National University of Sciences & Technology
School of Electrical Engineering and Computer Science
Department of Computing

CS-250 Data Structures & Algorithms (3+1)

Assignment 1	
Maximum Marks: 10	Instructor: Dr. Muhammad Shahzad
Due Date: 03 October, 2019	Linked List Data Structure

Introduction:

A linked list is a linear data structure in which the data elements are not sorted by their physical placement in system's memory. Instead, the elements in a linked lists use pointers to refer to the next element in a data sequence. A linked list is a dynamic data structure. The number of nodes in a list are not fixed and can grow and shrink on demand.

Objectives:

To understand the concepts of dynamic data structures using implementation.

Tools/Software Requirements:

C/C++

Task 1

APO (Animal Protection Organization) wants you to implement a simple data structure that will hold information about the condition of various animals in different regions of the world. This data structure must support various queries that will allow the users to keep track about the current situation, as well as updates that will allow APO users to feed information about new events (such as animal deaths, new spotting, etc.).

Basic Structure/ Idea are given to assist you in this assignment. You MUST NOT change the definitions in any manner. You are allowed to add as many additional structures as you please. You are required to create your own Data Structures using **Linked Lists** which can answer all the questions asked in the form of functions below.

Basic Structures

Animal

This structure contains the basic definition of an animal. It contains the animal's name and a pointer to list of all regions.

Region

A region is a strap of land. Each region has a name. Each region contains an additional field called rarity. All rarity values should be set to-1 initially. Rarity will tell about the animal's abundance in that region. Rarity can then have a value in the range of 0-10, where 10 means very abundant and 0 means dead.

Region List

Region List is a list of regions. This list has 2 uses either as a generic region list or a list of regions specific to animals

Animal List

Animal List is a list of animals with all the information found in which regions and how much rarity

Functions to be implemented

1. **Add region**
   Adds a new region to the data base. User is responsible to make sure that the new region's name differs from all existing regions' names.

2. **Get region list**
   List of All the regions in the data base

3. **Add animal**
   Adds a new animal to the database. User is responsible to make sure that the new animal's name differs from all existing animals' names. Animal should be added to every region in the list with rarity =-1. All rarities in the region list should be either -1, meaning animal shouldn't be added to those regions, or in range of 1-10 (new animals can't be added showing they are dead). The region list must contain at least one region with a positive rarity.

4. **Search animal by name**

Provide complete info along with name of animal, its rarity in all regions

5. **Search animals with particular rarity**
   Input-Rarity number is entered by the user
   Output-name of animal along with region

6. **Change the rarity of a particular animal**
   Input- Animal name, region name and rarity
   Output-Rarity found and updated

7. **Which animals are dead in regions**
   Output -Names of animals dead in region names

Task 2

Implementation of **doubly circular linked** list using C/C++

Perform the following operations and display results for each task:

1. Displaying Linked List (Traverse the whole data structure - from start to end and then to start)

2. Insertion of a node
   a. Insertion at the start
   b. Insertion at the end
   c. Insertion at a particular position

3. Deletion of a node
   a. Deletion at the start
   b. Deletion at the end
   c. Deletion at a particular position