PART II: Multiple Choice Questions: (SOLUTIONS)

1. Consider the algorithm for determining whether a sequence of parentheses is balanced. The maximum number of parentheses that appear on the stack AT ANY TIME when the algorithm analyzes: “(()(())(()))” are:
   a) 1
   b) 2
   c) 3
   d) 4

2. Which data structure is used for implementing recursion?
   a) Queue
   b) Stack
   c) Array
   d) List

3. Which data structure is needed to convert infix notation to postfix notation?
   a) Branch
   b) Tree
   c) Queue
   d) Stack

4. If the elements “A”, “B”, “C” and “D” are placed in a queue and are deleted one at a time, in what order will they be removed?
   a) ABCD
   b) DCBA
   c) DCAB
   d) ABDC

5. What is the time complexity of enqueue operation?
   a) O(logn)
   b) O(nlogn)
   c) O(n)
   d) O(1)

6. What is the term for inserting into a full queue known as?
   a) overflow
   b) underflow
   c) null pointer exception
   d) all of the mentioned

7. What does the following piece of code do?
   ```java
   public int function() {
       if(isEmpty())
           throw new Exception(“ERROR!!”);
   else
   ```
a) Dequeue
b) Enqueue
c) Return the front element
d) None of the mentioned

8. In a circular queue, how do you increment the back end of the queue?
   a) back++
   b) (back+1) % MAX_SIZE
   c) (back % MAX_SIZE)+1
d) back—

9. Which of the following statement(s) about stack data structure is/are NOT correct?
   a) Arrays can be used for implementing Stacks
   b) Top of the Stack always contain the new pushed node
   c) Stack is the FIFO data structure
   d) ArrayLists can be used for implementing Stacks

10. Consider the following operation performed on a stack of size 5.
    Push(1);
    Pop();
    Push(2);
    Push(3);
    Pop();
    Push(4);
    Pop();
    Pop();
    Push(5);

    After the completion of all operation, the number of elements present in stack are
    a) 1
    b) 2
    c) 3
    d) 4

11. Which of the following real world scenarios would you associate with a stack data structure?
    a) piling up of chairs one above the other
    b) people standing in a line to be serviced at a counter
    c) offer services based on the priority of the customer
    d) all of the mentioned
12. Which of the following is true of stacks and queues?

   a) A stack is a last-in, first-out structure, and a queue is a first-in, first-out structure
   b) A stack is a first-in, first-out structure, and both structures are random access structures.
   c) A stack is a last-in, first-out structure, and a queue is a random access structure.
   d) A queue is a last-in, first-out structure, and a stack is a first-in, first-out structure.
   e) A queue is a first-in, first-out structure, and a stack is a random access structure.

13. Suppose cursor points to a node in a linked list (using the node definition with member functions called data and link). What Boolean expression will be true when cursor points to the tail node of the list?

   a) A. (cur == NULL)
   b) B. (cur.next.next == NULL)
   c) C. (cur.item == NULL)
   d) D. (cur.item == 0.0)
   e) E. None of the above.

14. Linked list is considered as an example of __________ type of memory allocation.

   a) Dynamic
   b) Static
   c) Compile time
   d) None of the mentioned

15. What is the functionality of the following piece of code?

```java
public int function(int data, Node head) {
    Node cur = head;
    int var = 0;
    while(cur != null) {
        if(cur.item == data) {
            return var;
        }
        var = var + 1;
        cur = cur.next;
    }
    return -1;
}
```

   a) Find and delete a given element in the list
   b) Find and return the given element in the list
   c) Find and return the position of the given element in the list
   d) Find and insert a new element in the list
16. How do you insert an element at the beginning of the list?

a) ```java
public void insertBegin(Node node, Node head)
{
    node.next = head;
    head = node;
}
```  

b) ```java
public void insertBegin(Node node, Node head)
{
    head = node;
    node.next = head;
}
```  

c) ```java
public void insertBegin(Node node, Node head)
{
    Node temp = head.next;
    node.next = tmp;
    head = node;
}
```  

d) None of the mentioned

17. Given the code fragment, which of the following expressions has the value null?

```java
Node p = new Node(12);
Node q = new Node(5);
p.next = null;
q.next = p;
```  

a) p  
b) q  
c) q.next  
d) q.next.next  
e) none of the above

18. Consider the following pseudocode:
declare a stack of characters
while (there are more characters in the word to read)
{
    read a character
    push the character on the stack
}
while (the stack is not empty)
{
    pop a character off the stack
    write the popped character to the screen
}

What is written to the screen for the input “carpets”? 

a) serc  
b) carpets  
c) steprac  
d) ccaarrppeetts

19. Assume that head is pointing to the first node of a linked list of many nodes. Which code segment below searches the linked list for the first occurrence of searchVal, leaving cur pointing to the node where it was found? (Assume searchVal is definitely in the list.)

A) Node cur = head;
   while (item != searchVal)
       cur = next;
B) cur = head;
   while (cur.item != searchVal)
       cur = cur.next;
C) cur = head;
   while (cur.item != searchVal)
       cur++;
D) ptr = head;
   while (cur.item != searchVal)
       cur = cur.next;
E) cur = head.item;
   while (cur != searchVal)
       cur = cur.next;

Justification: __________________

20. Parenthesis are not mandatory for either the Infix or Postfix

a) True  
b) False  
c) Maybe

21. Assume a stack is implemented using a linked list. It is considered a

a) Array-based implementation  
b) Reference-based implementation
22. Finding the max element in an unordered stack would require
   a) $O(1)$ operations
   b) $O(\log n)$ operations
   c) $O(n)$ operations.
   d) None of the above

23. Why do we need an additional `prev` pointer in addition to `cur` when performing a linked list insertion or deletion?
   a) To be able to perform the operation in $O(n)$ time
   b) To be able to update the references of the linked list
   c) To have a cool data structure
   d) None of the above

24. Why do we call data structures as Abstract Data Type (ADT)?
   a) They have an array-based implementation
   b) Their implementation is hidden/abstracted to the user and only the operations on ADTs matter
   c) They implement an abstract interface
   d) None of the above

25. Given the postfix expression $6 \ 3 \ + \ 8 \ 7 \ - \ *$ what is the value of the expression after evaluation in its infix form
   a) An integer between -5 and 5
   b) An integer between 5 and 10
   c) An integer between 10 and 15
   d) None of the above

26. Which of the following data structure might give an overflow
   a) ArrayList implementation of Stack
   b) Circular array based implementation of Stack
   c) Reference Based implementation of Queue and Stack
   d) All of the above

27. Suppose we have a circular array implementation of a queue with 5 items. The front = 0 and back = 4. The max capacity of the array is MAX_SIZE = 40.
   (a) What will the peek operation return to the user
      a) `array[front]`
      b) `array[front+1]`
      c) `array[back]`
      d) None of the Above
(b) What will be the value of front and back after 2 dequeue operations

a) front = 1   back = 3
b) front = 0   back = 2
c) **front = 2   back = 4**
d) front = 40   back = 2

(c) Where does the push place the new item:

a) array[5]
b) array[6]
c) array[0]
d) Queue Overflow

28. One difference between a queue and a stack is:

a) Stacks require dynamic memory, but queues do not.
b) Queues use two ends of the structure; stacks use only one.
c) Stacks use two ends of the structure, queues use only one.
d) **Queues use two ends of the structure, stacks use only one.***