Question 1
Marks: 1
IDMAOA04 – What is the time complexity of the following algorithm with respect to the input size N

Choose one answer.

- O(1)
- O(N)
- O(N^2)
- O(2N)

Correct
Marks for this submission: 1/1.
Question 2
Marks: 1
IDEGRA08 – Which of the following is wrong about graph? Choose one answer.

- Weigh of an edge must be possitive.
- Weight of an edge can be negative.
- Adjacency matrix is an appropriate representation of a graph.
- Adjacency list is an appropriate representation of a graph.

Correct
Marks for this submission: 1/1.
Question 3
Marks: 1
IDESQAS12 – In a hash table of the size N using linear probing, what is the probing hash function hi(k)?
Choose one answer.

- hi(k)=h(k) mod N.
- **hi(k)=(h(k)+i) mod N.**
- hi(k)=i + k.
- hi(k)=i mod N.

Question 4
Marks: 1
IDELI04 – Which statement is correct about array-based list? Choose one answer.

- (●) Array-based is faster than linked-list in case of accessing list's items.
- ( ) Array-based is faster than linked-list in case of inserting new item into the list.
- ( ) Elements of array-based list can be located dinamically and discontinuously.
- ( ) They can be implemented by Java language only.

Correct
Marks for this submission: 1/1.

Question 5
Marks: 1
IDELI03 – In the ADT of the list data structure, isEmpty() method returns a/an _____ value? Choose one answer.

- ( ) Real number.
- ( ) String.
- ( ) Integer.
- (●) Boolean.

Correct
Marks for this submission: 1/1.

Question 6
Marks: 1
IDEGRA03 –

Choose one answer.

- ( ) The weight of the path from vertex Vi to vertex Vj going exactly through K verties.
- ( ) The number of paths of length K from vertex Vi to vertex Vj.
- ( ) The length of the Hamiltonian cycle that has K verties including Vi and Vj.
- (●) The weight of the shortest path from vertex Vi to vertex Vj using intermediate verties in the set {V1..Vk}.

Correct
Marks for this submission: 1/1.

Question 7
Marks: 1
IDMTRE06 – Given the following tree, what is the result of pre-order traversal the tree?

Choose one answer.

- ( ) A,B,C,D,E,F,G,H,I,J

- A,D,B,C,J,G,E,F,I,H
- A,B,D,C,E,G,J,F,H,I
- A,B,D,C,E,F,G,J,H,I

Correct

Marks for this submission: 1/1.

Question 8

Marks: 1

IDMSQ02 – A queue Q has 05 character items, Q={“A”, “B”, “C”, “D”, “E”} where “E” is the rear and “A” is the front of the queue. What is the content of Q if we perform the following list of operations on the queue: enqueue(“F”)-->dequeue()-->dequeue()-->dequeque()-->enqueue(“D”)?

Choose one answer.

- Q={“D”, “E” ,“F” ,“D”}
- Q={“D”, “F”, “A”, “B”}
- Q={“C”, “D”, “E”, “F”}
- Q={“A”, “B”, “C”, “D”}

Correct

Marks for this submission: 1/1.

Question 9

Marks: 1

IDESOA03 – Which statement below is wrong in the context of linear sorting algorithm? Choose one answer.

- The sorted order is determined based on the comparisons between sort keys.
- Counting sort and Radix sort are linear sorting algorithms.
- The time complexity is linear.
- **The sort key must be numeric.**

Question 10
Marks: 1
IDMSQ07 – One difference between a queue and a stack is: Choose one answer.

- Stacks require linked lists, but queues do not.
- Queues require linked lists, but stacks do not.
- Queues use two ends of the structure; stacks use only one.
- Stacks use two ends of the structure, queues use only one.

Correct
Marks for this submission: 1/1.
Question 11
Marks: 1
IDMLI04 – In a Singly Linked List implementation, what does this code to to the list?

Choose one answer.

- Search for a node in the list
- Remove the node at the pos position from the list
- Remove the tail node
- Remove the head node

Correct
Marks for this submission: 1/1.
Question 12
Marks: 1
IDMSOA03 – Bubble sort algorithm is used to sort the array A={23,78,45,8,32,56} in the ascending order. What are the items of A after 03 sort pass?
Choose one answer.

- A={8,23,32,45,56,78}
- A={23,45,8,32,56,78}
- A={8,32,23,45,56,78}
- A={23,32,78,56,45,8}

Correct
Marks for this submission: 1/1.
Question 13
Marks: 1
IDETRE17 – Which of the following is correct about array-based binary implementation using perfect binary tree indexing scheme?
Choose one answer.

- The parent of node i is i/2.

- Array L is used to store node's labels and array P is used to store the index of node's parent.
- The left child and right child of node i are 2i+1 and 2i+2.
- The left child and right child of node i are 2i+2 and 2i+1.

Correct

Marks for this submission: 1/1.

Question 14

Marks: 1

IDMSQAS04 – Evaluate the following expression:* - * + 7 3 + 9 1 * 5 + 2 8 3?

Choose one answer.

- 150
- 105
- 510
- 501

Correct

Marks for this submission: 1/1.

Question 15

Marks: 1

IDHTRE06 – Consider the recursive, nested representation of binary trees: T=(O L R) indicates a binary tree T with the root node O, the left sub-tree L and the right sub-tree R. Note that L and R may be null or further nested. Which of the following represents a valid binary tree?

Choose one answer.

- (1 (2 3 4) (5 6 7))
- (1 (2 3 null) (4 5))
- (1 (2 3) (4 5) (6 7))
- (1 (2 3 4) (5 6) 7)
- (1 2 3 4 5 6 7)

Correct

Marks for this submission: 1/1.

Question 16

Marks: 1

IDEGRA07 – Which is the best describe of the graph below?

Choose one answer.

- Unweighted, undirected graph.
- Unweighted, undirected, complete graph.
- Unweighted, undirected, connected graph.

- Complete graph.
- Connected graph.

Correct

Marks for this submission: 1/1.

Question 17

Marks: 1

IDESQ13 – Suppose you push 10, 20, 30, 40 onto a stack, then you pop three items. Which one is left on the stack?

Choose one answer.

- 30
- 40
- 10
- 20

Correct

Marks for this submission: 1/1.

Question 18

Marks: 1

IDMTRE07 – Given the following tree, what is the result of in-order traversal the tree?

Choose one answer.

- I,F,C,A,J,G,D,B,E,H.
- A,B,D,C,E,G,J,F,H,I.
- B,D,A,G,J,E,C,H,F,I
- A,B,C,D,E,F,G,H,I,J.

Correct

Marks for this submission: 1/1.

Question 19

Marks: 1

IDESOA10 – In Merge sort algorithm …?

Choose one answer.

- The worst case is O(N^2).
- The input array is divided into two parts at the middle of the array.
- The merge algorithm combines two sorted array by attaching the second array to the end of the first one.
- The input array is divided into two parts based on the pivot values.

Correct

Marks for this submission: 1/1.

Question 20

Marks: 1

IDETRE16 – Complete the following code of the method getNodeLabel() in the array-based tree implementation?

Choose one answer.

- l[node]
- p[node]
- l
- n

Correct

Marks for this submission: 1/1.

Question 21

Marks: 1

IDESQ11 – Which statement is wrong about list-based queue?

Choose one answer.

- **Queue is empty when front=rear.**
- List-based queue ADT does not have isFull() operation
- A linked-list is used to implement the queue.
- front is the head and rear is the tail of the linked-list.

Question 22

Marks: 1

IDEAOA08 – Which statement is wrong concerning to the best-case time complexity of an algorithm?

Choose one answer.

- The best case of an algorithm A is estimated as the minimum number of primitive operations performed by A on an input size n.
- **The best-case gives us an lower bound on the time complexity of algorithms.**
- Many algorithms perform exactly the same in the best case.
- The best-case is used frequently to analyze the time complexity of algorithms.

Incorrect

Marks for this submission: 0/1.

Question 23

Marks: 1

IDESQ03 – In the ADT of the Stack data structure, push() method is used to? Choose one answer.

- get an item without deleting it from the stack.
- get the total items in the stack.

- (•) add an item to the stack.
- ( ) take an item out of the stack.

Correct

Marks for this submission: 1/1.

Question 24

Marks: 1

IDESOA08 – Which sorting algorithm scans and exchanges any pair of elements that is out-of-order?

Choose one answer.

- ( ) Heap sort.
- (•) Bubble sort.
- ( ) Insertion sort.
- ( ) Selection sort.

Correct

Marks for this submission: 1/1.

Question 25

Marks: 1

IDMGRA03 - In an unweighted, undirected connected graph, the shortest path from a node S to every other node is computed most efficiently, in terms of time complexity by?

Choose one answer.

- ( ) Warshall's algorithm.
- (•) Dijkstra's algorithm starting from S.
- ( ) **Performing a BFS starting from S.**
- ( ) Performing a DFS starting from S.

Question 26

Marks: 1

IDESQAS08 – Which of the following is not an application of the queue data structure?

Choose one answer.

- (•) Evaluating a posfix expression.
- ( ) Job scheduling.
- ( ) Packet queueing.
- ( ) Stack reversing.

Correct

Marks for this submission: 1/1.

Question 27

Marks: 1

IDELI11 – Complete the code below to insert a new node X at the POS position of a Singly Linked List?

Choose one answer.

- Y.setNext(tail).
- X.getNext().
- X.setNext(Y).
- Y.getNext().

Correct

Marks for this submission: 1/1.

Question 28

Marks: 1

IDETRE01 – A perfect binary tree with 2N+1 nodes contain? Choose one answer.

- 2N leaf nodes.
- N leaf nodes.
- **N interior nodes**.
- 2N interior nodes.

Question 29

Marks: 1

IDHTRE08 –Given a binary tree T and a method print() as the following. What will be printed on the screen, if we call: print(T,5);

Choose one answer.

- U
- A
- E
- Z

Incorrect

Marks for this submission: 0/1.

Question 30

Marks: 1

IDEAOA06 – What is time complexity of an algorithm?

Choose one answer.

- The response time of the algorithm.
- The amount of time needed to implement the algorithm.
- The upper limits for excution time of the algorithm.

- **The amount of time that the algorithm needs to run for an input of a given size n.**

Question 31
Marks: 1

IDEGRA09 – To implement Dijkstra's shortest path algorithm on unweighted graphs the data structure to be used is?
Choose one answer.

- Heap
- Tree
- Stack
- Queue

Correct

Marks for this submission: 1/1.

Question 32
Marks: 1

IDHTRE05 – A complete N-ary tree is a tree which each node has N children or no children. Let I be the number of interior nodes and L be the number of leaves in a complete N-aray tree. If L=41 and I=10, what is the value of N?

