

Networks

Tanya Khovanova

May 13, 2013

Class Discussion

Networks. Examples: authors, Internet, actors, web pages. Erdős number. Kevin Bacon oracle.

Warm-Up

Exercise 1. There are two beautiful yet remote islands in the south pacific. The islanders born on one island always tell the truth, and the islanders from the other island always lie. You are on one of the islands, and meet three islanders. The first person says that the other two islanders are from the same island. The second person say the same thing. Can you guess what the third islander would say?

Exercise 2. Six members of a fishing club decided to have a triple wedding. As is the tradition with fisherman, they weighed the catches (the brides). But the brides argued that they were not the ones being caught, so they weighed the grooms, too. This resulted in six different numbers, but, surprisingly, the combined weight of each couple was the same. Mary weighed the most. Her weight plus Toby's was less than Tim's plus Gena's. Toby's weight plus Gena's was the same as Henry's plus Jessie's.

Who married whom?

Exercise 3. If Frank and Sam total their ages the answer is 49. Frank is twice as old as Sam was when Frank was as old as Sam is now. How old are Frank and Sam?

Exercise 4. If you add together the date of the last Monday of the previous month and the first Thursday of the next month, the result is 38. Both dates are in the same year. What is the current month?

Networks

Exercise 5. Use Kevin Bacon oracle, <http://oracleofbacon.org/>, and find an actor who is at least 3 away from Kevin Bacon.

Exercise 6. Invent your own network example.

Exercise 7. Take a map and connect each town shown on it to its nearest neighboring town using a straight line segment. Assume that each different pair of towns is a different distance apart. What is the maximum number of towns that any one town can be connected to?

Exercise 8. One hundred circles are drawn on a plane so that all of them are connected. Prove that there exists an Euler walk for the resulting figure.

Challenge Problems

Exercise 9. In a country there are 1988 towns and 4000 roads. Prove, that there exists a tour that starts in a town and comes back and passes through not more than 20 towns.

Exercise 10. You are standing in a school hallway lined with 100 closed lockers. You then open all 100 lockers. After this, you then close every 2nd locker. Then, you go to every third locker and open it if it is closed or close it if it is open (lets call this toggling the locker for our discussion). You proceed to toggle every n -th locker on pass number n . After your hundredth pass of the hallway, in which you toggle only locker number 100, how many lockers are now open?