;
n = n+i;
i++;
return f(n);
}
```

The value returned by f(1) is

Answer:

- 7
- 5
- 8
- 6

Question 12.
Consider the following program:

```
Program P2
   var n: int:
    procedure W(var x: int)
    begin
       x=x+1;
       print x;
    end

    procedure D
    begin
       var n: int;
       n=3;
       W(n);
    end
begin //beginP2
  n=10;
  D;
end
```

If the language has dynamic scoping and parameters are passed by reference, what will be printed by the program?

Answer:

- 10
- 11
- 3
- None of the above

Question 13.
The output of the following C program is?

```
void f1 (int a, int b)
{
  int c;
  c=a; a=b; b=c;
}
void f2 (int *a, int *b)
{
  int c;
  c=*a; *a=*b;*b=c;
}
int main()
{
  int a=4, b=5, c=6;
  f1(a, b);
  f2(&b, &c);
  print(c-a-b);
  return 0;
}
```

Answer:

- -5
- -4
- 5
- 3

Question 15.
Consider the following pseudo-code fragment, where m is a non-negative integer that has been initialized :

```
p=0;
k=0;
while(k < m)
    p = p + 2k;
    k=k+1;
end while
```

Which of the following is a loop invariant for the while statement?
(Note: a loop variant for a while statement is an assertion that is true each time guard is evaluated during the execution of the while statement).

Answer:

- ○ $p = 2k - 1$ and $0 \le k < m$
- ○ $p = 2k+1 - 1$ and $0 \le k < m$
- ○ $p = 2k - 1$ and $0 \le k \le m$
- ○ $p = 2k+1 - 1$ and $0 \le k \le m$

Question 16.
Consider the midpoint (or Bresenham) algorithm for rasterizing lines given below:

(1) Input (x 1 ,y 1) and (x 2 ,y 2)
(2) y=y 1
(3) d=f(x 1 +1, y 1 +1⁄2) // f is the implicit form of a line
(4) for x=x 1 to x 2
(5) do
(6) plot(x,y)
(7) if(d<0)
(8) then
(9) y=y+1
(10) d=d+(y 1 - y 2) + (x 2 - x 1)
(11) else
(12) d=d+(y 1 - y 2)
(13) end
(14) end

Which statements is/are true?

P: For a line with slope m>1, we should change the outer loop in line (4) to be over y.
Q: Lines (10) and (12) update the decision variable d through an incremental evaluation of the line equation f.
R: The algorithm fails if d is ever 0.

Answer:

- ● Q and R only
- ○ P only
- ○ P and Q only
- ○ P, Q and R

Question 17.
Find the time complexity of the following iterative code:

```
int i=0, j=N;  // N is any positive integer
while(j>0)
{
i=i*j;
j=j/2;
}
```

Answer:

- O(1)
- O(N)
- O(log n)
- O(sqrt(n))

Question 18.
Where is the given formula used in?

left_tree(data)<=node(data)<=right_tree(data)

Answer:

- Binary tree
- Binary Search tree
- AVL tree
- Heap

Question 19.
Which of the following are the two main characteristics used to define the efficiency of an algorithm?

Answer:

- (●) Time and space
- ( ) Data and time
- ( ) Processor and memory
- ( ) Complexity and capacity

Question 20.
You are given a function to calculate xy. Complete the code with appropriate options:

```
int calculate_power(int x, int y)
{
int result = 1;
while (?1?)
{
if (y % 2 == 1)
result = ?2?;
y = ?3?;
?4?
}
return result;
}
```

Note: >> is right shift operator

Answer:

- 1: y, 2: result*x, 3: y=y >>1, 4: x=x*x;
- 1: y<x, 2: result*x, 3: y=y-1, 4: result=result*y;
- 1: y&(y-1), 2: x*y, 3: y=y-1, 4: x=x*2;
- 1: y>>1, 2: result*x*y, 3:y=y-1, x=x*2;

Question 21.
Choose the option which is not an example of a control statement.

Answer:

- The Loop
- The process
- The Sequential
- The decision

Question 22.
What is the time complexity to insert a node at a specific position in a linked list?

Answer:

- O(1)
- O(n)
- O(log n)
- O(n log n)

Question 23.
A postfix expression: 18 3 2 ^ / 3 3 * + 11 7 * - is evaluated using stack algorithm (All the values are separated via space). When the first multiply (*) is evaluated, what is the value of S[top] and S[top-1]?

Answer:

- 3, 3
- 18, 9
- 9, 2
- 11, 7

Question 24.
Convert an infix expression: 34+2*(9*5-22) into postfix expression using stack. What will be the maximum count of symbols present in the stack at a time while converting?

Answer:

- 3
- 4
- 5
- 2

Question 26.
Choose the appropriate option with reference to optimal binary search tree(BST)

Answer:

- The elements present in the BST should be known prior.
- To improve the lookup time, the frequency at which the keys are accessed should be known.
- You should not modify the tree and how often the keys are accessed should be known
- The tree should be modified regularly.

Question 27.
In a max-heap element with the greatest key is always in the which node?

Answer:

- Leaf node
- First node of left sub tree
- Root node
- First node of right sub tree

Question 28.
What is the complexity of adding an element to the heap

Answer:

- O(log n)
- O(h)
- O(log n) & O(h)
- O(n)

Question 29.
Which among the following data structures is best suited for storing very large numbers (numbers that cannot be stored in long long int). Following are the operations needed for these large numbers.

Answer:

- Array
- Linked list
- Binary Tree
- Hash

Question 30.
In the Union/Find algorithm, the ranks of the nodes on a path will increase monotonically from?

Answer:

- leaf to root
- root to node
- root to leaf
- left subtree to right subtree