Derivation of Masses in terms of time period and orbital velocities:

$$Let\ M_1\ and\ M_2\ be\ the\ masses\ of\ the\ binary\ stars.$$

$$Let\ R_1\ and\ R_2\ be\ their\ respective\ distances\ from\ the\ barycenter.$$

$$Their\ periods\ of\ revolution\ T\ are\ equal:$$

$$T = \frac{2\pi R_1}{V_1} = \frac{2\pi R_2}{V_2}\ (Circular\ orbit)$$

$$F_G = F_{C_1} = F_{C_2}\ (where\ F_C\ refers\ to\ the\ centripetal\ force)$$

$$\frac{GM_1M_2}{(R_1+R_2)^2} = \frac{M_1{V_1}^2}{R_1} = \frac{M_2{V_2}^2}{R_2}\ (R_1 + R_2\ since\ diametrically\ opposite)$$

$$\frac{GM_1M_2}{(R_1+R_2)^2} = \frac{M_2{V_2}^2}{R_2} \Rightarrow M_1 = \frac{{V_2}^2(R_1+R_2)^2}{GR_2} = \frac{{V_2}^2\left(\frac{TV_1}{2\pi}+\frac{TV_2}{2\pi}\right)^2}{G\frac{TV_2}{2\pi}} = \frac{TV_2(V_1+V_2)^2}{2\pi G}$$

$$\frac{GM_1M_2}{(R_1+R_2)^2} = \frac{M_1{V_1}^2}{R_1} \Rightarrow M_2 = \frac{{V_1}^2(R_1+R_2)^2}{GR_1} = \frac{{V_1}^2\left(\frac{TV_1}{2\pi}+\frac{TV_2}{2\pi}\right)^2}{G\frac{TV_1}{2\pi}} = \frac{TV_1(V_1+V_2)^2}{2\pi G}$$

$$M_1 = \frac{TV_2(V_1+V_2)^2}{2\pi G}$$

$$M_2 = \frac{TV_1(V_1+V_2)^2}{2\pi G}$$

These are the formulae used in the Python script to calculate the masses.

~ Arnav Das