Ciclo de competencia: 2023 – 2024

Hoja de ejercicios

Tema: **“Basic Data Structures and Trees”**

Elaborador: Iván Yahir Gómez Mancilla

Fecha: 22/03/2023

1. Following the next data characteristics which is the ideal data structure to implement?
    a. Data order is important.
    b. Data does not have Last In First Out nature.
    c. Data does not have First In First Out nature.
    d. Data does not have Largest Element First Out nature.
    e. Data is Sorted by Key.
    f. We do not need to find an element by key.
    g. We do need to merge data.

2. You will have a set of *n* numbers starting from an *s* value so
    $$s_0 = s,\ s_{i+1} = s_i + 1,\ s_{i+2} = s_i + 2,\ s_{i+n} = s_i + n.$$
    Store the sequence of numbers in a C++ STL vector. Write the program.

3. Suppose that you are a data scientist studying the effects of a very rare virus called cockbig-21 in a state called Vaporestibios. Your boss is asking you to store efficiently the data from a huge data set which contains the name of a patient infected by cockbig-21 (string) and the size of the bump that virus caused in that specific patient (float). Which data structure should you choose? Justify your answer.
    Note: In Vaporestibios state there is no two infected persons with the same name.

4. When using STL containers in C++ we can obtain iterator begin and end positions of any container by using .begin() and .end() functions. Which functions should we use if we want to iterate from back to front any container?

5. Quintanar's uncle is trying to obtain the size of a C++ STL container but, since he is a beginner using this type of containers, he is iterating over the array using a while loop until he reaches the end of the container, then he can know the size of the container by checking which value is stored at a counter which increments by one at each iteration of the while loop. Due to the fact that you have already assisted an algorithms club at your university you want to help by telling him about a new function that you have learned to obtain the size of a STL container in just one line. Which function do you recommend to Quintanar's uncle?

6. Write three real-life implementations of a queue. Justify your answers.

7. What does double-ended stand for in a double-ended queue?

8. Read the next sequence of actions, draw the state of the stack at each moment and also write its size. Code the sequence of actions and compare your results.
    a. Create an empty stack for bool values.
    b. Push a true value.
    c. Push a true value.
    d. Push a false value.
    e. Pop a value.
    f. Obtain the top value at the stack.
    g. Clear the stack.

9. Code the next sequence of actions. Include evidence of your code and execution.
    a. Create a list of vectors L.
    b. Create a vector v1 whit size 3 and initial values of -1.
    c. Create an empty vector v2.
    d. Create a vector v3 whit size 8 and no initial values.
    e. Add v2 to L.
    f. Add v1 at the front of L.
    g. Add v3 at the middle of L.
    h. Create a list of vectors L2.
    i. Assign L to L2.
    j. Remove v1 from L2.
    k. Print L2.

10. Write a C++ code that creates a map using vectors and pairs. Fill it with any data that you want and then create a function to find an element by its key. DO NOT USE STL MAP FUNCTIONS!

11. Write a C++ code that achieves the following:
    a. Creates a value type for nodes that stores animals by their race and gender.
    b. Creates any number of animal nodes filling race and gender attributes.
    c. Creates a binary tree representing breed crosses.
    d. Prints the binary tree in postorder.