

## 1 Introduction

## 2 Warm-up: Fruit in Jars

*The key is that the jars are mislabeled. For example, if you get a grape from a jar that says grape and apples, you know that the jar must be grapes because it is mislabeled- it cannot be apples because you just got a grape and it cannot be grapes and apples because that was what it was labeled as (and the jar was mislabeled). Repeat this for the other jar and the last jar is the leftover label.*

## 3 Knights and Liars

1. While visiting this island, you meet a boy who says he a liar. Does he live on this island?

*He does not live on the island because neither a knight nor a liar would say they are a liar.*

2. Two island boys, Sam and Kurt, are introducing themselves to you. Sam says, "At least one of us is a liar." Who is/are the liar(s)?

*Sam is a knight and Kurt is a liar. If Sam were a liar then his statement would be true which would contradict the assumption that he was a liar. Therefore, he must be a knight, his statement must be true, and Kurt must be the liar*

3. While visiting this island, I had a conversation with a local knight. I asked him the same question twice, and he gave me two different answers. What was my question?

*A variety of answers are possible, for example, "What time is it?", "How many questions have I asked?" etc.*

4. At the island, you meet two islanders, Ben and Jerry. Ben says at least one of the two is a liar. Is Ben a knight or a liar? What about Jerry?

*Ben is a knight and Jerry is a liar. If Ben were a liar, then his statement would be true, which would contradict the assumption that he was a liar. Therefore, he must be a knight, his statement must be true, and Jerry must be the liar.*

5. While visiting the island, you pass a beautiful garden where you meet three islanders, Kevin, James, and Kyle. You ask Kevin, "Are you a Knight or a Liar?" Kevin ignores you. You then ask James, "Is Kevin a Knight or a Liar?" James says, "Kevin is a liar." Then, Kyle screams, "Don't listen to James! He's a liar!" Is James a liar? Is Kyle a liar?

*You ask Kevin if he is a Knight or a Liar, but there is another option- to be a Tourist. Tourists can lie or tell the truth and by not answering, Kevin is telling the truth because he is indeed, neither a Knight nor a Liar, so he cannot answer the question. Therefore, James must be a Liar because he called Kevin a Liar (which he is not) and since Kyle called James a Liar, Kyle is a knight.*

## 4 A Knight and a Dragon

Why did the knight live? Why did the dragon die?

*The dragon's strategy was to give the knight poison from well 6 because the knight would not be able to reach 7 so he would die. However, the knight used logic and outsmarted the dragon. The previous night, while the dragon was sleeping, the knight went out and drank poison from well 1. He knew that the dragon would give him water from well 6 so the knight would be saved. And, the knight gave the dragon normal water, so that no matter which well the dragon drank from, he would die because he would only get one dose of the poison.*

## 5 Bad Children and Halloween Candy

*Once all the Moms know there are at least 1 bad child, we can understand the process recursively. Let's assume that there is only 1 bad child. Then his mom doesn't see anybody else being bad, so she knows that he is bad, and she will take away his candy that very day. If there are 2 bad children, their moms know of one bad child and must wait one day before concluding that their own child is bad (since no other child got their Halloween candy taken away on the day of the announcement). So with 100 bad children, all is well until 99 days later, when the 100 moms take away the Halloween candy from their bad children all on the same day.*

## 6 Challenge: Logic and Math

*Essentially, one needs to prove that there are more than 1000 combinations that can be made with the prisoners. This can be done by showing there are  $10^2 - 1$  different combinations of different prisoners*