Choose one answer. 3

- 6
- **5**
- 4

Question 33
Marks: 2

The method below represent a number k in base b using a stack. Please complete the code of this method?

```
public void BaseConversion(int k, int b)
{
    ArrayStack s = new
    ArrayStack(); while (k/b != 0)
    {
       s.push(k%b);
       k=k/b ;
    }
    s.push(k);
    while (!s.isEmpty())
       System.out.print( s.pop() );
}
```

Partially correct
Marks for this submission: 1/2.
Question 34
Marks: 1
IDEGRA05 – If we use adjacency matrix for representing a weighted undirected graph, we will have?
Choose one answer.

- An asymmetric matrix.
- A symmetric matrix contains only 0 and 1.
- A matrix contains only 0 and 1.
- A symmetric matrix over its diagonal.

Correct
Marks for this submission: 1/1.
Question 35
Marks: 1
IDETRE07 – What can you say about the following tree?

Choose one answer.

- This is a heap.
- This is a binary tree.
- This is a binary search tree.
- This is a tree with integer labels.

Incorrect
Marks for this submission: 0/1.
Question 36
Marks: 3

Method search() is used to search for an item in a singly linked list. Please complete the code for this method?

```
public int search(int data)
{
   int count=1;

   SLNode current=this.head;

   while ((current !=null) && (current.getData() != data ))

   {

      count++;
```

```
        current= current.getNext() ;
    }
    if (current == null)
        return -1;
    else
        return count;
}
```

Correct

Marks for this submission: 3/3.

Question 37

Marks: 1

IDMGRA01 –The maximum degree of any vertex in a simple graph with N vertices is? Choose one answer.

- N
- 2N-1
- 2N
- N-1

Correct

Marks for this submission: 1/1.

Question 38

Marks: 1

IDETRE04 – Number of leaf nodes in a perfect binary tree of depth h is? Choose one answer.

- 2h-1.
- 2^h.
- 2^(h+1)-1.
- 2^(h+1).

Correct

Marks for this submission: 1/1.

Question 39

Marks: 1

IDMTRE20 – In a binary search tree, node B is right child of node A, and node C is the right child of B. Which of the following statements are true?
Choose one answer.

- Value of node C is bigger than value of node B, but smaller than value of node A.
- Value of node C is bigger than value of node A, but smaller than value of node B.
- **Node C has the smallest value.**
- Node C has the biggest value.

Question 40
Marks: 1
IDMSQAS03 – Evaluate the following expression:8 7 + 6 4 + * 2 3 7 + * - 1 -?
Choose one answer.

- 291
- 129
- 192
- 219

Correct
Marks for this submission: 1/1.

Question 41
Marks: 1
IDESQAS14 – In the context of seach algorithms, which of the following statements are true? Choose one answer.

- Linear search is faster than binary search.
- Binary search is the fastest search algorithm.
- Hash data structure is used to support sorting.
- Binary search is faster than linear search, but it requires a sorted array.

Correct
Marks for this submission: 1/1.
Question 42
Marks: 1
IDEAOA15 – What are Big-Oh, Big-Omega, Big-Theta?
Choose one answer.

- They are very specific and pre-defined functions.
- They are algorithm's characteristic.
- They are mathematic notation for comparing growth rates between functions.
- They are mathematic notation to define the maximum growth rates of functions.

Correct
Marks for this submission: 1/1.

Marks: 1

IDMAOA03 – What is the time complexity of the following algorithm with respect to the input size N

```
Algorithm: GCD(m,n)
Input: Two integers m and n
Output: The value of gcd(m,n)

i←n
While (i>1) do
  If (m is divisible by i) AND (n is divisible by i)
    Return i
  i--
Return 1
```

Choose one answer.

- O(N+M)
- O(N*M)
- O(N)
- O(M)

Question2
Marks: 1

IDHSOA06 – Which of the following sorting algorithms has the lowest worst case time complexity?

Choose one answer.

- Bubble sort
- Quick sort
- Merge sort
- Insertion sort

Question3
Marks: 2

Method search() is used to search for an item in a singly linked list. Please complete the code for this method?

```
public int search(int data)
{
      int l=getLength();

      for (int i=1; i<l; i++)

      {

         SLNode aNode=[ aNode ];

         if (aNode.getData()==data)

            return i;
      }

      return [ 0 ];
}
```

Question4
Marks: 1

IDESQ07 – In ADT of the Queue data structure, enqueue() method will?

Choose one answer.

- Add a new item to the queue at the front position.
- Add a new item to the queue at the rear position.
- Remove an item from the queue at the front position.
- Remove an item from the queue at the rear position.

Question5
Marks: 1

IDEAOA04 – Which statement is correct concerning to the complexity of algorithm?

Choose one answer.

- The complexity of an algorithm is a measure of the amount of time and cost needed to implement this algorithm.
- The complexity of an algorithm is a measure of the amount of time and space required by the algorithm for an input of a given size n.

- The complexity of an algorithm is determined by the maximum value of the input size n that does not affect the correctness of the algorithm.
- The complexity of an algorithm is determined by the total lines of code of the program that implements the algorithm using a given programming language.

Question6
Marks: 1

IDHAOA09 – What is O(T(N)), if

$$T(n) = \begin{cases} 1 & if\ n = 0 \\ 2T(n-1) + 1 & otherwise \end{cases}$$

Choose one answer.

- O(NlogN)
- O(logN)
- O(N^2)
- O(2^N)

Question7
Marks: 1

IDESQAS07 – A close hashing hash table has an array size of 512. What is the maximum number of entries that can be placed in the table?

Choose one answer.

- 256.
- 1024.
- There is no maximum.
- 511.
- 512.

Question8
Marks: 1

IDESQAS13 – Given the following input (4322, 1334, 1471, 9679, 1989, 6171, 6173, 4199) and the hash function: h(k)=k mod 10. Which of the following statements are true?

Choose one answer.

- 1471 and 6171 has to different value.

- Each element hashes to a different value.
- All elements hash to the same value.
- 4199 and 9679 hash to the same value.

Question9
Marks: 1

IDESOA12 – In Radix sort algorithm …?

Choose one answer.

- A stable sorting algorithm is used to sort the digits.
- Sort key can be a string or an object.
- The time complexity is O(NlogN).
- Digits are sort from left most to right most.

Question10
Marks: 1

IDMSOA09 – Which array represents a Max-Heap?

Choose one answer.

- A={78,56,45,32,23,8,15}
- A={8,78,56,32,15,23,45}
- A={78,23,15,56,32,8,45}
- A={8,15,23,32,56,45,78}

Question11
Marks: 1

IDELI14 – Which is the common form of a node X in a Doubly Linked List? Choose one answer.

- X(data, prev)
- X(data, prev, next)
- X(data)
- X(data, next)

Question12

Marks: 1

IDEAOA14 – Suppose that the estimated time complexity of algorithm A and algorithm B is TA(N) and TB(N) respectively. How can we compare the time complexity of A and B?

Choose one answer.

- We compare the value of TA and TB corresponding to every value of n.
- We compare the value of TA and TB corresponding to some special value of n.
- We compare the value of TA and TB corresponding to a very large, pre-defined value of n.
- We compare the grow rate of the leading terms of TA(N) and TB(N).

Question13
Marks: 1

IDESOA04 – The time complexity of an algorithm T(N) is estimated by couting the number of primitive operations….?

Choose one answer.

- The order of both key and non-key values are maintained.
- The relative order of elements with equal keys are maintained.
- The order of key values are maintained.
- The relative order of elements with equal keys are not maintained.

Question14
Marks: 1

IDMSQ08 – In an array-based stack, which operation has time complexity O(N) in the worst-case?

Choose one answer.

- No operation that has time complexity O(N).
- isEmpty().
- push().
- pop().

Question15
Marks: 1

IDHSQ01 – Suppose that you are writing a program to evaluate if a given string input has proper closing parenthesis for every opening parenthesis. Which data structure should be used?

Choose one answer.

- Array of strings.
- Stack.
- Tree.
- Queue.

Question16
Marks: 3

The following method implement the recursive version of the binary search algorithm. Please complete the code of the method?

```
public static int BinarySearch(int []a, int key, int left, int right)
{
   if (left > right)
      return KE ;
   else
   {
      int mid = (left + right)/2;
      if ( a[mid]<key )
        return BinarySearch(a,key,mid+1,right);
      else
      {
        if (a[mid]>key)
          return BinarySearch(a,key,left, mid-1
        ); else
          return mid;
      }
   }
}
```

Question17
Marks: 1

IDMLI03 – In an Array-based list, what does this code do to the list?

```
for (int i=pos-1;i<length;i++)
  items[i]=items[i+1];
length--;
```

Choose one answer.

- Traversing the list.
- Remove an item from the list.
- Duplicate items in the list.
- Remove all item from the list except one.

1 Marks:
1

IDEAOA01 - Which statement below is correct?

Choose one answer.

- An algorithm takes the input to a problem and transforms it to the output which solves the problem. There is only one algorithm for a specific problem.
- An algorithm is a program written in machine code.
- An algorithm is a step-by-step procedure for solving a problem in a finite amount of time.
- An algorithm is a representation of a program in pseudocode.

Question2
Marks: 1

IDMSQ04 – A queue Q has 05 character items, Q={“5”, “4”, “3”, “2”, “1”} where “1” is the front and “5” i the rear of Q. Which operations must be perform to change Q into a new state: Q={“3”, “2”, “1”, “4”, “5”}

Choose one answer.

- enqueue(“5”)-->enqueue(“4”)-->dequeue()-->dequeue()
- enqueue(“4”)-->enqueue(“5”)-->dequeue()-->dequeue()
- dequeue()-->enqueue(“5”)-->dequeue()-->enqueue(“4”)
- dequeue()-->dequeue()-->enqueue(“5”)-->enqueue(“4”)

Question3
Marks: 1

IDMAOA13 – Consider three algorithms which have the time complexity in Big-Oh notation below. Please arrange these algorithms in the ascending order of time efficiency (the slowest algorithm is the first one in t order).

$f_1(N)=O(2N^5 + N)$; $f_2(N)=O(N\log N)$; $f_3(N)=O(2^N)$

Choose one answer.

- Algorithm 3, Algorithm 1, Algorithm 2
- Algorithm 1, Algorithm 3, Algorithm 2
- Algorithm 1, Algorithm 2, Algorithm 3
- Algorithm 3, Algorithm 2, Algorithm 1
- Algorithm 2, Algorithm 3, Algorithm 1
- Algorithm 2, Algorithm 1, Algorithm 3

Question4
Marks: 1

IDEL16 – A mathematical-model with a collection of operations defined on that model is called?

