4. SUPERBALLS (5 points) $n+1$ elastic balls are dropped so that they are exactly above each other, with a very small gap between each. Bottom ball has a mass of m_0, the one above has a mass of fm_0, next f^2m_0 and so on, until the topmost ball with mass f^nm_0, where $f < 1$. At the moment when the bottom ball touches the ground, all the balls are moving with the speed v.

i) *(1 point)* After the collision between the two bottommost balls, what is the speed v_1 of the second ball from the bottom?

ii) *(3 points)* What is the speed of the topmost ball v_n after all collisions?

iii) *(1 point)* How many times higher would that ball fly compared to the initial drop height h? Take $f = 0.5$ and $n = 10$.

It maybe useful that that sequence $a_0 = 1$, $a_{k+1} = a_k\alpha + \beta$ has a general term $a_n = \alpha^n + \beta\frac{\alpha^n-1}{\alpha-1}$, where α and β are constants.