Various Methods of Computing a Satellite's Orbit:

METHOD 1: Period of a circular orbit

$$\frac{\psi}{2\pi} = \frac{\Delta T}{\tau}$$

Where ψ is the angle through which the satellite travels in time T. Calculate the angle using the following approximation for two perpendicular angles:

$$cos(\psi) = sin(\delta_1)sin(\delta_1) + cos(\delta_1)cos(\delta_2)cos(\alpha_1 - \alpha_2)$$

Where δ is the declination and α is the Right Ascension, and points 1 and 2 are the two points separated by T.

Use the code provided on canvas.

METHOD 2: Kepler's Third Law

$$\tau = 2\pi * \sqrt{\frac{ma^3}{k}}$$

where m is the mass of the satellite, a is the semi-major axis, and k is the constant G * m1 * m2 or m * μ.

Use this method for verification only.

METHOD 3: Elapsed time between rises

Note many occurrences of your satellite rising and setting. Calculate period from time elapsed between subsequent rises or sets.

METHOD 4: Constant Elevation Angles

Measure elapsed time between satellite appearances at constant elevation angle. Do this many times.

METHOD 5: Mean Motion

Use the TLE data's mean motion *n* (number of revolutions per day)

$$\tau = \frac{\text{seconds per day}}{\text{orbits per day}} = \frac{86400}{n}$$

All of these methods have their limitations. Use multiple methods (3-ish), and compare your result. Why are your various methods limited? Compare to the listed period online.

Bonus points if you develop and demonstrate a more rigorous method that solves the major issue of several of the above methods. Be clear about what this major issue is.