For many years people have been interested in the question of how connected social networks are. A famous experiment was carried out by Stanley Milgram in 1967. The experiment went something like this: Randomly chosen people in Omaha were given packets that included a letter addressed to a randomly chosen person in Boston. In the unlikely event that the resident of Omaha knew the recipient, he was to send it directly. Otherwise, he was asked to select someone he knew who was more likely to know the recipient and send it on to them for forwarding. The question: On average, how many intermediaries before the letter reached its final destination? The answer turned out to be about 6. See http://en.wikipedia.org/wiki/Small-world_experiment.

We can perform this type of experiment more easily nowadays using publicly available data, for example using the IMDB actor data. Let's say that if two actors worked on the same film, they are distance 1 apart. If actor 1 worked on a film with actor 2, and actor 2 worked on a film with actor 3, who worked on a film with actor 4, then we would say that the distance between actor 1 and actor 4 is 3 if there is no shorter path connecting them.

The text file ActorRoles contains a line for each actor. Each line starts with the actor's name, followed by a tab and then the movies the actor appeared in, with each entry separated by a tab.

The program BusyActor.java reads in the data from ActorRoles and determines which actor appeared in the most movies.

Write a program that creates a graph using the data in ActorRoles. You should have a vertex for each actor and an edge between two actors if they worked on a film together. Your program should prompt for and accept two nonnegative integers on a line, each representing an index into the list of actors, and gives the distance between the two actors, with the chain of actors that connects them and the movies they appeared in. If there is no connection between the actors, your program should print out "No connection.". Your program should loop, prompting for additional input until the input numbers are both 0 (see the sample session below). Use the graph classes on Vocareum or Canvas. In addition to the Graph implementations that are described in the Shaffer book, there is a Graphl.java implementation that uses a slightly different adjacency list implementation. That directory also contains a file ShortActorRoles, which is of the same format as ActorRoles but with only 8 actors and 5 movies. You can check the distances you obtain with the solution in ActorsSmallWorld.pdf.

Call your program SmallWorld. For part 1 your program should work for ShortActorRoles. For part 2 (due on Nov. 24), tune your program so that it works for ActorRoles. You may need to re-evaluate your choices of data structures and algorithms to deal with the large data set. You may need to increase the memory size of the JVM; for example "java -Xmx16g SmallWorld". Use only algorithms and data structures (and your modifications) that we have covered in the course.

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Here is a sample session:

```
$ java -Xmx8g SmallWorld
Enter source and destination indices:
3728 7261
Shortest path between Ackerman, Audrey and Adzovic, Ljubica
Distance: 5; the chain is:
Ackerman, Audrey appeared with Anschutz, Melissa (I) in Beyond Acceptance (2011)
Anschutz, Melissa (I) appeared with Alex, Penelope in Chasing the Rain (2018)
Alex, Penelope appeared with Brack, Suzy in Selling Stupid (2017)
Brack, Suzy appeared with Katic, Branka in Public Enemies (2009)
Katic, Branka appeared with Adzovic, Ljubica in Crna macka, beli macor (1998)
Enter source and destination indices:
3173624 2649821
Shortest path between Verdon, Timothy and Patel, Amar (I)
Distance: 5; the chain is:
Verdon, Timothy appeared with Viola, Raffaele in Il compromesso - La tomba di Giulio II e
laViola, Raffaele appeared with Bonaiuto, Anna in L'amore molesto (1995)
Bonaiuto, Anna appeared with Golino, Valeria in La putain du roi (1990)
Golino, Valeria appeared with Sharif, Bina in Side Streets (1998)
Sharif, Bina appeared with Patel, Amar (I) in American Desi (2001)
Enter source and destination indices:
3000 4000
Shortest path between Abt, Marion and Acosta, Karla (I)
Distance: 4; the chain is:
Abt, Marion appeared with Dahlberg, Monika in M¨adchen beim Frauenarzt (1971)
Dahlberg, Monika appeared with Rojo, Gustavo (I) in Sch¨on ist die Liebe am K¨onigssee (1961)
Rojo, Gustavo (I) appeared with Garc´ıa, Mar´ıa Fernanda in Fuera de la ley (1998)
Garc´ıa, Mar´ıa Fernanda appeared with Acosta, Karla (I) in Cuatro a la fuga (1993)
Enter source and destination indices:
5000 6000
No path between Adams, Elinor and Addison, Stephanie
Enter source and destination indices:
0 0
$
```