Choose one answer.

- Data structure.
- Primitive data type.
- Abstract Data Type.
- Algorithm.

Question5
Marks: 1

IDESOA10 – In Merge sort algorithm …?

Choose one answer.

- The worst case is O(N^2).
- The input array is divided into two parts based on the pivot values.
- The input array is divided into two parts at the middle of the array.

The merge algorithm combines two sorted array by attaching the second array to the end of the first one.

Question6
Marks: 1

IDESQ10 – Complete the code for the dequeue() method in array-based circular queue?

```
public void dequeue()
{
  if (!isEmpty())
  {
       int pos=front;
       _______;
       return items[pos]
   }
}
```

Choose one answer.

- rear=rear+1
- front=(front+1)%maxSize
- front=front+1
- rear=(rear+1)%maxSize

Question7
Marks: 1

IDMLI09 - Consider method F in Java and a singly linked list L below. Suppose that H is the head node of the list L. What is the result if we call F(H)?

```
public static void F(SLNode node)
{
  if (node!=null)
  {
    if (node.getNext()!=null)
      F(node.getNext().getNext());
    System.out.println(node.getData());
  }
}

L={ 'A'-->'B'-->'C'-->'D'-->'E'-->'F' }
H is the head node of L, H='A'
```

Choose one answer.

- ‘F’-- >‘D’-->‘B’
- ‘A’-- >‘C’-->‘E’
- ‘E’-- >‘C’-->‘A’
- ‘B’ >‘D’ >‘F’

Question8
Marks: 2

Please complete the code of the linear search method below?

```
public int LinearSearch(int[] a, int key)
{
    int index=0;
    boolean found=false;
    int pos=-1;
    while ((index<n)&&(!found)
    {
      if ( a[index]!=key )
            {
                found=true;
                pos=index;
            }
            index++;
    }
        return pos ;
}
```

Question9
Marks: 1

IDESOA09 – Which statement is wrong concerning to the Heap data structure?

Choose one answer.

- It is used in Heap sort algorithm.
- In a min-heap the parent node value is always greater than or equal to its children’s values.
- An array can be used to store heap’s nodes.
- It is a tree where all nodes have zero, one or two children.

Question10
Marks: 1

IDHAOA08 – The method f3(N) calls two methods f1(N) and f2(N) as follows. What is the time complexit of method f3(N)?

```
Suppose that f1(n) is O(n^2) and f2(n) is O(n)
public void f3(int n)
{
      for (int i=1; i<n; i++)
      {
            f2(n);
            for (int j=1; j<n; j++)
                  f1(n);
      }
```

Choose one answer.

- (•) O(N^4)
- ( ) O(N^2)
- ( ) O(N)
- ( ) O(N^3)

Question11
Marks: 1

IDESQAS11 – Complete the code below to search for key in an array using linear seach algorithm?

```
public int LinearSearch(int[] a, int key)
int i=0;
while (i<a.length)
{
  if (a[i]==key)
    return ____;
  i++;
}
return -1;
```

Choose one answer.

- ( ) -1.
- ( ) i.

a[i].

true.

Question12
Marks: 3

Method swap() is used to swap two nodes in a Singly Linked List. Please complete the code for this method

```
public void swap(int pos1, int pos2)
{
    SLNode node1 = get(pos1);
    SLNode node2 = get(pos2) ;
    SLNode tmp=new SLNode(node1.getData());
    node1.setData( node2.getData() );
    node2.setData( tmp.getData() );
}
```

Question13
Marks: 1

IDHSQ04 – In the method F below, q1 and q2 are two queues containing integer items. What should metho F print on the screen?

```
public static void F()
{
  Queue q1=new Queue();
  Queue q2=new Queue();
  for (int i=1; i<10; i=i+2)
  {
    q1.enqueue(i);
    q2.enqueue(i+1);
  }
  while (!q1.isEmpty())
  {
    System.out.print(q1.dequeue()+ " ");
    System.out.print(q2.dequeue()+ " ");
  }
}
```

Choose one answer.

- 1 2 3 4 5 6 7 8 9 10
- 9 7 5 3 1 10 8 6 4 2
- 9 10 7 8 5 6 3 4 1 2
- 1 3 5 7 9 2 4 6 8 10
- 10 9 8 7 6 5 4 3 2 1

Question14
Marks: 1

IDEAOA05 – When evaluating algorithm's complexity, which approach makes possible an evaluation that independent of the hardware and software environments?

Choose one answer.

- Theoretical approach.
- Measuring the running time and memory space using the same hardware and software environment.
- Using input data sets of varying size.
- Experimental approach.

Question15
Marks: 1

IDMSOA01 – Selection sort algorithm is used to sort the array A={23,78,45,8,32,56} in the ascending orde What are the items of A after 03 sort pass?

Choose one answer.

- A={8,32,23,45,56,78}
- A={78,45,56,8,32,23}
- A={78,45,56,23,32,8}
- A={23,32,8,45,56,78}

Question16
Marks: 1

IDESQAS10 – Consider a hash table of size seven, with starting index zero, and a hash function h(k)=(3k+ mod 7. What is the address of the key k=10?

Choose one answer.

- 0.
- 3.
- 6.
- 7.

Question17
Marks: 1

IDHSOA03 – Given an array A that is almost sorted (only one or two elements are misplaced). Which sorti algorithm gives the best time efficiency when applied on A.

Choose one answer.

- Selection sort
- Insertion sort
- Bubble sort
- Quick sort

Question 4
Marks: 1

IDHSOA02 – Insertion sort is used to sort an array in the descending order. When does the best case occur?
Choose one answer.

- The array is already sorted in the ascending order.
- The array is already sorted in the descending order.
- The array contains several zero items.
- The array has several duplicated items.

Question 9
Marks: 1

IDEAOA09 – Which statement is wrong concerning to the average-case time complexity of an algorithm?
Choose one answer.

- The average-case is easy to determine.
- The verage-case is places somewhere between the best-case and the worse-case.
- The average-case of an algorithm A is depended on the characteristic of the input data.
- The average-case of an algorithm A is estimated as the average number of primitive operations performed by A on an input size n.

Question 10
Marks: 1

IDMSOA14 – Quick sort algorithm is used to sort the array A={30,22,33,42,10,9,52,2}. Suppose that the first array elements is chosen as the pivot for partitioning. What is the array after the first partition?
Choose one answer.

- A={10,2,9,30,22,52,33,42}
- A={10,22,2,9,30,42,52,33}
- A={30,52,42,33,10,22,9,2}
- A={30,2,9,10,22,33,42,52}

Question 16
Marks: 1

IDMLI12 – What is the number of comparisons needed in the worst case to search for a given node in a Singly Linked List of the length N nodes?
Choose one answer.

- N
- log(N)
- N/2

- Nlog(N)

Question 17
Marks: 1
IDESQAS01 – What is the worst-case time for linear search finding a single item in an array? Choose one answer.

- Quadratic time.
- Logarithmic time.
- Linear time.
- Constant time.

Question 1

Marks: 1

IDELI07 – In a Singly Linked List, if a Node X(data,next) is a tail which is the value of the X's next?

Choose one answer.

- head
- null
- 0
- undefined

Question 10

Marks: 1

IDMSOA12 – The Merge method in Merge sort algorithm is used to combine two sorted array A={3,27,38,43} and B={9,10,82}. What is the result array C?

Choose one answer.

C={3,9,10,27,38,43,82}

C={3,82,9,43,10,38,27}

C={3,27,38,43,9,10,82}

C={9,10,82,3,27,38,43}

Question 11

Marks: 1

IDESQ11 – Which statement is wrong about list-based queue?

Choose one answer.

List-based queue ADT does not have isFull() operation

A linked-list is used to implement the queue.

Queue is empty when front=rear.

front is the head and rear is the tail of the linked-list.

Question 14

Marks: 1

IDESQAS14 – In the context of seach algorithms, which of the following statements are true? Choose one answer.

Binary search is faster than linear search, but it requires a sorted array. Binary search is the fastest search algorithm.

Hash data structure is used to support sorting.

Linear search is faster than binary search.

Marks: 1

IDMSOA02 – Insertion sort algorithm is used to sort the array A={23,78,45,8,32,56} in the ascending order. What are the items of A after 03 sort pass?

Choose one answer.

- A={45,56,78,23,32,8}
- A={8,23,45,78,32,56}
- A={8,23,45,56,32,78}
- A={45,56,78,32,23,8}

Question 2

Marks: 1

IDESQ16 – What is the result of the following operation on the stack S: S.peek(S.push(X))? Choose one answer.

- Null.
- S.top.
- S.push(X).
- X.

Question 3

Marks: 1

IDHSOA01 – Selection sort is used to sort an array in the descending order. When does the worst case occur?

Choose one answer.

- The first and the last items of the array are the same.
- The array is already sorted in the ascending order.
- The array is already sorted in the descending order.
- The array has several duplicated items.

Question 4

Marks: 2

The method below represent a number k in base b using a stack. Please complete the code of this method?

```
public void BaseConversion(int k, int b)
{
    ArrayStack s = new
```

ArrayStack(); while (k/b != 0)

```
        {
            s.push(k%b);
            k=k/b ;
        }
        s.push(k);
        while (!s.isEmpty())
            System.out.print( s.Disp() );
    }
```

Question 6
Marks: 1
IDMLI02 – In a Singly Linked List implementation, what do we do when assigning head to null? Choose one answer.

- Delete all nodes from the list.
- Avoid traversing the list.
- Remove the last node from the list.
- Remove the first node from the list.

Question 7
Marks: 1
IDEAOA06 – What is time complexity of an algorithm? Choose one answer.

- The upper limits for excution time of the algorithm.
- The amount of time needed to implement the algorithm.
- The amount of time that the algorithm needs to run for an input of a given size n.
- The response time of the algorithm.

Question 9
Marks: 1
IDESOA13 – Which statement is wrong concerning to Counting sort algorithm? Choose one answer.

- It is a stable sorting algorithm.
- It is an internal sorting algorithm.
- It is a linear sorting algorithm.
- The correct position of the key x is determined by the number of keys less than x.

Question 10
Marks: 1
IDESOA14 – Suppose that we are using Radix sort on N elements, each element has P digits in base b (each digit is in the range [0 .. B-1]), and couting sort algorithm is used to sort the digits. What is the time complexity of the Radix sort algorithm?
Choose one answer.

- O(P(N+B)).
- O(N.P.B).
- O(P+N+B).
- O(B+N).

