University Mohamed Khider-Biskra

Computer Science Department

1st year Computer Science Degree

Exercises Serie N°3

TD ASD2

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Linked Lists

Consider the following data structure (linked list) :

Type

$linked_list = $ Record

$\qquad el$: element_type ;

$\qquad Next :\uparrow linked\_list$;

$\qquad$ End ;

$List =\uparrow linked\_list$;

Write the following procedures :

1. **Procedure** insert_begin$(v$: element_type ; **var** l : $List)$; which insert an element v at the beginning of the list l.

2. **Procedure** insert_end$(v$: element_type ; **var** l : $List)$; which insert an element v at the end of the list l.

3. **Procedure** delete_begin(**var** v : element_type ; **var** l : $List)$; which delete the first of a list l. v will contains the value of the deleted element.

4. **Procedure** delete_end(**var** v : element_type ; **var** l : $List)$; which delete the last element of the list l. v will contains the value of the deleted element.

5. Use the previous operations to accomplish :

   (a) a procedure to transfer the elements of an array T of N real numbers into a linked list L.
   Procedure array2list$(T$: array $[N]$ of real ; **var** L : $list)$;

   (b) a procedure of a reverse transfer (list to array).
   Procedure list2array(**var** L : $list$; **var** T : array $[N]$ of real) ;

   (c) a sub-program to sort a list L.

   (d) a sub-program to merge two ordered lists L_1 and L_2 in a third list L which will be also sorted.

6. Let L be a sorted linked list. Write :

   (a) **Procedure** insert$(v$: element_type ; **var** L : $list)$; which insert the value v in the list L so that the list remains sorted.

   (b) **Procedure** delete$(v$: element_type ; **var** L : $list)$; which deletes v from the list L.

Stacks and Queues

Exercise 1   Write an algorithm that displays the elements of a linear linked list in reverse order using a stack.

Exercise 2   A post-fixed arithmetic expression is an expression where the operands are placed before the operators.

Example : the expression $((a + b + c) * (a * b/c))/c$ is expressed as follows : $ab + c + ab * c/ * c/$

1. Represent the following expressions in post-fixed form :
   - $a + b, (a + b)/d$
   - $((c + d) + (d - e)) + 5$
   - $-(a + b) + (5 + b)c$
   - $((a + b) + (c - d))/5$

2. Give the algorithm that evaluates a post-fixed arithmetic expression. We assume that the latter is in an array whose elements are of type : (Value, Type (operator or operand)).

Exercise 3   A queue with priority is one where elements are characterized by a service priority : an element of higher priority is served even if it is not arrived first.

a. Describe the structures necessary to implement this model using lists.

b. Write the Enqueue and Dequeue procedures for this model.

c. Explain how can we implement a stack using a queue with priority.

d. Explain how can we implement an ordinary queue using a queue with priority.