

# CSCE 221 Cover Page

## Programming Assignment #5

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Please list all sources in the table below including web pages which you used to solve or implement the current homework. If you fail to cite sources you can get a lower number of points or even zero. According to the University Regulations, Section 42, scholastic dishonesty are including: acquiring answers from any unauthorized source, working with another person when not specifically permitted, observing the work of other students during any exam, providing answers when not specifically authorized to do so, informing any person of the contents of an exam prior to the exam, and failing to credit sources used. Disciplinary actions range from grade penalties to expulsion read more: Aggie Honor System Office

Type of sources			
People			
Web pages (provide URL)			
Printed material	Textbook: Data Structure and Algorithms in C++		
Other Sources	Slides	Piazza	

I certify that I have listed all the sources that I used to develop the solutions/codes to the submitted work.

“On my honor as an Aggie, I have neither given nor received any unauthorized help on this academic work.”

Your Name    Shaeeta                      Sharar                      Date    04/16/2015

## Program Description

The purpose of this assignment was to familiarize ourselves with the Disjoint Set data structure. This program implemented the disjoint set structure by using a vector of linked lists. A node and a doubly linked class was created to be used as the base of the linked list structure. Then a class for disjoint set was created. This class had the functions of making a set, union of two sets, and finding sets.

## Data Structures and Algorithm Description and Run Times

In the DListNode class, I implemented the setRepresentative, setKey, setTrailer, and setListSize functions. In DisjointList, I created the constructor, implemented the makeset, the union, and the find set functions. MakeSet was implemented by creating a new node for each new set then setting that element's previous and next pointers to null, adding its key and node values, and setting the representative and trailer to itself and putting the node at the designated key spot of the vector. This function runs in  $O(n)$  time. The FindSet was implemented in two ways, both of which run in constant time. The first implementation takes in a node and returns the representative, the second takes in a key and then finds the representative and returns it. The union function runs in  $O(\log n)$  time. It is implemented by first checking for which set is larger. Then it takes the larger set and adds on the first element of the second set to the end. It then sets the previous pointer of the second set's first element to the last element of the first set. Each element of the smaller set is adjusted so that their representative is now the representative of the larger set. The trailer of the larger set is set to the trailer of the smaller set and the list size is set to the sum of the two list sizes. The representative is returned.

## Instructions to Compile and Run your Program

To compile the Disjoint Set, go into the directory that contains the files. Once in the directory, simply use the g++ comand line prompt of "g++ -std=c++11 main.cpp" to run the file. No user generated inputs are necessary. All outputs will appear on the screen.

## Logical Exceptions

In the algorithms written, there are checks to ensure that there are no null pointers being accessed and causing errors. In addition, making sure that all pointers are properly addressed was checked. The union part of the code is a little error prone due to its memory handling procedures.

## **C++ object oriented or generic programming features**

The template implementation is through the use of generic programming features. A template type “T” is used in place of other types. Each function including constructors is reworked to work with the templates. The use of multiple classes in the disjoint set program is also an example of inheritance. The doubly linked list class uses features of the node class. Likewise the disjoint list class uses features of vectors and doubly linked lists to work.

## **Tests**

These are implemented in the main file.