Question 13
Marks: 1

IDESQAS06 – A separate chaining hash table has an array size of 512. What is the maximum number of entries that can be placed in the table?
Choose one answer.

- 511.
- 512.
- 1024.
- There is no maximum.
- 256.

Question 14
Marks: 1

IDMSQ03 – A stack S has 05 character items, S={“5”, “4”, “3”, “2”, “1”} where “1” is the top of S. Which operations must be perform to change S into a new state: S={“5”, “4”, “2”, “3”, “1”}?
Choose one answer.

- pop()-->push(“2”)-->pop()-->push(“3”)-->pop()-->push(“1”)
- pop()-->pop()-->pop()-->push(“2”)-->push(“3”)-->push(“1”)
- push(“2”)-->pop()-->push(“3”)-->pop()-->push(“1”)-->pop()
- push(“2”)-->push(“3”)-->push(“1”)-->pop()-->pop()-->pop()

Question 15
Marks: 1

IDMAOA12 – Consider two algorithms which have the time complexity in Big-Oh notation below. Which statement is correct?

Choose one answer.

- The second algorithm is four times faster than the first one.
- With the same value of N, two algorithm have the same computational steps.
- The first algorithm is four times faster than the second one.
- Two algorithm are equivalent in term of time efficiency.

Question 16
Marks: 1

IDEAOA08 – Which statement is wrong concerning to the best-case time complexity of an algorithm?
Choose one answer.

- The best-case is used frequently to analyze the time complexity of algorithms.
- Many algorithms perform exactly the same in the best case.
- The best-case gives us an lower bound on the time complexity of algorithms.
- The best case of an algorithm A is estimated as the minimum number of primitive operations performed by A on an input size n.

1 Marks:
1

IDMLI04 – In a Singly Linked List implementation, what does this code to to the list?

```
if (!isEmpty())
{
 if (pos == 1)
  head=head.getNext();
 else
 {
  SLNode prevNode=traversing(pos-1);
  SLNode posNode=prevNode.getNext();
  prevNode.setNext(posNode.getNext());
 }
}
```

Choose one answer.

- Remove the tail node
- Search for a node in the list
- Remove the node at the pos position from the list
- Remove the head node

Question2
Marks: 1

IDMAOA05 – What is the time complexity of the following algorithm with respect to the input size N

```
Algorithm sum(n)
Input: an integer n
Output: the sum S = ∑_{i=1}^{n} i^3

    s ← 0
    for  i← 1 to n do
         s=s+i*i*i;
    return s;
```

Choose one answer.

- O(2N)
- O(1)
- O(N)
- O(N^2)

Question3
Marks: 1

IDELI13 – In a Circular Linked List, if a Node X(data,next) is a tail which is the value of the X's next?

Choose one answer.

- 0
- head
- null
- undefined

Question4
Marks: 1

IDESQAS12 – In a hash table of the size N using linear probing, what is the probing hash function hi(k)?

Choose one answer.

- hi(k)=h(k) mod N.
- hi(k)=i + k.

- hi(k)=i mod N.
- hi(k)=(h(k)+i) mod N.

Question5
Marks: 1

IDESQAS09 – Which of the following is not an application of the stack data structure?

Choose one answer.

- Backtracking.
- Arithmetic expression evaluation.
- Managing function calls.
- Message buffering.

Question6
Marks: 1

IDMSQ05 – In method F below, the stack s contains character items. Which is the result if we call method F with the input string text="datastructure"?

```
public static void F(String text)
{
  Stack s=new Stack();
  for (int i=0; i<text.length(); i++)
    s.push(text.charAt(i));
  while (!s.isEmpty())
   System.out.print(s.pop());
}
```

Choose one answer.

- erutcurtsataderutcurtsatad
- datastructure
- erutcurtsatad
- datastructuredatastructure

Question9
Marks: 1

IDHSQ06 – In the method F below, s is a stack containing integer items. What is the content of s after calling F(), suppose that the top of the stack is the right most item?

```
public void F()
{
  Stack s=new Stack();
  s.push(3); q.push(5); q.push(9);
  s.push(s.pop());
  s.push(2); s.push(4);
  s.push(s.pop());
}
```

Choose one answer.

- 3 9 5 4 2
- 4 3 5 9 2
- 4 2 9 5 3
- 9 3 2 4 5
- 3 5 9 2 4

Question10
Marks: 1

IDEAOA12 – Which notation represents the upper-bound of the grow rate of a function?

Choose one answer.

- Big-Omega notation
- Big-Theta notation
- Big-Alpha notation
- Big-Oh notation

Question11
Marks: 1

IDMSOA13 – Heap sort algorithm is used to sort the array A={15,19,10,7,17,16} in the ascending order (using a Max-Heap). What is the content of A after calling BuildHeap() method?

Choose one answer.

- A={19,17,16,7,15,10}
- A={10,7,15,19,16,17}

- A={19,10,17,7,15,16}
- A={10,15,17,19,7,16}

Question12
Marks: 1

IDHAOA02 – An algorithm that has the time complexity O(NlogN) spends 3 seconds to finish running with the input size N=1,000. Assuming that total number of primitive excution T(N) is directly proportional to NlogN, or T(N)=C.(NlogN) where C is a constant. Estimate how long this algorithm run with the input size N=10,000?

Choose one answer.

- 50 seconds
- 30 seconds
- 60 seconds
- 40 seconds

Question13
Marks: 3

Method copyStack() is used to copy the content of the source stack into the destination stack. Please complete the code for this method.

```
public static void copyStack(ArrayStack scr, ArrayStack des)
{
   ArrayStack tmp=new
   ArrayStack(); String item;
   do
   {
      item=[ scr.pop() ];
      if (item != null)
         tmp.push(item);
   }
   while (item != null);
   do
   {
      item=[ tmp.pop() ];
      if (item != null)
      {
         scr.push(item);
         des.push(item);
      }
```

```
    }
    while ( item!=null );
}
```

Question14
Marks: 1

IDHSOA05 – Consider a modified version of Merge sort where the input array is partitioned at the position one-third of the length N of the array. What is the recurrence of this algorithm?

Choose one answer.

- T(N)=T(N/3)+T(2N/3)+O(N)
- T(N)=2T(2N/3)+O(N)
- T(N)=T(N/2)+T(3N/2)+O(N)
- T(N)=2T(N/3)+O(N)

Question15
Marks: 1

IDESOA01 - Which statement below is wrong in the context of sorting algorithms?

Choose one answer.

- The time complexity of some sorting algorithms can be faster than O(NlogN).
- Stability and efficiency are two characteristics of a sorting algorithm.
- Sorting algorithms rearrange a sequence of elements into numerical order based on the sort key.
- The sort key must be numeric.

Question16
Marks: 1

IDESQ01 - Which statement below is wrong concerning to stack data structure?

Choose one answer.

- A stack contains a sequence of zero or more items of the same type.
- List-based stack has no limit on total number of items of the stack.
- push() and pop() are two operations defined in Stack's ADT.
- It is a First In First Out (FIFO) list.

Question17
Marks: 2

A singly linked list is used to store a polynomial. In order to find the first derivative of the polynomial two methods are implemented as the following, the first one is used to evaluate the first derivative of a term (a node) and the second one is used to find the first derivative of the whole polynomial. Please complete the code for two methods?

```
/* This operation calculate the first derivative of one node  */

public void derivative()
{

    if (degree==0)

        coeff=0;

    else

    {

        coeff=coeff*degree;

        coeff++;

    }

}

/*This operation evaluate the first derivative of the polynomial.  */

public void derivative()

{

    SLNodePoly current=this.head;

    while (current != null)

    {

        ;

        current=current.getNext();
```

```
    }

  }
```

Marks: 1

IDESQAS04 – What additional requirement is placed on an array, so that binary search may be used to search for a key?

Choose one answer.

- The array must have at least 2 entries.
- The array elements must form a heap.
- The array must be sorted.
- The array's size must be a power of two.

Question 9

Marks: 1

IDESQ13 – Suppose you push 10, 20, 30, 40 onto a stack, then you pop three items. Which one is left on the stack?

Choose one answer.

- 20
- 10
- 40
- 30

Question 12

Marks: 1

IDMSQ01 – A stack S has 05 character items, S={“A”,“B”,“C”,“D”,“E”} where “E” is the top of S. What is the content of S if we perform the following list of operations on the stack: push(“F”) –-> pop() –-> pop() –-> pop() –-> push(“D”)?

Choose one answer.

- S={“B”,“E”, “F” ,“D”}
- S={“C”,“D”,“E”,“F”}
- S={“A”,“B”,“D”,“F”}
- S={“A”,“B”,“C”,“D”}

Question 15

Marks: 1

IDMSOA05 – A sorting algorithm is used to sort the array A={51,11,56,83,20,26,33} in ascending order. The items of A in each sort pass are listed below. Which sorting algorithm is used?

Choose one answer.

- Insertion sort
- Selection sort
- Merge sort
- Bubble sort

Question 16

Marks: 1

IDEAOA03 – Which statement below is wrong? Choose one answer.

- For the same data, some data structures may require more or less space.
- A data structure is a piece of information (a physical instantiation of a data type)
- A data structure is a way of organizing data for processing within a computer program.
- For the same operations on the data, some data structures lead to more or less efficient algorithms.

Question 17

Marks: 1

IDELI11 – Complete the code below to insert a new node X at the POS position of a Singly Linked List?

Choose one answer.

- X.setNext(Y).
- Y.setNext(tail).
- Y.getNext().
- X.getNext().

Question2
Marks: 1

IDMLI04 – In a Singly Linked List implementation, what does this code to to the list?

```
if (!isEmpty())
{
 if (pos == 1)
  head=head.getNext();
 else
 {
  SLNode prevNode=traversing(pos-1);
  SLNode posNode=prevNode.getNext();
  prevNode.setNext(posNode.getNext());
 }
}
```

Choose one answer.

- [x] Remove the head node
- [ ] Search for a node in the list
- [ ] Remove the node at the pos position from the list
- [ ] Remove the tail node

Question3
Marks: 1

IDESOA08 – Which sorting algorithm scans and exchanges any pair of elements that is out-of-order?

Choose one answer.

- [ ] Insertion sort.
- [ ] Selection sort.
- [ ] Heap sort.
- [ ] Bubble sort.

Question6
Marks: 1

IDESQ04 – Which statement is correct about array-based stack?

Choose one answer.

- top is the first item of the array.
- top is the last item of the array.
- To add a new item into the stack: firstly, top is increased by 1, then current items will be shifted one slot to the right to make space for the new item.
- To add a new item into the stack: firstly, top is increased by 1, then current items will be shifted one slot to the left to make space for the new item.

