This is Gigi. Gigi is an incessant tennis ball player. The ball is thrown by a human, Gigi chases it, catches it, retrieves it, and drops it at the thrower’s feet (really). Then the thrower picks up the ball and throws it, and the cycle repeats. The ball may be thrown as a fly (arc) or a line drive (skipping). The ball has a mass of 66 g and a diameter of 68 mm. [aerodynamic drag is expressed \( \frac{1}{2} \rho_{\text{air}} V^2 C_D A \), where \( A \) is projected area and \( V \) is the ball speed; drag coefficient \( C_D \) may be taken as 0.7; air density \( \rho_{\text{air}} \) may be taken as 1.2 kg/m\(^3\)]. Gigi has far more game duration endurance than the thrower, and a much higher desired game frequency than the thrower.

This is Zane. Zane plays tennis whenever Gigi does, but is less intense. He may sit out a throw. He gets distracted, and plays with the things that distract him (including Gigi). He is bigger and stronger than Gigi, and just as fast. Zane is part of the environment that Gigi has to play in (the rest of the environment is a large, fenced, grassed, lightly forested suburban back yard).

A device is desired that will meet Gigi’s ball-playing needs without the presence of a human thrower (except for daily setup of the device). The device should be capable of functioning all day, in the presence of Zane, without human intervention.

Again – all exam problems pertain exclusively to the design problem of a device for playing ball with Gigi, in the presence of Zane, without human intervention.