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The Open University of Sri Lanka
B.Sc Degree Programme: Level 04
Final Examination 2007
CSU 2279 – Data Structures and Algorithms – Paper II
Duration: Two and Half hours

Date: 29th June 2007

Time: 10.00 a.m. – 12.30 p.m.

Answer **FOUR** Questions **ONLY**.

Q1.

- (a)
 - (i) Give the type definition of the pointer based stack data structure.
 - (ii) What is the uniqueness of the stack data structure ?
- (b) Using appropriate diagrams describe the differences between the array implementation of a stack and the pointer implementation of a stack.
- (c)
 - (i) Write a procedure to add a character into an array based stack.
 - (ii) Write a procedure to delete a character from an array based stack.
 - (iii) Write a procedure to count the number of elements in an array based stack.

Q2

- (a) Briefly explain the circular array implementation of a queue.
- (b) Indicate whether a Queue would be a suitable data structure for each of the following applications Give reasons.
 - (i) A data structure to keep track of certain employee records to be sorted according to the date of birth.
 - (ii) A program to store passenger requests for air ticket booking company.
 - (iii) A program to store daily sales data of a shop in order to process later.
 - (iv) A data structure to store received messages as the last come first out basis.
- (c) Use the following ADT to create functions/procedures for question (i) to (iii).

Type

```
queueitem = integer;  
queue      = record  
    front, rear : integer;  
    data : array [1..max ] of queueitem;  
end;
```

- (i) Insert an integer into the queue (ENQUEUE).
- (ii) Delete an integer from the queue (DEQUEUE).
- (iii) Write down input, output, precondition, postcondition and the process for one of the above procedures.



Q3.

- (a)
 - (i) Define a doubly linked list structure to store the name, age and the gender of a student
 - (ii) What are the advantages and disadvantages of a doubly linked list over a single linked list structure.
- (b) Write a procedure to append two pointer based single linked lists and then count the total number of elements in the combined list.
- (c) Write suitable functions/procedures for the following tasks in a single linked list structure. Assume that the type definition is given.
 - (i) Delete a given integer.
 - (ii) Insert an integer prior to a given integer.

Q4.

- (a). Using an appropriate diagram, explain the following terms.
 - (i) Binary tree.
 - (ii) Sub trees.
 - (iii) Ancestors.
 - (iv) Siblings.
- (b)
 - (i) Give the pointer based type definition of a binary tree.
 - (ii) What feature/features of the above type definition have caused it to be a binary tree.
 - (iii) "Finding duplicates are more easier in Tree structure than in List structure".
Do you agree with this statement ? Give reasons briefly.
- (c) In a Binary tree, operators and operands are stored as non-leaf and leaf nodes respectively.
 - (i) "If a binary tree represents a valid algebraic equation then it should be a strictly binary tree". Do you agree with this statement.
 - (ii) With a suitable diagram justify your answer.

Q5.

- (a)
 - (i) Draw a binary tree to represent the following algebraic expression.

$$[(x+y) \$ \{ (a+b) * (c-d) \}]$$

- (ii) Give the
 - (a) preorder (NLR)
 - (b) inorder (LNR)
 - (c) postorder (LRN) outputs of the above tree.

(b) Consider the following set of integers.

10, 14, 15, 4, 9, 10, 18, 3, 5, 16, 4, 20, 17, 9, 14, 5

- (i) Draw a Binary tree for the above integers in the given order.
- (ii) Draw the resultant tree after deleting 15 and inserting 13 to the tree in part (i).

(c) Write a procedure to delete 3 from the above Binary tree.

Q6.

(a) Assume that there is no simple data type in your pascal version to represent a character string. Write suitable pascal functions or procedures to implement the following string operations.

- (i) LENGTH(s1) – Returns the length of the given string s1.
- (ii) STREQ(s1, s2) – A function to determine whether two strings s1 and s2 are identical
- (iii) STROC(s1, CHAR) – Returns the number of occurrences of a given character CHAR in a string s1.

(b) Write a function to return the number of words in a given string. Assume that words are separated by one space. [Hint: Find the number of space characters using STROC(s1, CHAR)]

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