Question8
Marks: 1

IDELI01 - Which statement below is wrong in the context of list data structure?

Choose one answer.

- In the list, items are referenced by their value.
- A list is a sequence of zero or more items of the same type.
- Every item in the list except for the head and tail, has an unique predecessor and an unique successor.
- List can be implemented using an array or a collection of linked nodes.

Question10
Marks: 2

Method printList() is used to print out the data of all nodes in a Singly Linked List.
Please complete the code of the method?

```
public static void printList(SLList list)
{
    int l=list.getLength() ;
    for (int i=1; i<=l; i++)
    {
        SLNode node=list.get(i);
        System.out.println(node.getData() );
```

```
    }

  }
```

Question11
Marks: 1

IDEAOA07 – Which statement is wrong?

Choose one answer.

- The estimated time complexity of an algorithm T(N) varies with the input data of the different size.
- Pseudocode can be used to describe an algorithm for estimating its time complexity T(N).
- The time complexity of an algorithm T(N) is estimated by couting the number of primitive operations.
- The estimated time complexity of an algorithm T(N) does not vary with the input data of the same size N.

Question12
Marks: 1

IDEAOA11 – Which one determines the asymptotic behavior of the function T(N)?

Choose one answer.

- The term has the biggest coefficient.
- The last term.
- The leading term.
- The first term.

Question13
Marks: 1

IDMSOA07 – Quick sort algorithm is used to sort the array A={55,81,39,92,18,47,63,99,16}. Suppose that the first array element is chosen as the pivot for partitioning. What is the array after the first partition?

Choose one answer.

- A={18,16,39,47,55,92,63,99,81}

A={99,81,92,63,55,39,47,18,16}

A={55,16,39,47,18,92,63,99,81}

A={55,99,81,63,92,47,39,16,18}

Question15
Marks: 1

IDESQAS02 – What is the worst-case time for binary search finding a single item in an array?

Choose one answer.

Linear time.

Constant time.

Logarithmic time

Quadratic time.

Question16
Marks: 1

IDESOA07 – Which statement is wrong about Insertion sort?

Choose one answer.

Scan and exchange any pair of elements that is out-of-order.

Unsorted elements are inserted into an already sorted list

It is O(n^2) sorting algorithm.

We must shift several elements to make place for the inserted one.

(1) Starting from the root and performing _____, level order traversal of a rooted tree can be done.

(A) Breadth first search
(B) Depth first search
(C) In-order traversal
(D) Pre-order traversal

(2) We have a hash function and a hash table. The size of hash table is 7 with starting index zero. The hash function is (3x+4) mod 7. Assume that initially the hash table is empty and the sequence 1, 3, 8, 10 is inserted into the table using closed hashing. The content of the table is ('_' denotes an empty location in the table)

(A) 1, _, _, _, _, _, 3
(B) 8, _, _, _, _, _, 10
(C) 1, 8, 10, _, _, _, 3
(D) 1, 10, 8, _, _, _, 3

(3) Which one of the following statement is false if G is an undirected graph with distinct edge weight, Emax is the edge with maximum weight and Emin is the edge with minimum weight?

(A) Emin is present in every minimum spanning tree of G
(B) Emax is not present in any minimum spanning tree.
(C) The removal of Emax must disconnect G, if Emax is in a minimum spanning tree.
(D) G has a unique minimum spanning tree.

(4) Consider an array L. If an element in an array L is greater than all elements to the right of it then it is called a leader. The best algorithm to find all leaders in an array

(A) Solves it in time $\theta(n^2)$
(B) Solves it in linear time using a left to right pass of the array
(C) Solves it in linear time using a right to left pass of the array
(D) Solves it using divide and conquer in time θ (n logn)

For questions 5 and 6 refer to the data given below:

Table shows the tasks Ti to be completed and the profit Pi that can be earned if the task is completed before the end of the deadline di th unit of time. The execution of each task requires

one unit and at a time only one task can be executed.

Task	T1	T2	T3	T4	T5	T6	T7	T8	T9
Profit	15	20	30	18	18	10	23	16	25
Deadline	7	2	5	3	4	5	2	7	3

(5) Which one of the following statement is true?

(A) All tasks are completed in the schedule time that gives maximum profit.
(B) T4 and T6 are left out
(C) T1 and T8 are left out
(D) T1 and T6 are left out

(6) The maximum profit that can be earned is

(A) 165
(B) 147
(C) 167
(D) 175

(7) Consider a complete n-array tree. This tree is such that each node has either n number of children or no children. Let l = 10 be the number of internal nodes and L = 41 be the number

of leaves in a complete n-array tree. The value of n is

(A) 5
(B) 4
(C) 3
(D) 2

For Questions 8 and 9 refer to the data given below:

```
int f1(int n)
{
if (n == 0 II n ==
1) return n;
else
return (2*f1(n-1) + 3*f1(n-2));
}

int f2(int n)
{
int a;
int X[N], Y[N], Z[N];
X[0] = Y[0] = Z[0] = 0;
```

```
X[1] = 1;
Y[1] = 2;
Z[1] = 3;
for(a = 2; a<=n; a++)
{
X[a] = Y[a-1] + Z[a-2];
Y[a] = 2*X[a];
Z[a] = 3*X[a];
}
return X[n];
}
```

(8) What is the running time of f1(n) and f2(n) respectively?

(A) $\theta(2^n)$ and $\theta(2^n)$
(B) $\theta(n)$ and $\theta(2^n)$
(C) $\theta(2^n)$ and $\theta(n)$
(D) $\theta(n)$ and $\theta(n)$

(9) What is the return value of f1(8) and f2(8) respectively?

(A) 1661 and 1640
(B) 1640 and 1661
(C) 59 and 59
(D) 1640 and 1640

(10) Let i, j and n be the integer variables of the C program fragment given below.

For (i = n, j = 0; i > 0; i /=2, j += i). After termination of the for loop the value stored in the variable j is denoted by val (j). The statement, which is true for this, is

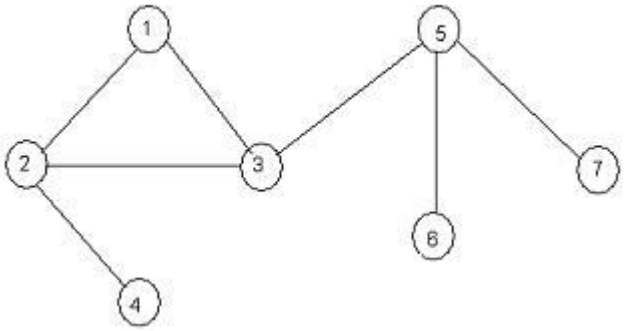
(A) val (j) = $\theta(n/2)$
(B) val (j) = $\theta(\log n)$
(C) val (j) = $\theta(2n)$
(D) val (j) = $\theta(n)$

(11) In a complete binary tree, LASTPOST denotes the last vertex visited in a post order

traversal, LASTIN denotes the last vertex visited in an inorder traversal and LASTPRE denotes the last vertex visited in a preorder traversal. The statement, which always holds true, is

(A) LASTIN = LASTPRE
(B) LASTPRE = LASTPOST
(C) LASTIN = LASTPOST
(D) None of the above.

(12) For the graph shown below the number of articulation points is



(A) 3
(B) 2
(C) 1
(D) 0

(13) Which one of the following statement is false?

(A) $\sqrt{}$ logn = O (log log n)
(B) 100n log n = O (nlogn/100)
(C) 2n ≠ O (nk)
(D) If $0<x^{x = O (ny)}$

(14) Consider an unweighted, undirected connected graph. In terms of time complexity, the shortest path from a node S to every other node is most efficiently computed by

(A) Performing a DFS starting from S
(B) Performing a BFS starting from S

(C) Warshall's algorithm
(D) Dijkstra's algorithm starting from S

(15) _____ in place sorting algorithm needs the minimum number of swaps.

(A) Selection sort
(B) Quick sort
(C) Insertion sort
(D) Heap sort

(16) The algorithm is as given below:

Procedure A(n)
If n<=2
Return (1)
Else
Return (A(√n));
The running time of this algorithm is best described by

(A) O(log n)
(B) O(n)
(C) O(log log n)
(D) O(1)

(17) Consider an undirected graph G whose depth first search tree is T and vertices u and v are the leaves of this tree. The degrees of both u and v in G are at least 2. The statement that holds true is

(A) There must exist a vertex whose removal disconnects u and v in G
(B) There must exist a vertex adjacent to both u and v in G
(C) There must exist a cycle in G containing u and all its neighbours in G
(D) There must exist a cycle in G containing u and v

(18) _____ is used if the concatenation of two lists is to be performed on O(1) time?

(A) Array implementation of list
(B) Circular doubly linked list
(C) Singly linked list
(D) Doubly linked list

(19) The vertices of a cycle with n nodes is to be coloured in such a way that no two adjacent nodes have the same colour. The minimum number of colours required is

(A) n!
(B) 3
(C) n - 2 n/2 +2
(D) 2

(20) A set V = {v1, v2,…., vn} has n number of vertices. Out of this given set, the number of undirected graphs (not necessarily connected) that can be constructed are

(A) 2n(n-1)/2
(B) n
(C) n!
(D) None of the above

(21) Which data structure is to be used to implement Dijkstra's shortest path algorithm on unweighted graphs so that runs in linear time?

(A) Stack
(B) Heap
(C) Queue
(D) B-Tree

(22) Which one of the following option is true for merge sort?

(A) It uses greedy approach
(B) It uses heuristic search
(C) It uses divide and conquer strategy
(D) It uses backtracking approach

(23) Match the following:

List I List II

u) All pairs shortest paths p) Greedy
v) Quick sort q) Depth first search
w) Minimum weight spanning tree r) Dynamic programming
x) Connected components s) Divide and conquer

(A) u – r, v – s, w – p, x - q
(B) u – r, v – p, w – s, x - q

(C) u – q, v – p, w – r, x - s
(D) u – p, v – s, w – r, x - q

(24) The recurrence relation capturing the optimal execution time of the towers of Hanoi problem with n discs is

(A) T(n) = 2T(n-2

(25) Consider two positive function of n: f(n) = n^2 log n and g(n) = n(log n) 10. The statement which is correct for these two functions, is

(A) f(n) = O(g(n)) and g(n) = O(f(n))
(B) f(n) ≠ O(g(n)) and g(n) ≠ O(f(n))
(C) f(n) = O(g(n)) and g(n) ≠ O(f(n))
(D) f(n) ≠ O(g(n)) and g(n) = O(f(n))

For the Questions 26 and 27 refer to the data given below:

The probability of letters a = 1/2, b = 1/4, c = 1/8, d = 1/16, e = 1/32, f = 1/32.

