Section B: Four `0`s and three `1`s are arranged around a circle in some (unknown) order. You replace each consecutive pair of bits with a `0` if they are equal and with a `1` if they are different, obtaining another configuration of bits. After some number of repetitions can you end up with one `0` and six `1`s?

Justify your answer with a proof. Specify your proof method.

Solution: Yes. We prove it by giving an example: There exists a configuration of four zeros and three ones that gives one zero and six ones in one step, namely the configuration `0101010` (say in clockwise direction).

Section C: Prove that $(\sqrt{2}+1)^2$ is irrational. Specify your proof method.

Solution: We prove it by contradiction. Suppose $(\sqrt{2}+1)^2 = n/d$ for some integers n and $d \neq 0$. Expanding the left hand side we get $2+2\sqrt{2}+1 = n^2/d^2$, from where $\sqrt{2} = (n^2-3d^2)/(2d^2)$. This is a ratio of two integers and therefore rational, a contradiction.