

of getting at least one pair of the same color is the same as the minimum number I must pick in order to be sure of getting at least two socks of different colors. How many socks are in the drawer?

2. Ok, let's get onto the problems involving **kNights**, **kNaves** and **kNormals** (**NNN**). These kinds of logical puzzles have been popular for a long time, so you might have heard some before. The idea is this:

You go to visit a far off island of Rayland. Everyone on Rayland (other than you) is either a knight or a knave (we'll talk about knormals later). Knights will always tell the truth, while knaves will always lie.

- (a) You come across three folks sitting in a garden. Let's call them A, B and C. You ask A if they are a knight. A answers, but you can't quite make out what they said. You ask B "What did A say?" B replies "A said that she was a knave." At this moment C says "Don't believe B! He is lying!"

The question is, what are B and C?

- (b) You walk on a bit further, and you see two little kids, A and B, climbing a tree. You ask them who they are and A responds "At least one of us is a knave"

What are A and B?

- (c) Suppose instead that A had said "Either I am a knave or B is a knight."

What are A and B?

- (d) Suppose instead that A had said "Either I am a knave or else two plus two equals fish."

What could you conclude?

- (e) You continue walking across the Rayland, and come across another three people, A B and C each of whom is either a knight or a knave. A and B make the following statements.

A: All of us are knaves

B: Exactly one of us is a knight

What are A, B and C?

- (f) Suppose instead that A and B had said the following

A: All of us are knaves.

B: Exactly one of is is a knave

What can you conclude?

(g) Suppose that A had said "I am a knave, but B isn't"

What are A and B?

(h) We again have three inhabitants, A, B and C, each of whom is either a knight or a knave. Two people are said to be of the same type if they are both knights or both knaves. A and B make the following statements:

A: B is a knave.

B: A and B are of the same type.

What can you conclude?

(i) Again three people A, B and C. A says B and C are of the same type." Someone then asks C, "Are A and B of the same type?" What does C answer?

- (j) You walk a bit further still and see two inhabitants of Rayland laying under a tree. You ask one of them, "Are either of you a knight?" She responded, and you knew the answer to your question.

Was the person that you asked the question to a knight or a knave?
How about the other person?

3. You decide that you have seen quite enough of Rayland, and decide to leave to Smullville. Smullville is also inhabited by knights and knaves, but it also has a third kind of inhabitant, knormals. Knormals sometimes tell the truth, and other times lie. It is here where our next few puzzles take place

- (a) We are given three people, A, B and C, one of whom is a knight, one of whom is a knave, and the last of whom is a knormal. They make the following statements:

A: I am the knormal.
B: That isn't true!
C: I am not knormal.

What can you conclude?

- (b) Two people, A and B say the following:

A: B is a knight.
B: A is not a knight.

Prove that at least one of them is telling the truth, but is not a knight.

(c) This time A and B say the following:

A: B is a knight.

B: A is a knave.

What can you conclude?

(d) On the island of Mullville, there is a caste system. knights belong to the highest caste, normals below, and knaves the lowest caste. Two inhabitants make the following statements:

A: I am a lower rank than B.

B: That's not true!

What can you conclude?

(e) Given three people A, B and C, one of whom is a knight, one a knave, and the last a knormal. A and B say:

A: B is of higher rank than C.

B: C is of higher rank than A.

Then C is asked, "Who has the higher rank, A or B?" What does C answer?

4. The last stop on our journey is the island of Merrilia. On the island of Merrilia, a knight can only marry a knave, a knave could only marry a knight, and so a knormal could knormal.

(a) The first people that we meet on the island are Mr. and Mrs. A. They make the following statements.

Mr. A: My wife is not a knormal.

Mrs. A: My husband is not knormal.

What are Mr. and Mrs. A?

(b) Suppose instead that they had said:

Mr. A: My wife is a knormal.

Mrs. A: My husband is knormal.

Would the answer have been different?

(c) The final people that you meet on this island are a pair of couples, Mr and Mrs A, and Mr and Mrs B. They say the following:

Mr. A: Mr. B is a knight.

Mrs. A: That's right, Mr. B is a knight.

Mrs. B: Indeed! My husband is a knight.

What can you conclude?