Introduction to Quant Problems

These are ordered in (roughly) ascending difficulty.

Problem 1

In some Asian countries, couples will have children until they get a boy. In a large population following this rule, what is the expected gender proportion? Assume that every child born is either male or female with equal odds.

Problem 2

A CS student is in a bright room with three switches, all initially on. Intimidated by the light, the student frantically flips switches at random, at a rate of one per second. The light only turns off when all three switches are off. How long does this take on average?

Problem 3

Jeffrey breaks a stick of length one into three pieces, with the break points chosen uniformly on $(0, 1)$. What is the probability these pieces can form a triangle?

Problem 4

A humanities student is in a dark room with three switches, in some unknown arrangement. The light in the room turns on when all three switches are flipped on simultaneously. The student cannot observe the state of the switches, but he can plan a strategy to flip them. What is the optimal strategy to minimise the average time it takes to turn the light on? What is the optimal strategy to minimise the maximum (in the worst case scenario) time to turn the light on?

Problem 5

Kevin and Brenden play a game. In a turn, a player generates a random number in $(0, 1)$, and add it to their sum (initially 0 for both players). If their sum exceeds 1 they automatically lose the game. Kevin goes first, and can take as many turns in a row as he wishes. Brendan, who is aware of Kevin's sum, repeats this process. If neither player has lost when Brendan decides not to take a turn, the winner is whoever has the largest sum. What is Kevin's best strategy?

Problem 6

Jeffrey breaks a stick of length one into three pieces just like Q2. What is the probability these pieces can form an **acute** triangle?