**MAT 2540: Data Structures and Algorithms II**

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| **PROJECT 2** (Due 4/5/2015) |  |  |

The goal of this project is to make you become familiar with the trees, and how they are implemented in a computer programming language, like C++. For this assignment, please first see the link <http://cpp.sh/2jcf> for the **Family Tree Program**, writtenin C++.

**Assignment:**

1. Extend the family tree, by adding 5 more nodes of third generation (5 grand-grandchildren of Adam). It is up to you to decide where to add these nodes, as long as all of them are level 3. Draw a schematic picture of your extended tree, visually, in a program, like Microsoft Word.
2. Inside the definition of the class “node” in the original code, add an additional new parameter: node\* parent. For each node in the tree, define the parents. For example, if the node X is the parent of Y, then you must write **Y.parent=X** in addition to **X.child1=Y**. Thus, every edge in your tree is “doubled”, that is it runs both directions between parent and their child.
3. Similar to the function “**IsChild**” that we defined in the original code, define three other functions of Boolean type, called “**IsParent**”, “**AreCousins**”, “**AreSiblings**”. For example **IsParent(X,Y)** should return true if X is the parent of Y. Similarly **AreCousins(X,Y)** should return true if X and Y are cousins. Note that, in real life, we call two people “cousins”, if they have the SAME grandparents but different parents. Save the program on cpp.sh. Create a short URL. The first line of your code must include your name(s) as a comment.
4. In your main function, test all your functions by 3 examples each. For example, if Ben is the child of Adam, your program must print

>> Adam is the parent of Ben

Or >> Ben and Adam are not cousins

Or >> Ben and Adam are not siblings

Etc.

1. Think of other uses of the code that you wrote. Can you apply the program in another innovative setting? Or can you extend your program by adding new functions, or classes, or objects?

**Grading Scheme:**

**70% for the accuracy**: Your code is expected to do everything what is asked in the assignment. It must be error-free. Expecially if you are working on this assignment in pairs...

**20% for the clarity**: You are expected to write comments within your code that explain the role of each of the line you add to the original code. Pay attention to spacing and indentation. Name your variables and functions appropriately.

**10% for additional work**: Think of other possible uses of the code you've written and extend it to make it more useful. Program the extended code, explain what it does, and send the cpp.sh link to me.

**Submit the following by e-mail by the due date:** Three cpp.sh links containing the code for Assignment, an extended-use-version. Also, send the picture of the extended tree that you used.