

**Uva Wellassa University, Sri Lanka**  
**End Semester Examination – June/July 2010**  
**CST 202-2 Data Structures & Algorithms**  
**Time: Two (02) hours**

Total 05 Questions  
 Answer all questions

**Question 1.**

- (a) What is an Algorithm? What are the desirable properties of an Algorithm? (3 Marks)
- (b) Assuming the RAM model of computation, analyze the running time of the following program fragment. Clearly show the steps in each statement. (5 Marks)

```
sum ← 1
for i ← 1 to n+5
  do sum ← sum + a[i]
```

- (c) Find the 'Big O' value for the following functions; (2Marks)
- i)  $f(n) = 2n^3 + n! + 12n \log n$
  - ii)  $f(n) = n^4 + 2n$
- (d) What is a data structure? Briefly describe three usages of data structures. (5 Marks)
- (e) State the advantages and disadvantages of following data structures. (5 Marks)
- i) Array    ii) Ordinary array    iii) Stack    iv) Queue    v) Linked List

**Question 2.**

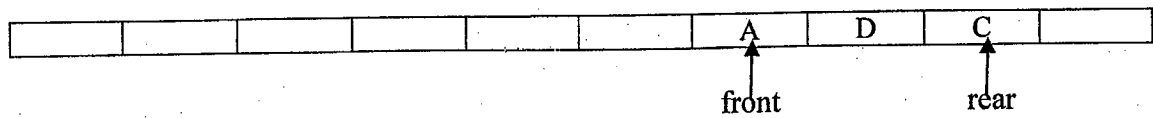
- (a) Describe the properties of stacks and queues. (4 marks)
- (b) You are given an empty stack  $S$ , which can hold 5 integer elements. Draw a sequence of stack frames showing the progress of the following segments of code. (2 marks)
- i) push('a');
  - ii) push('b');
  - iii) pop();
  - iv) Peek();
  - v) pop();
  - vi) push('x');
  - vii) pop();
  - viii) pop();

(c) Write the algorithms for following stack operations;

- a. push an item to a stack (3 marks)
- b. pop an item from a stack (3 marks)

(d) How to overcome the problem of “using linear queues” by using “circular queues”? (3marks)

(e) Draw a sequence of queue frames showing the progress of each of the following segments of code. Clearly show the both front and rear pointers. Consider the queue was implemented as a Circular Queue. (3 Marks)



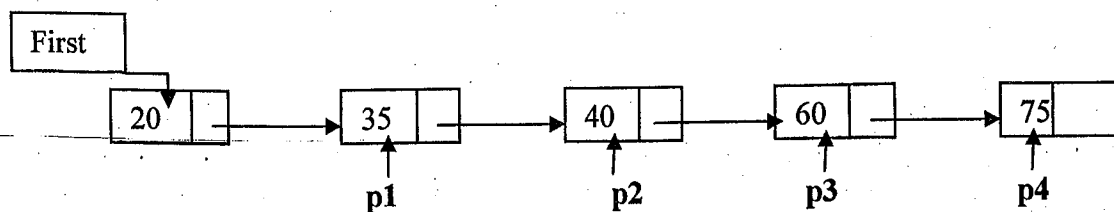
- i) insert('B');
- ii) peekFront();
- iii) remove();
- iv) insert('Y');
- v) remove();

(f) Compare the efficiencies of methods available in stacks with the methods available in queues. (2.marks)

### Question 3.

(a) Describe the properties of a Linked Lists and state the usages of Linked Lists in computer systems. (3 marks)

(b) You are given the following Linked List of Link objects and references p1, p2, p3, and p4. For each code segment, draw a similar figure indicating how the list changes. (5 marks)



- i. p2 = p1.next;
- ii. first = p1.next;
- iii. p3.data = p1.data;
- iv. p3.data = p1.next.data;
- v. p1.next.data = p1.data;

- (c) Give an algorithm to reverse the elements of a single linked list without using a temporary list. (5 Marks)
- (d) Write the algorithms to search a given element from a data array using following two searching methods and comment on the complexity. (7 marks)
- i) Linear search
  - ii) Binary search.

**Question 4.**

- (a) Is **insertion sort** fast compared to **bubble sort** and **selection sort**? Justify your answer. (3 marks)
- (b) Write the algorithm for **quick sort** and explain with an example. (7marks)
- (c) Briefly describe **merge sorting** mechanism. (3 marks)
- (d) Apply **merge sort** on following array. (Show all steps) (3 marks)

64	21	33	70	12	85	44	3
----	----	----	----	----	----	----	---

- (e) Complete the following table of efficiencies. (4 marks)

Sorting Method	Efficiency (Big O)	
	Worst Case	Best Case
Insertion		
Shell		
Merge		
Quick		

**Question 5.**

(a) Define a **binary tree**.

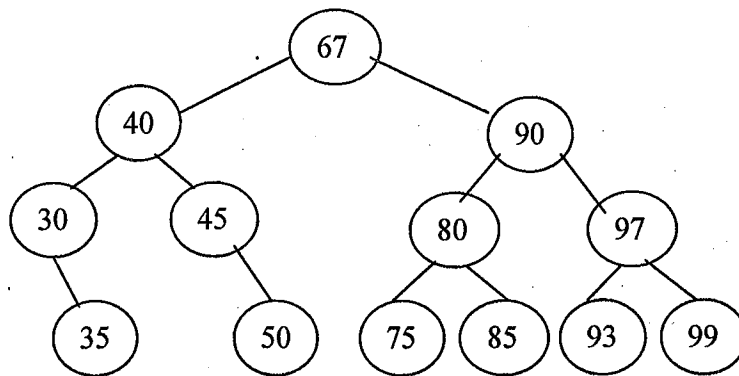
(2 marks)

(b) Insert following numbers into a binary tree.

(3 marks)

54, 89, 36, 90, 78, 45, 10, 100, 67, 50

(c)



Write the elements of the above tree making use of **pre-order** and **post-order**. (5 marks)

(d) Give the iterative algorithm for the **in-order** traversal of a binary tree.

(5 marks)

(e) Write an algorithm to **delete** a node from a binary tree.

(5 marks)

---End---