

DTP-Math-Circle: Session 4—Probability, Inequalities and Quantum Mechanics

Oct 14 2022

2 A quantum revolver

There are many possible outcomes of Gabbar's shooting of the three henchmen with his bullets. All three survived (SSS), but all three may have died (DDD).

- (a) What are the other possible outcomes ? Are there any outcomes that are not possible at all ?

The outcomes that do not seem possible (by common sense) can be possible if we have a "quantum revolver". This means that, once a bullet is fired from a compartment, the remaining bullets distribute themselves in all remaining compartments so that the probability of any of the compartments having a bullet is equal. This looks strange, but such situations are possible with quantum mechanics.

- (b) With a quantum revolver as described above (such revolver has not been constructed yet as far as we know), what are the probabilities of survival of A, B, and Kalia ? If Kalia, the seniormost henchman, is given a choice of his position in the execution queue, which position should he choose to maximize his probability of survival?

Samba is an external observer whose life is not in danger, so he can indulge in other activities like calculating probabilities. He denotes a "hit" (dead henchman) by 1 and a "survival" by 0. So possible outcomes are 000, 001, etc.

- (c) What are the "classical" probabilities of these 8 outcomes ?
- (d) What are the "quantum" probabilities of these 8 outcomes ?
- (e) Samba wants to construct a function of the outcomes of the three shots such that it gives 1 for a possible "classical" outcome (without quantum mechanics), and 0 for an outcome with quantum mechanics. Help him construct this function using Boolean operators AND, OR, NOT (There can be multiple answers.)