

The Pigeon Hole Principle

Problem 1 (*Old Problem*). A drawer contains socks of two different colors: black or white. If you pull socks out of the drawer without looking, what is the minimum number of socks to pull out to assure yourself of a match?

Problem 2. The population of King county is about 1,800,000 people. If humans have no more than one million hairs on their heads, show that there must be two people in the county with the same number of hairs on their heads.

Problem 3. Thirteen crates of apples arrives at a warehouse. Each crate contains apples of one of three varieties: Delicious, Granny Smith, or Pink Lady. Are there four crates of one variety? Why?

Problem 4. Are there five crates of one variety? Why?

Problem 5. An equilateral triangle can not be covered with two smaller equilateral triangles. Why?

Problem 6. If each of five friends have some change in their pockets, and together they have a total of \$1.47. Can each of them buy a piece of thirty cent candy?

Problem 7. At most, how many among the friends can buy the candy?

Problem 8. Show that in any group of five people, there are two people who have the same number of friends with in the group.

Problem 9. Show that if fifteen people attend a party and some shake hands with others (but not with themselves), then at the end, there are at least two people who have shaken hands with the same number of people.

Problem 10. Six squirrels have collected a total of fourteen nuts. Why must two of the squirrels have collected the same number of nuts?

Problem 11. In chess, a king can attack any piece in a neighboring square, either vertically, horizontally, and diagonally. How many kings can you put on a 8×8 chessboard so that no king can attack any other? Why can't you put any more than that?