1 Trains Boliviens et Péruviens

Dans le texte en anglais qui suit, pour chaque *Explain*, donnez un algorithme modélisant la situation, puis proposez une explication.

*High in the Andes mountains, there are two circular railroad lines. As shown in the diagram, one line is in Peru, the other in Bolivia. They share a section of track, where the lines cross a mountain pass that lies on the international border.*
that the drivers of the two trains are blind and deaf, so they can neither see nor hear each other.

The two drivers agreed on the following method of preventing collisions. They set up a large bowl at the entrance to the pass. Before entering the pass, a driver must stop his train, walk over to the bowl, and reach into it to see if it contains a rock. If the bowl is empty, the driver finds a rock and drops it in the bowl, indicating that his train is entering the pass; once his train has cleared the pass, he must walk back to the bowl and remove his rock, indicating that the pass is no longer being used. Finally, he walks back to the train and continues down the line. If a driver arriving at the pass finds a rock in the bowl, he leaves the rock there; he repeatedly takes a siesta and rechecks the bowl until he finds it empty. Then he drops a rock in the bowl and drives his train into the pass. A smart aleck\(^1\) college graduate from the University at La Paz (Bolivia) claimed that subversive train schedules made up by Peruvian officials could block the Bolivian trains forever. (Explain). The Bolivian driver just laughed and said that could not be true because it never happened. (Explain). Unfortunately, one day the two trains crashed. (Explain).

Following the crash, our college graduate was called in as a consultant to ensure that no more crashes would occur. He explained that the bowl was being used the wrong way. The Bolivian driver must wait at the entry until the bowl is empty, drive through the pass, and walk back to put a rock in the bowl. The Peruvian driver must wait at the entry until the bowl contains a rock, drive through the pass and walk back to remove the rock from the bowl. Sure enough, his method prevented crashes. Prior to the arrangement, the Peruvian train ran twice a day and the Bolivian train ran once a day. The Peruvian were very unhappy with the new arrangement. (Why?)

Our college graduate was called in again and was told to prevent crashes while avoiding the problem of his previous method. He suggested that two bowls be used, one for each driver. When a driver reaches the entry, he first drops a rock in his bowl, then checks the other bowl to see if it is empty. If so, he drives his train through the pass, stops it and walks back to remove his rock. But if he finds a rock in the other bowl he goes back to his bowl and removes his rock. Then he takes a siesta, again drops a rock in his bowl, and re-checks the other bowl and so on, until he finds the other bowl empty. This method worked fine until late in May, when the two trains were simultaneously blocked at the entry for many siestas (Explain).

To solve this problem, a Dutch mathematician named Dekker was brought in. What did he recommend\(^2\)? Another Dutchman named Dijkstra said there was a better way using a single bowl as a semaphore. What did he call the bowl?

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\(^1\)Smart aleck (slang) : A person regarded as obnoxiously self-assertive.

\(^2\)Voir l'algorithme donné plus loin.