Roll Number: _____

Thapar Institute of Engineering and Technology, Patiala

Computer Science and Engineering Department

MID SEMESTER EXAMINATION

B. E. (2nd Year): Semester-II (2017/18) (COE)

Course Code: UCS406

Course Name: Data Structure and Algorithms

March 13, 2018

Tuesday, 10.30 – 12.30 Hrs

Time: 2 Hours,

M. Marks: 25

Faculty: Maninder Kaur, Sunita Garhwal, Tarunpreet Bhatia, Sumit Miglani, Karun Verma, Rajeev Kumar

Note: Attempt all the questions. All subparts of the question are to be solved in sequence and in continuation, otherwise only first part(s) would be evaluated. Highlight assumptions (if considered).

1. a) Give any two advantages of linked lists over arrays. 1

   b) Given a sorted doubly linked list L in ascending order of integers with $START$ pointing to first node of the L. Write an algorithm for insertion of element q into the list L. 3

2. Consider Insertion-Sort and Bubble-Sort. For each algorithm, what will be the worst case asymptotic upper bound on the running time if you know additionally that 4

   i. the input is already sorted?
   ii. the input is reversely sorted?
   iii. the input is a list of n elements containing the same number?

   For each case and for each sorting algorithm, state your answer and justify your answer with suitable example.

3. a) Given an unsorted array of size n, each insert operation will write a value into the array at the next available location. The index of this location is stored in the integer variable $next\_loc$. The $next\_loc$ is updated (incremented) after each insert. Once the array is full, the $(n+1)^{th}$ insertion will cause a new array of size $2n$ to be created, and all previous n entries are copied in the new array and the new insertions will follow the same procedure discussed above. What would be order of an individual insert operation? Justify your answer. 1

   b) Consider the following code:

```
count=0;
for(i=0,j=0; i<n; i++,j=i%2)
    {
        if(j!=0)
        {
            if(a[i]%2!=0)
                count++;
        }
    }
```

   i. Explain the outcome of the above code. 1
   ii. Find complexity in Big-Oh notation. 2

4. How would you sort the following data with standard quicksort algorithm (taking the leftmost element as the partitioning item)? 5

   $E, V, E, R, Y, E, Q, U, A, L, K, E, Y, S, T, O, P, S, I, T$

   Show the partitioning of the array (or partitioned array data) after each pass. Also write the total number of exchanges.

5. Consider the following infix expression $Expr$:

   $Expr$: $((P+Q)*R) \uparrow (S-T)$

   i. Convert the expression into postfix expression using stack. Show each step. 3
   ii. Evaluate the result obtained in previous part i with given values $P=4, Q=3, R=2, S=4, T=2$. 1

6. Demonstrate the linked list implementation of queues. What will be the complexity of enqueue() and dequeue() operation in this case? 4