(26) The Huffman code for the letter a, b, c, d, e, f is

(A) 10, 110, 1111, 1010, 1100, 00110
(B) 11, 10, 01, 001, 0001, 0000
(C) 1, 11, 111, 1110, 11000, 10000
(D) 0, 10, 110, 1110, 11110, 11111

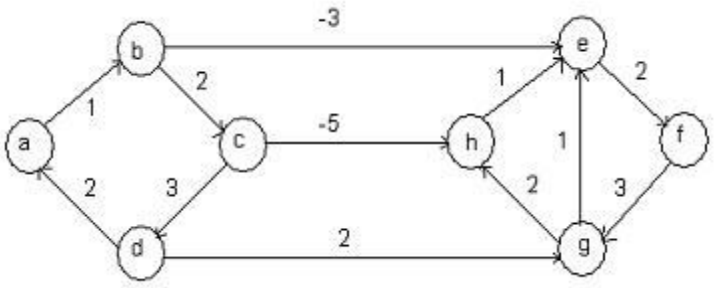
(27) The average length of the correct answer to question 26 is

(A) 1.9375
(B) 2.3546
(C) 4
(D) 3.3241

(28) To evaluate polynomial x (j) = m0 + m1j + m2j^2 + m3j^3 where mi ≠ 0, the minimum number of multiplications needed on the input j is

(A) 6
(B) 5
(C) 3
(D) 4

(29) Consider the graph shown below. When Dijkstra's single source shortest path algorithm run from vertex a, it computes the correct shortest path distance to



(A) Vertices a, b, c, d
(B) Vertices a, e, f, g, h
(C) Only vertex a
(D) All the vertices

(30) We have two sorted lists whose sizes are a and b. For merging these two lists into a sorted list of size a + b, we require comparisons of

(A) O (log a + log b)
(B) O (a + b)
(C) O (a)
(D) O (b)

(31) The technique of sorting is called stable if and only if

(A) It uses divide and conquer technique
(B) It takes O (n) space
(C) It takes O (n log n) time
(D) It maintains the relative order of occurrence of non-distinct elements

(32) What is the maximum number of nodes in a binary tree whose height is h where height is the maximum number of edges in any root to leaf path?

(A) 2h+1
(B) 2h+1 - 1
(C) 2h
(D) 2h-1

For questions 33 and 34 refer to the data given

below: Double func(int n)

```
{
int j; double
sum; if(j
==0) return
1.0; else

{
sum = 0.0;
for(j = 0; j
sum += func(j);
return sum;
}
}
```

(33) What is the space complexity of the above function?

(A) O(n!)
(B) O(n)
(C) $O(n^2)$
(D) O(log n)

(34) When the above function func() is modified and store the values of func(j),

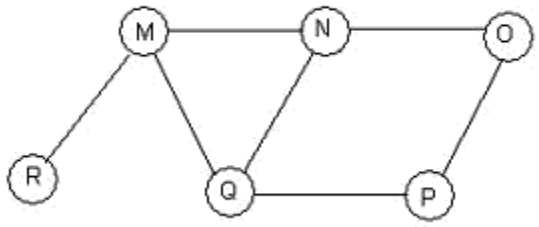
0<=j significantly. What is the space complexity of the modified function?

(A) O(n!)
(B) O(n)
(C) $O(n^2)$
(D) O(log n)

(36) Consider a graph G on vertices n and 2n-2 edges. The statement that does not hold true for graph G, when the edges of the graph G is partitioned into two edge-disjoint spanning trees, is

(A) Between every pair of vertex there are two vertex-disjoint paths.
(B) Between every pair of vertex there are two edge-disjoint paths
(C) There are at least two edges for the minimum cut in G.
(D) At most 2k-2 edges are present in the induced subgraph for every subset of k vertices

(37) The implementation of Breadth first search algorithm has been done using queue data structure. In the graph shown below, one possible order of visiting the nodes is



(A) NQMPOR
(B) MNOPQR
(C) QMNPOR
(D) QMNPRO

(38) Consider a rooted tree with n nodes. Each node is having 0 or 3 children. The number of leaf nodes in the rooted tree is

(A) (n-1)/2
(B) (n-1)/3
(C) (2n + 1)/3
(D) n/2

(39) T(n) = 2T(n/2) + n and T(0) = T(1) = 1. The statement, which is not true, is

(A) T(n) = θ (n log n)
(B) T(n) = O(n log n)
(C) $T(n) = O(n^2)$
(D) $T(n) = \Omega (n^2)$

(40) We have a Max heap, which is represented by an array, and the process of inserting an element into it is going on. How many comparisons are done to find the position for the newly inserted element if we perform a binary search on the path from the new leaf to the root?

(A) θ (log2 n)
(B) θ (log2 log2 n)
(C) θ (log2 n/2)
(D) θ (n)

(41) What is the maximum number of edges in an n-node unidirectional graph without self loops?

(A) n/2
(B) (n + 1)(n)/2

(C) n+1
(D) n(n-1)/2

(42) Which one of the following statement is true for the recurrence T(n) = 2T([√n]) + 1, T(1) = 1?

(A) T(n) = θ (2n)
(B) T(n) = θ (n)
(C) T(n) = θ (log log n)
(D) T(n) = θ (log)

(43) From the scratch a B-tree of the order of 4 is built by 10 successive iterations. The maximum number of node splitting operations that may take place is

(A) 6
(B) 5
(C) 4
(D) 3

(44) T1 and T2 are the time taken by the Quicksort program P to sort the inputs [1 2 3 4] and [5 4 3 2 1] in ascending order respectively. The statement that holds true is

(A) T1 = T2
(B) T1 < T2
(C) T1 > T2
(D) T1 = T2 + 5 log 5

(45) To convert the array 8, 19, 40, 17, 12, 10, 2, 5, 7, 11, 6, 9, 70 into a heap with maximum elements at the root, the minimum number of interchanges needed are

(A) 0
(B) 1
(C) 2
(D) 3

(46) Out of 4 distinct keys the number of distinct binary search trees that can be created is

(A) 10
(B) 14
(C) 8
(D) 24

(47) Consider the statements given below and find the correct option regarding Bellman-Ford shortest path algorithm.

I) It always finds a negative weighted cycle, if one exists.
II) It finds whether any negative weighted cycle is reachable from the source.

(A) Only II holds true
(B) Only I holds true
(C) Both I and II holds true
(D) Neither I nor II holds true

For questions 48 and 49 refer to the data given below:

Consider the matrix W given below where entry Wij is the weight of the edge {i, j}. We have a complete undirected graph with vertex set {0, 1, 2, 3, 4}.

$$W = \begin{bmatrix} 0 & 1 & 8 & 1 & 4 \\ 1 & 0 & 12 & 4 & 9 \\ 8 & 12 & 0 & 7 & 3 \\ 1 & 4 & 7 & 0 & 2 \\ 4 & 9 & 3 & 2 & 0 \end{bmatrix}$$

(48) The minimum possible weight of a spanning tree T in this graph such that vertex 0 is a leaf node in the tree T is

(A) 4
(B) 7
(C) 10
(D) 5

(49) The minimum possible weight of a path P from vertex 1 to vertex 2 in this graph such that P contains at most 3 edges is

(A) 9
(B) 8
(C) 7

(D) 6

(50) We have hash function x mod 10 and the following input (4322, 1334, 1471, 9679, 1989, 6171, 6173, 4199). From the statements given below the one, which holds true, is

I. 9679, 1989, 4199 hash to the same value.
II. 1472, 1671 hash to the same value
III. All elements hash to the same value
IV. Each element hashes to a different value.

(A) Only I
(B) I and IV
(C) II and III
(D) I and II

(51) int func(a, b)
{
if(a%b ==
0) return b;
a = a%b;
return func(b, a);
}

In the above function let a = b. The number of recursive calls made by this function is

(A) θ (log2 n)
(B) θ (log2 log2 n)
(C) θ (log2 n/2)
(D) θ (n)

(52) In the worst-case scenario, the number of swaps required to sort n elements using selection sort is

(A) θ (logn)
(B) θ (n)
(C) θ (n/2)
(D) θ (n^2)

(53) We have the functions as given below:

f(n) = 2n , g(n) = n! and h(n) = nlog n. The statement that holds true about the asymptotic behaviour of functions f(n), g(n) and h(n) is

(A) h(n) = O(f(n)); g(n) = Ω (f(n))
(B) g(n) = O(f(n)); h(n) = O(f(n))
(C) f(n) = O(g(n)); g(n) = O(h(n))
(D) f(n) = Ω (g(n)); g(n) = O(h(n))

(54) Matrix M1 is to be stored in array A and matrix M2 is to be stored in array B. Considering each array to be stored either in row-major or column-major order in contiguous memory locations, the time complexity of an algorithm to compute M1xM2 will be

(A) Independent of the storage scheme.
(B) Best if both the array will be in column-major
(C) Best if array A will be in row-major and array B will be in column-major order
(D) Best if both the array will be in row-major

(55) Two inputs that are to be sorted in ascending order using quicksort are given below:

I) 1, 2, 3 …… n
II) n, n-1, n-2, …… 2, 1

For the inputs given above the number of comparisons that are to be made is represented by C1 and C2. Then,

(A) C1 > C2
(B) C1 = C2
(C) C1 < C2
(D) None of the above

(56) Consider that each set is represented as a linked list with elements in arbitrary order. Which one of the following operations is the slowest?

