EASTERN UNIVERSITY, SRI LANKA

DEPARTMENT OF MATHEMATICS

SECOND EXAMINATION IN SCIENCE -2008/2009

FIRST SEMESTER (FEBRUARY/MARCH- 2010)

CS 201 –DATA STRUCTURES AND DESIGN OF ALGORITHM

Answer all question **Time allowed: 02 Hours**

1.

a) This part is regarding the Stack ADT Data structure.

i. Give the definition of Stack ADT. *(05 Marks)*

ii. Give at least 4 operations and their descriptions that can be done on Stack ADT. *(20 Marks)*

iii. Give <u>prototypes</u> only for the Stack ATD class. *(25 Marks)*

b) This part is regarding the Queue ADT Data structure.

i. Give the definition of Queue ADT. *(05 Marks)*

ii. Give at least 4 operations and their descriptions that can be done on Queue ADT. *(20 Marks)*

iii. Give <u>prototypes</u> only for the Queue ATD class. *(25 Marks)*

(100 Marks)

2.

(i.) Starting from an empty doubly-linked list, the following operations are performed, in order: addFirst(A), addFirst(B), addLast(C), addLast(D), insertBefore(2, E), insertAfter(3, F), remove(2), where indices start at 0 and A, B, etc, are instances of the Node interface. Draw the list that results after those operations. Draw only the final result.

(ii.) How does the Bubble Sort algorithm run on the array {7, 2, 3, 6}? You should draw the squares below to trace the algorithm. Start with the elements in the sequence written vertically, with the first (7) on the top-left square and the last (6) on the bottom-left square, and then proceed horizontally to the right. You may not need all the squares, so don't feel obliged to use them all.

0	7										
1	2										
2	3										
3	6										

(2 x 50 Marks)

3.

(i.) For each of the following complexity classes, name an algorithm treated in this course that belongs to the class.

a. $O(1)$

b. $O(\log_2 n)$

c. $O(n)$

d. $O(n\log_2 n)$

e. $O(n^2)$

f. $O(2^n)$

(30 Marks

(ii.) Show $f(n) = 2n^7 - 6n^5 + 10n^2 - 5 = O(n^7)$ and state the reasons for this.

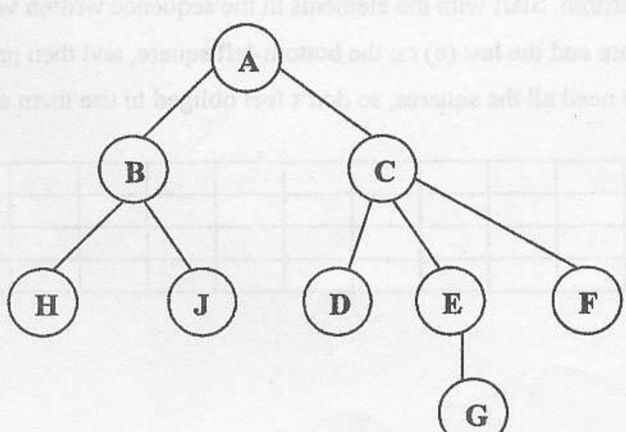
(10 Marks

(iii.) Consider the sorting algorithm shown below. Find the number of instructions executed and the complexity of this algorithm.

```
1)    for (i = 1; i < n; i++) {
2)          SmallPos = i;
3)          Smallest = Array[SmallPos];
4)          for (j = i+1; j <= n; j++)
5)                if (Array[j] < Smallest) {
6)                      SmallPos = j;
7)                      Smallest = Array[SmallPos]
                  }
8)          Array[SmallPos] = Array[i];
9)    Array[i] = Smallest;
      }
```

(40 Marks)

(iv.) Give the following tree diagram as a)nested sets b)nested parentheses c)indentation



(20 Marks

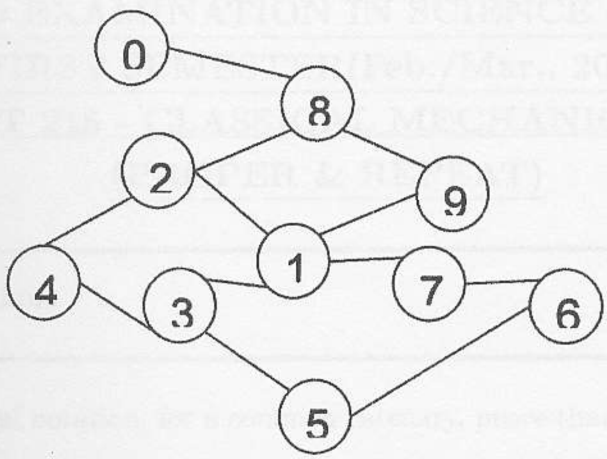
4.

a) Define the followings.

i. Graphs , Edge, Vertex. (15 Marks)

ii. Directed graph, Undirected graph. (20 Marks)

b) Draw the adjacency and Transitive matrix for the following graph: (35 Marks)



c) Construct the binary tree from the given Preorder and inorder traversal.

Preorder:

a	b	c	d	f	g	e

Inorder

c	b	f	d	g	a	e

(30 Marks)