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END OF SEMESTER EXAM **June 2021 Session** **DESIGN AND IMPLEMENTATION OF DATA STRUCTURES**
Level: I Academic year: 2020/2021 Speciality: Software Engineering Duration: 02h

Question:(1.5+ 1.5 + 3 = 6 marks)

1. Define the following terms: Doubly linked list, AVL tree ,
2. Compare a linked list and an array while bringing out clearly the advantages and disadvantages of one over the other.
3. A palindrome is a word which can be read from both directions. The words "redivider" and "madam" are some examples of palindromes.
   Write a function that returns 1 if the word passed as parameter is a palindrome and0 if not.
   NB: Define the data structure of your choice.

Probem A:(3 + 3 = 6 marks)

Given the following declarations:

```
struct info{
        int age;
        char * name;
};
list  first;
```

```
typedefstructnode{
        struct info individual;
        struct node * next;
} * list;
```

1. Write a function separation (intageMax, list * young, list * old) which without recopy of nodes, splits the list first into two list: that of individuals less than the value ageMax(i.e list of young people) and that of individuals greater than or equal to the value ageMax(i.e list of old people).
2. Write a function invert (list * l) which inverts (without creating a new node) the list l.

Problem B: (1 + 2 + 1 + 1 + 1 + 1 + 1 = 8 marks)

Our interest here is on the management of students in the different specialities and levels in the African Institute of Computer Science. To do this we use two types of pointers (Pcl and Pst) and two types of structures (Class and Student). A structure of type Class contains the name of a speciality, the number of the level in the speciality, a pointer Pcl of type Class and another pointer Pst of type Student. A structure of type student contains a field matricule, a field name (name of the student) and a pointer Pst of type Student. The structures of type Class are linked amongst themselves, each pointing to the next. Moreover each structure of type Class points on the first student of the class. The structures of type Student of the same class (same speciality and level) are linked amongst themselves, each pointing to the next. For each procedure or function written, precise the preconditions and postcoditions if any.

1. Illustrate the above data structure with the help of a diagram showing an example
2. Propose appropriate data structures (definition of types!).
3. Write a procedure to insert a student in the structure.
4. Write a function to look for a student in the structure.
5. Write a function that returns the number of students in a given speciality; Just to remind you that a speciality is made up of different levels.
6. Write a sub program to delete a student from the structure.
7. Write a sub program to delete the structure

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