(A) Membership and cardinality
(B) Union only
(C) Intersection and membership
(D) Union and intersection

(57) Consider n number of elements whose median can be found in O(n) time. The statement that is correct about the complexity of quick sort, in which median is selected as

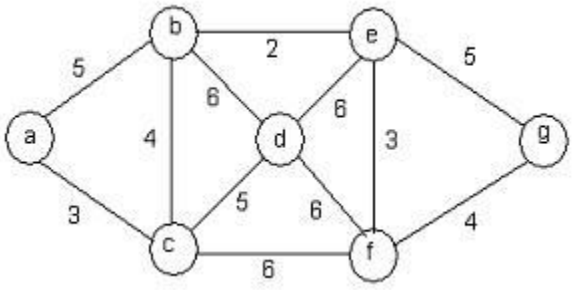
a pivot is

(A) θ (n logn)
(B) θ (n^2)
(C) θ (n)
(D) θ (n^3)

(58) Package A and package B are the two alternative packages for processing a database that has 10k records. To process n records package A takes $0.0001n^2$ time units and package B takes 10nlog10n time units. The smallest value of k for which package B will be preferred over package A is

(A) 6
(B) 10
(C) 2
(D) 5

(59) The graph is as shown below. From the options given below the one, which is not the sequence of edges added to the minimum spanning tree using Kruskal's algorithm, is

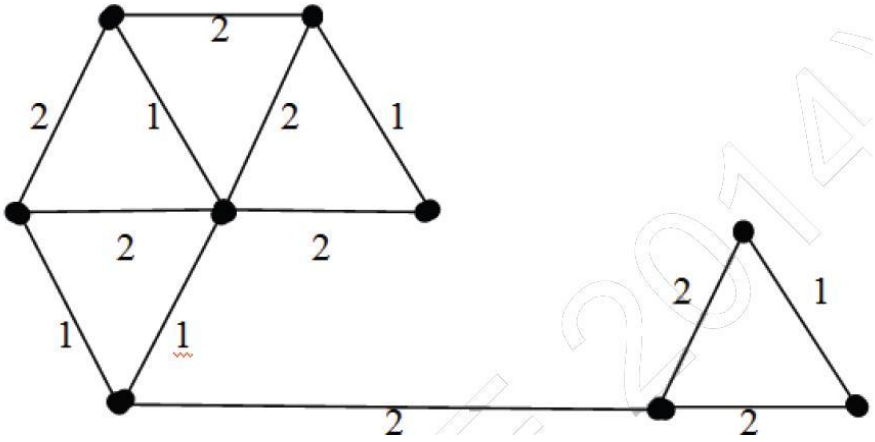


(A) (b, e) (a, c) (e, f) (b, c) (f, g) (c, d)
(B) (b, e) (e, f) (a, c) (b, c) (f, g) (c, d)
(C) (b, e) (e, f) (b, c) (a, c) (f, g) (c, d)
(D) (b, e) (e, f) (a, c) (f, g) (b, c) (c, d)

(60) The adjacency matrix of an undirected graph G that has n nodes is given by an nxn square matrix whose diagonal and non-diagonal elements are 0's and 1's respectively. Graph G has

(A) Unique minimum spanning tree of cost n-1
(B) No minimum spanning tree (MST)
(C) Multiple spanning trees of different costs
(D) Multiple distinct MST's, each of cost n-1

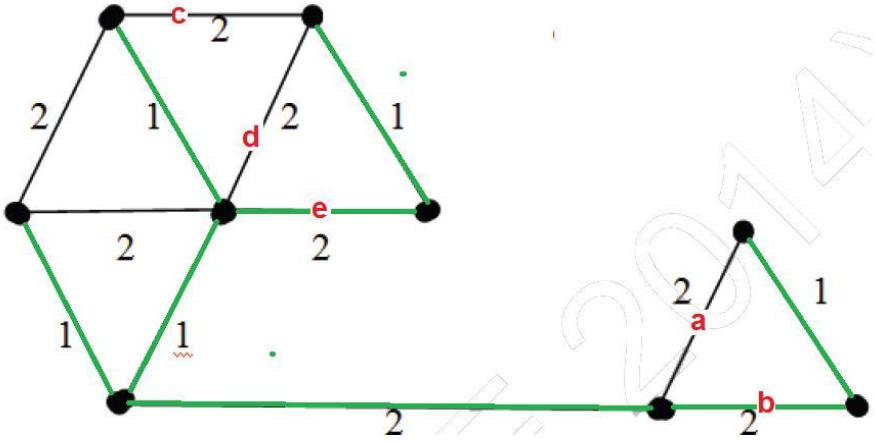
1) The number of distinct minimum spanning trees for the weighted graph below is ____



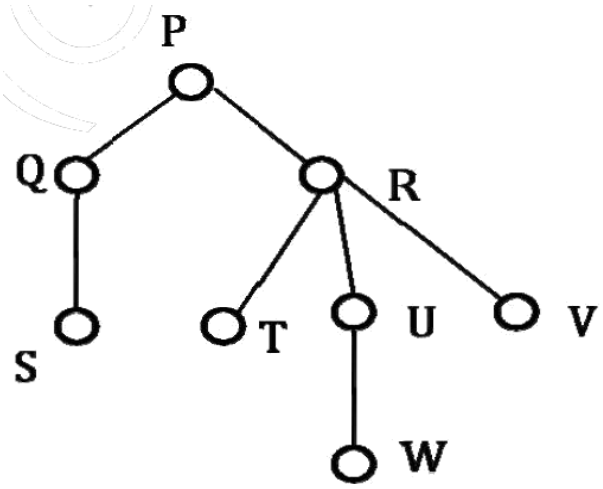
Answer: 6

Highlighted (in green) are the edges picked to make a MST. In the right side of MST, we could either pick edge 'a' or 'b'. In the left side, we could either pick 'c' or 'd' or 'e' in MST

There are 2 options for one edge to be picked and 3 options for another edge to be picked. Therefore, total 2*3 possible MSTs.



2) Consider the following rooted tree with the vertex P labeled as root



The order in which the nodes are visited during in-order traversal is

(A) SQPTRWUV

(B) SQPTURWV

(C) SQPTWUVR

(D) SQPTRUWV

Answer: (A)

3) Let A be a square matrix of size n x n. Consider the following program. What is the expected output?

```
C = 100
for i = 1 to n do for
    j = 1 to n do
    {
        Temp = A[i][j] + C
        A[i][j] = A[j][i]
        A[j][i] = Temp - C
    }
for i = 1 to n do for
    j = 1 to n do
        Output(A[i][j]);
```

(A) The matrix A itself

(B) Transpose of matrix A

(C) Adding 100 to the upper diagonal elements and subtracting 100 from diagonal elements of A

(D) None of the above

Answer: A

4) The minimum number of arithmetic operations required to evaluate the polynomial $P(X) = X^5 + 4X^3 + 6X + 5$ for a given value of X using only one temporary variable.

(A) 6

(B) 7

(C) 8

(D) 9

Answer: B

5) You have an array of n elements. Suppose you implement quicksort by always choosing the central element of the array as the pivot. Then the tightest upper bound for the worst case performance is

(A) $O(n^2)$

(B) O(nLogn)

(C) Θ(nLogn)

(D) $O(n^3)$

Answer: (A)

The middle element may always be an extreme element (minimum or maximum) in sorted order, therefore time complexity in worst case becomes $O(n^2)$

1) Consider the tree arcs of a BFS traversal from a source node W in an unweighted, connected, undirected graph. The tree T formed by the tree arcs is a data structure for computing.

(A) the shortest path between every pair of vertices.

(B) the shortest path from W to every vertex in the graph.

(C) the shortest paths from W to only those nodes that are leaves of T.

(D) the longest path in the graph

Answer: (B)

2) 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.
Answer (D)

3) Consider a hash table with 9 slots. The hash function is h(k) = k mod 9. The collisions are resolved by chaining. The following 9 keys are inserted in the order: 5, 28, 19, 15, 20, 33, 12, 17, 10. The maximum, minimum, and average chain lengths in the hash table, respectively, are

(A) 3, 0, and 1
(B) 3, 3, and 3
(C) 4, 0, and 1
(D) 3, 0, and 2

Answer: (A)
Following are values of hash function for all keys

```
 5 --> 5
28 --> 1
19 --> 1 [Chained with 28]
15 --> 6
20 --> 2
33 --> 6 [Chained with 15]
12 --> 3
17 --> 8
10 --> 1 [Chained with 28 and 19]
```

The maximum chain length is 3. The keys 28, 19 and 10 go to same slot 1, and form a chain of length 3.

The minimum chain length 0, there are empty slots (0, 4 and 7).
Average chain length is (0 + 3 + 1 + 1 + 0 + 1 + 2 + 0 + 1)/9 = 1

4) A priority queue is implemented as a Max-Heap. Initially, it has 5 elements. The level-order traversal of the heap is: 10, 8, 5, 3, 2. Two new elements 1 and 7 are inserted into the heap in that order. The level-order traversal of the heap after the insertion of the elements is:

(A) 10, 8, 7, 3, 2, 1, 5

(B) 10, 8, 7, 2, 3, 1, 5

(C) 10, 8, 7, 1, 2, 3, 5

(D) 10, 8, 7, 5, 3, 2, 1

Answer: (A)

5) Which one of the following correctly determines the solution of the recurrence relation with T(1) = 1?

T(n) = 2T(n/2) + Logn

(A) [Tex]\Theta[/Theta](n)

(B) [Tex]\Theta[/Theta](nLogn)

(C) [Tex]\Theta[/Theta](n*n)

(D) [Tex]\Theta[/Theta](log n)

Answer: (A)

7) Suppose implementation supports an instruction REVERSE, which reverses the order of elements on the stack, in addition to the PUSH and POP instructions. Which one of the following statements is TRUE with respect to this modified stack?

(A) A queue cannot be implemented using this stack.

(B) A queue can be implemented where ENQUEUE takes a single instruction and DEQUEUE takes a sequence of two instructions.

(C) A queue can be implemented where ENQUEUE takes a sequence of three instructions and DEQUEUE takes a single instruction.

(D) A queue can be implemented where both ENQUEUE and DEQUEUE take a single instruction each.

Answer: (C)

1) 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.

(A) O(n)
(B) O(m+n)
(C) $O(n^2)$
(D) O(mn)

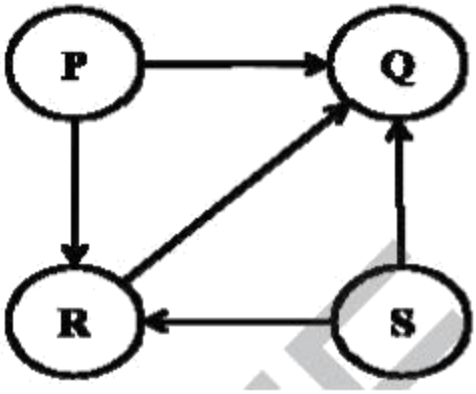
Answer: (C)

2) Consider a rooted Binary tree represented using pointers. The best upper bound on the time required to determine the number of subtrees having having exactly 4 nodes $O(n^a Logn^b)$. Then the value of a + 10b is _____

Answer: 1

```
int print4Subtree(struct Node *root)
{
    if (root == NULL)
      return 0;
    int l = print4Subtree(root->left);
    int r = print4Subtree(root->right);
    if ((l + r + 1) == 4)
       printf("%d ", root-
    >data); return (l + r + 1);
}
```

3) Consider the directed graph given below. Which one of the following is TRUE?



