

# Small World

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## Class Discussion

Compare road networks and air traffic networks. Properties of many networks:

- small diameter
- degree distribution, hubs and connectors
- 80/20 rule

## Warm-Up

**Exercise 1.** On a Christmas tree there were two blue, two red and two white balls. All seemed the same, however in each color pair one ball was heavier. All three lighter balls were the same weight, just like all three heavier balls. Using a balance twice, identify the lighter balls.

**Exercise 2.** Three Palefaces were taken captive by a hostile Indian tribe. According to tribe's custom they had to pass an intelligence test, or die. The chieftain showed 5 headbands — 2 red and 3 white. The 3 men were blindfolded and positioned one after another, face to back. The chief put a headband on each of their heads, hid two remaining headbands, and removed their blindfolds. So the third man could see the headbands on the two men in front of him, the second man could see the headband on the first, and the first could not see any headbands at all. According to the rules any one of the three men could speak first and try to guess his headband color. And if he guessed correctly — they passed the test and could go free, if not — they failed. It so happened that all 3 Palefaces were prominent logicians from a nearby academy. So after a few moments of silence, the first man in the line said: “My headband is ...”. What color was his head band? Why?

**Exercise 3.** What has six faces but does not wear makeup. It also has twenty-one eyes but cannot see?

**Exercise 4.** There is a word in the English language where the first two letters indicate a male, the first three letters indicate a female, the first four indicate a great man, and the whole word is a great woman?

**Exercise 5.** One snowy night, Sherlock Holmes was in his house sitting by a fire. All of a sudden a snowball came crashing through his window, breaking it. Holmes got up and looked out the window just in time to see three neighborhood kids who were brothers run around a corner. Their names were John Crimson, Mark Crimson and Paul Crimson. The next day Holmes got a note on his door that read “? Crimson. He broke your window.” Which of the three Crimson brothers should Sherlock Holmes question about the incident?

**Exercise 6.** There are five people. One of them shot and killed one of the other five. Which man is the murderer?

1. Dan ran in the NY City marathon yesterday with one of the innocent men. 2. Mike considered being a farmer before he moved to the city. 3. Jeff is a topnotch computer consultant and wants to install Ben’s new computer next week. 4. The murderer had his leg amputated last month. 5. Ben met Jack for the first time six months ago. 6. Jack has been in seclusion since the crime. 7. Dan used to drink heavily. 8. Ben and Jeff built their last computers together. 9. The murderer is Jack’s brother. They grew up together in Seattle.

**Exercise 7.** What is  $3/7$  chicken,  $2/3$  cat and  $1/2$  goat?

**Exercise 8.** How can you make the following equation correct without changing it at all?  $8 + 8 = 91$

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**Exercise 9.** Give an example of a hub in a math authors network, actors network, friendship network, webpages network.

**Exercise 10.** What might 80/20 rule state for math authors network, actors network, friendship network, webpages network?