

CPSC 212: Data Structures and Algorithms

Program 4: Dutch Bingo

In this exercise you'll write a C# program to read a list of people and relationships such as friend, parent, or child and build a labeled graph to represent the information. Then the program should answer questions about people such as "Who are Aachie's descendants?," "List Abeltje's second-cousins-once-removed," or "Find a chain of relationships connecting Adalind and Adaluuidis" using a syntax described below. The latter is called "Dutch Bingo."

This assignment requires that the graph be directed (if Aachie is a parent of Aalberts, it doesn't follow that Aalberts is a parent of Aachie) and labeled (Aafke may be a friend of Aaltie but not a parent). Using a nice graph library that supports labeled directed graphs would make the program easier, but I was unable to find one, so I wrote a simple one. You will add capabilities for the program below.

I have provided starter code that reads a file of relationships and build a directed, labeled graph and implements some basic commands such as printing the relationships a person participates in and printing a representation of the whole graph. For simplicity it's a console application. You should add support for the following commands. Each is worth 10 points. The total possible score is 110, with 10 points of extra credit available.

1. **Friends.** Given a command line like "friends Adalrada," the program should print all of Adalrada's friends.
2. **Orphans.** This command, which takes no arguments, should list all the people with no parents.
3. **Bingo.** The command "bingo Aaf Adalmut" should find a shortest chain of relationships between Aaf and Adalmut. For example, it might report that
Aaf is a parent of Aardina
Aardina is a friend of Aagtje
Aagtje is a child of Adalmut
4. **Descendants.** Print all of a person's descendents, labeled as children, grandchildren, great grandchildren, etc.
5. **Cousins n k.** This command should print all of a person's nth-cousins k times removed where n and k are nonnegative integers. For example, "cousins Adaja 1 0" would report first cousins, "cousins Abigail 2 1" would list second cousins once removed, and "cousins Aartje 0 1" would list nieces, nephews, uncles, and aunts. (Cousin relationships are symmetric: if A is B's zeroeth cousin once removed, then B is A's as well.) Note that if someone is a sibling, that person is not also a cousin, second cousin, etc.

Submit your zipped project directory through moodle. Also turn in a printout of your source code with the grading sheet (other side) stapled to it.

CS212 Program 4 – Grading Sheet

Name: _____ Date/time: _____ Is this program late? _____

Parts of the program I didn't get to work correctly:

Comments:

_____ [below the line for instructor use only] _____

Submit a program that compiles and runs (50%) _____

1. Friends command (10%) _____

2. Orphans (10%) _____

3. Bingo finds and prints the shortest path of relationships between two people—
or says that they are unrelated (10%) _____

4. Descendants command, with labeled output (children, grandchildren, etc.)
If the graph has a cycle, it should say so and abort (10%) _____

5. Cousins n k. Relationships don't apply if there is a closer relationship,
e.g. a sibling is not a cousin (10%) _____

Style and mechanics of submission (10%) _____

Total: _____