(A) The graph doesn't have any topological ordering
(B) Both PQRS and SRPQ are topological ordering
(C) Both PSRQ and SPRQ are topological ordering
(D) PSRQ is the only topological ordering

Answer: (C)

4) Let P be a QuickSort Program to sort numbers in ascending order using the first element as pivot. Let t1 and t2 be the number of comparisons made by P for the inputs {1, 2, 3, 4, 5} and {4, 1, 5, 3, 2} respectively. Which one of the following holds?
(A) t1 = 5
(B) t1 < t2
(C) t1 > t2
(D) t1 = t2

Answer: (C)
Explanation: When first element or last element is chosen as pivot, Quick Sort's worst case occurs for the

5) Consider the following C function in which size is the number of elements in the array E:
The value returned by the function MyX is the

```
int MyX(int *E, unsigned int size)
{
    int Y =
    0; int Z;
    int i, j, k;

    for (i = 0; i < size;
        i++) Y = Y + E[i];
```

```
    for (i = 0; i < size; i++) for
        (j = i; j < size; j++)
        {
            Z = 0;
            for (k = i; k <= j;
                k++) Z = Z + E[k];
            if (Z > Y)
                Y = Z;
        }
    return Y;
}
```

(A) maximum possible sum of elements in any sub-array of array E.
(B) maximum element in any sub-array of array E.
(C) sum of the maximum elements in all possible sub-arrays of array E
(D) the sum of all the elements in the array E.

Answer: (A)

Chapter 19: Binary Trees

TRUE/FALSE (đáp án là ANS nhé).

1. In a binary tree, the branches go only from a child to a parent.

   ANS: F PTS: 1 REF: 1309

2. The level of the root node of a binary tree is 1.

   ANS: F PTS: 1 REF: 1310

3. All binary tree traversals start at the left-most child node.

   ANS: F PTS: 1 REF: 1312

4. The item search, insertion, and deletion operations all require the binary tree to be traversed.

   ANS: T PTS: 1 REF: 1317

5. For classes with pointer data members, you must explicitly overload the assignment operator and include the destructor.

   ANS: T PTS: 1 REF: 1320

6. The operations to do inorder, preorder, and postorder traversals of a binary search tree are the same as those for a binary tree.

   ANS: T PTS: 1 REF: 1327

7. Duplicates are allowed in a binary search tree.

   ANS: F PTS: 1 REF: 1329

8. After deleting the desired item from a binary search tree, the resulting tree must be a binary search tree.

   ANS: T PTS: 1 REF: 1331

9. To delete an item from the binary search tree, you must do the following:
   1. Find the node containing the item (if any) to be deleted.
   2. Delete the node.

   ANS: T PTS: 1 REF: 1333

10. In C++, a function name without any parentheses is considered a pointer to the function.

    ANS: T PTS: 1 REF: 1341

MULTIPLE CHOICE (Đáp án là ANS nhé)

1. In the diagram of a binary tree, an arrow is called a(n) ____.
   a. relation
   b. path
   c. directed line
   d. directed branch

   ANS: D PTS: 1 REF: 1306

2. A binary tree has a special node called the ____ node.
   a. super
   b. root
   c. superparent
   d. rootleaf

   ANS: B PTS: 1 REF: 1306

3. In a diagram of a binary tree, each node is represented as a(n) ____.
   a. line
   b. triangle
   c. circle
   d. rectangle

   ANS: C PTS: 1 REF: 1306

4. Three lines at the end of an arrow in the diagram of a binary tree indicate that the subtree ____.
   a. has three branches
   b. has three children
   c. is full
   d. is empty

ANS: D PTS: 1 REF: 1306

5. Consider that A is a binary tree, C and D are the subtrees of A. Which of the following statements is always true?
   a. C and D are binary trees.
   b. C and D are search binary trees.
   c. C and D are empty trees.
   d. A is empty.

   ANS: A PTS: 1 REF: 1306

6. Each link in a binary tree node points to a(n) ____ of that node.
   a. parent
   b. child
   c. value
   d. sibling

   ANS: B PTS: 1 REF: 1307

7. Every node in a binary tree has at most ____ children.
   a. one
   b. two
   c. three
   d. four

   ANS: B PTS: 1 REF: 1308

8. Every node in a binary tree has ____ pointers.
   a. one
   b. two
   c. three
   d. four

   ANS: B PTS: 1 REF: 1308

9. A pointer to the root node of the binary tree is stored outside the binary tree in a pointer variable, usually called the ____.
   a. node
   b. parent
   c. root
   d. nodeType

   ANS: C PTS: 1 REF: 1309

10. A node in a binary tree is called a(n) ____ if it has no left and right children.
    a. edge
    b. branch
    c. leaf
    d. path

    ANS: C PTS: 1 REF: 1309

11. In a binary tree, the level of the children of the root node is ____.
    a. 0
    b. 1
    c. 2
    d. 3

    ANS: B PTS: 1 REF: 1310

12. The ____ of a node in a binary tree is the number of branches on the path from the root to the node.
    a. height
    b. level
    c. width
    d. size

    ANS: B PTS: 1 REF: 1310

13. In copying a binary tree, if you use just the value of the pointer of the root node, you get a ____ copy of the data.

a. static
b. shallow
c. deep
d. local

ANS: B PTS: 1 REF: 1311

14. The most common operation performed on a binary tree is a(n) ____.
a. insertion
b. deletion
c. search
d. traversal

ANS: D PTS: 1 REF: 1312

15. The three traversal algorithms discussed for binary trees are ____, ____, and ____.
a. order, preorder, postorder
b. in, preorder, order
c. order, preorder, post
d. inorder, preorder, postorder

ANS: D PTS: 1 REF: 1312

16. The listing of the nodes produced by the postorder traversal of a binary tree is called the ____.
a. postsequence
b. postorder sequence
c. postorder table
d. post-script

ANS: B PTS: 1 REF: 1313

17. The sequence of operations in a postorder traversal is ____.
a. traverse left; traverse right
b. traverse left; traverse right; visit
c. visit; traverse left; traverse right
d. traverse left; visit; traverse right

ANS: B PTS: 1 REF: 1313

18. A binary tree is also a(n) ____.
a. stack
b. linked list
c. graph
d. array

ANS: C PTS: 1 REF: 1317

19. A binary tree is empty if `root` is ____.
a. `0`
b. `1`
c. `"zero"`
d. `NULL`

ANS: D PTS: 1 REF: 1321

20. Assume the key of the left child below the root node of a binary search tree is 30. The value in the root node could be ____.
a. 0
b. 10
c. 30
d. 40

ANS: D PTS: 1 REF: 1327

21. The key of the right child below the root node of a search binary tree is 40. The value in the root node could be ____.
a. 30
b. 40
c. 50
d. 60

ANS: A PTS: 1 REF: 1327

22. In a binary search tree, the data in each node is ____ the data in the left child.
    a. larger than
    b. smaller than
    c. equal to
    d. larger or equal to

    ANS: A PTS: 1 REF: 1327

23. In a binary search tree, the data in each node is ____ the data in the right child.
    a. equal to
    b. smaller than
    c. greater than
    d. smaller or equal to

    ANS: B PTS: 1 REF: 1327

24. The search function searches the binary search tree for a given item. If the item is found in the binary search tree, it returns ____.
    a. `true`
    b. `false`
    c. a reference to the node where the item was found
    d. `1`

    ANS: A PTS: 1 REF: 1328

25. When traversing a binary tree with the pointer `current`, the pointer `current` is initialized to ____.
    a. `NULL`
    b. `llink`
    c. `rlink`
    d. `root`

    ANS: D PTS: 1 REF: 1328

COMPLETION

1. The _____ of a path in a binary tree is the number of branches on that path.

   ANS: length

   PTS: 1 REF: 1309

2. The _____ of a binary tree is the number of nodes on the longest path from the root to a leaf.

   ANS: height

   PTS: 1 REF: 1310

3. In a(n) _____ traversal, the binary tree is traversed as follows:
   1. Traverse the left subtree
   2. Visit the node
   3. Traverse the right subtree

   ANS: inorder

PTS: 1 REF: 1312

4. In a(n) _____ traversal, the binary tree is traversed as follows:
   1. Visit the node.
   2. Traverse the left subtree.
   3. Traverse the right subtree.

   ANS: preorder

   PTS: 1 REF: 1312

5. The listing of the nodes produced by the preorder traversal of a binary tree is called the _____.

   ANS: preorder sequence

   PTS: 1 REF: 1313

6. The listing of the nodes produced by the inorder traversal of a binary tree is called the _____.

   ANS: inorder sequence

   PTS: 1 REF: 1313

7. In addition to the inorder, preorder, and postorder traversals, a binary tree can also be traversed level-by-level, which is also known as _____ traversal.

   ANS:
   breadth first
   breadth-first

   PTS: 1 REF: 1317

8. To destroy a binary tree, for each node, first we destroy its left subtree, then its right subtree, and then the node itself. We must then use the operator _____ to deallocate the memory occupied by the node.

   ANS: `delete`

   PTS: 1 REF: 1323

9. When a class object is passed by value, the _____ constructor copies the value of the actual parameters into the formal parameters.

   ANS: copy

   PTS: 1 REF: 1324

10. After inserting an item in a binary search tree, the resulting binary tree must be a(n) _____.

ANS: binary search tree

PTS: 1 REF: 1329

11. Let *T* be a binary search tree with *n* nodes, in which *n > 0*. When *T* is linear, the search algorithm makes _____ key comparisons, in the unsuccessful

case. ANS: *n*

PTS: 1 REF: 1336

12. Let *T* be a binary search tree with *n* nodes, in which *n > 0*. The average number of nodes visited in a search of *T* is approximately *O(*_____*)*.

ANS: $log_2 n$

PTS: 1 REF: 1337

13. Let *T* be a binary search tree with *n* nodes, in which *n > 0*. The number of key comparisons is approximately *O*(_____).

ANS: $log_2 n$

PTS: 1 REF: 1337

14. The algorithm below describes the nonrecursive _____ traversal of a binary tree.

```
1. current = root;

2. while (current is not NULL or stack is nonempty)
          if (current is not NULL)
          {
              push current onto stack;
              current = current->lLink;
          }
          else
          {
              current = stack.top();
              pop stack;
              visit current; //visit the node
              current = current->rLink;//move to right child
          }
```

ANS: inorder

PTS: 1 REF: 1338

15. The algorithm below describes the nonrecursive _____ traversal of a binary tree.

```
1. current = root;
```

```
2. while (current is not NULL or stack is nonempty)
   if (current is not NULL)
   {
           visit current node; push
           current onto stack;
           current = current->lLink;
   }
   else
   {
           current  =  stack.top();
           pop stack;
           current = current->rLink; //move to the right child
   }
```

ANS: preorder

PTS: 1 REF: 1339