The Flags Problem

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Abstract

This is a problem I thought about while driving around my town, yelling at pedestrians. Turning them into an abstraction proves useful here but it may not hold up in traffic court.

1 The Problem

Pedestrians are crossing a city street, either going left or right. Orange handheld flags sit in racks on either side of the street to them to provide visibility to cars (Fig. 1). If there is a flag in their side's rack, a pedestrian will take it across the street with them (Fig. 2) and place it in the opposite rack (Fig. 3). If their side's rack is empty, they cross the street anyway and don't touch the flags (Fig. 4).

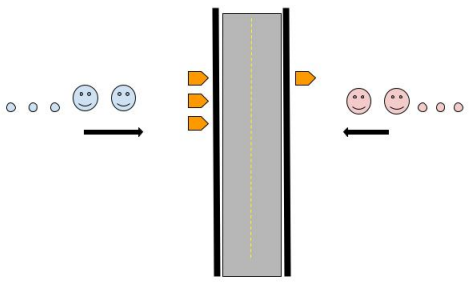

Figure 1: Before Crossing

We can assume:

- A very large number of pedestrians cross over the course of the day.
- Pedestrians arrive and cross immediately, one at a time.

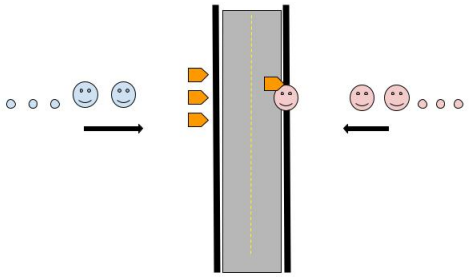

Figure 2: Carry the flag

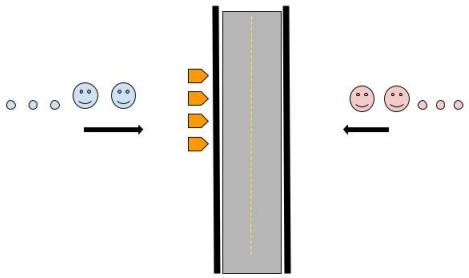

Figure 3: After Crossing

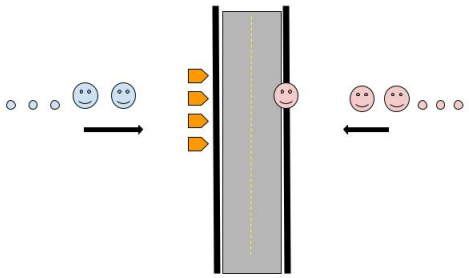

Figure 4: Flagless Crossing

- Pedestrians cross once, either right to left or left to right, and vanish for the rest of the day.
- Each crossing is an independent event. The probability that the next pedestrian crosses left to right is some p, which doesn't change over the day. Right-to-left is

then $1 - p$.

Questions:

1. At the end of the day, suppose we see three flags on the left and one on the right. What's the most likely value of p?[1]
2. Suppose we see m flags on the left and n flags on the right. What's the most likely value of p?

[1] Given that we have no priors, we could call this the *maximum likelihood estimate*. Or, the value of p that makes this most probable.