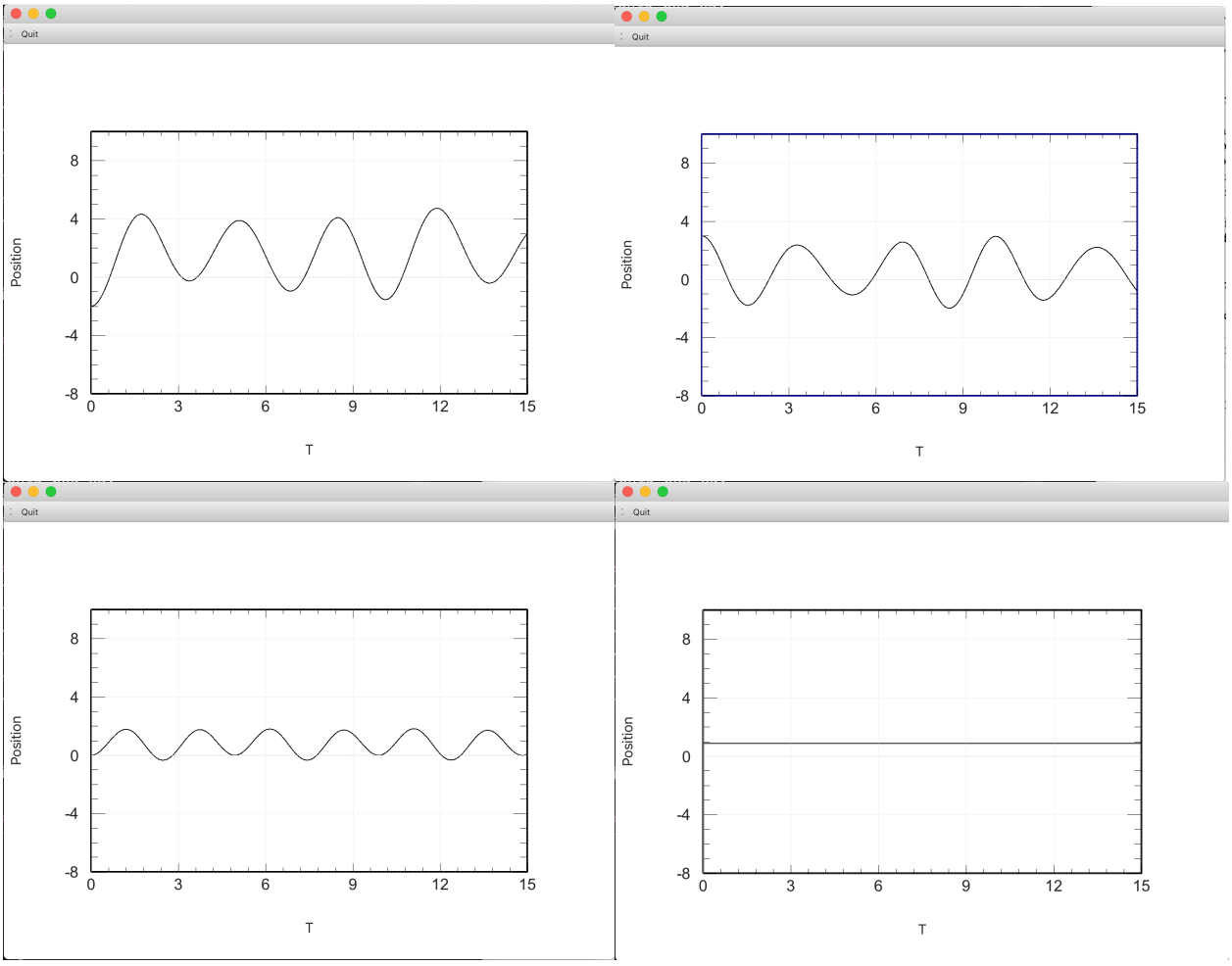
Assignment 4

EX13.

In this question, I first write the differential equations in matrix form: $D^2\overrightarrow{x} = -\omega^2\overrightarrow{x}$, where ω is the frequency of normal mode. I use the *SelfAdjointEigneSolver* to solve the eigenvector and eigenvalue. Because the initial velocities for all metal balls are 0, all normal modes can be written as: $X_i = A_i\cos(\omega_i t)$. The coefficients A_i can be obtained by the boundary conditions.

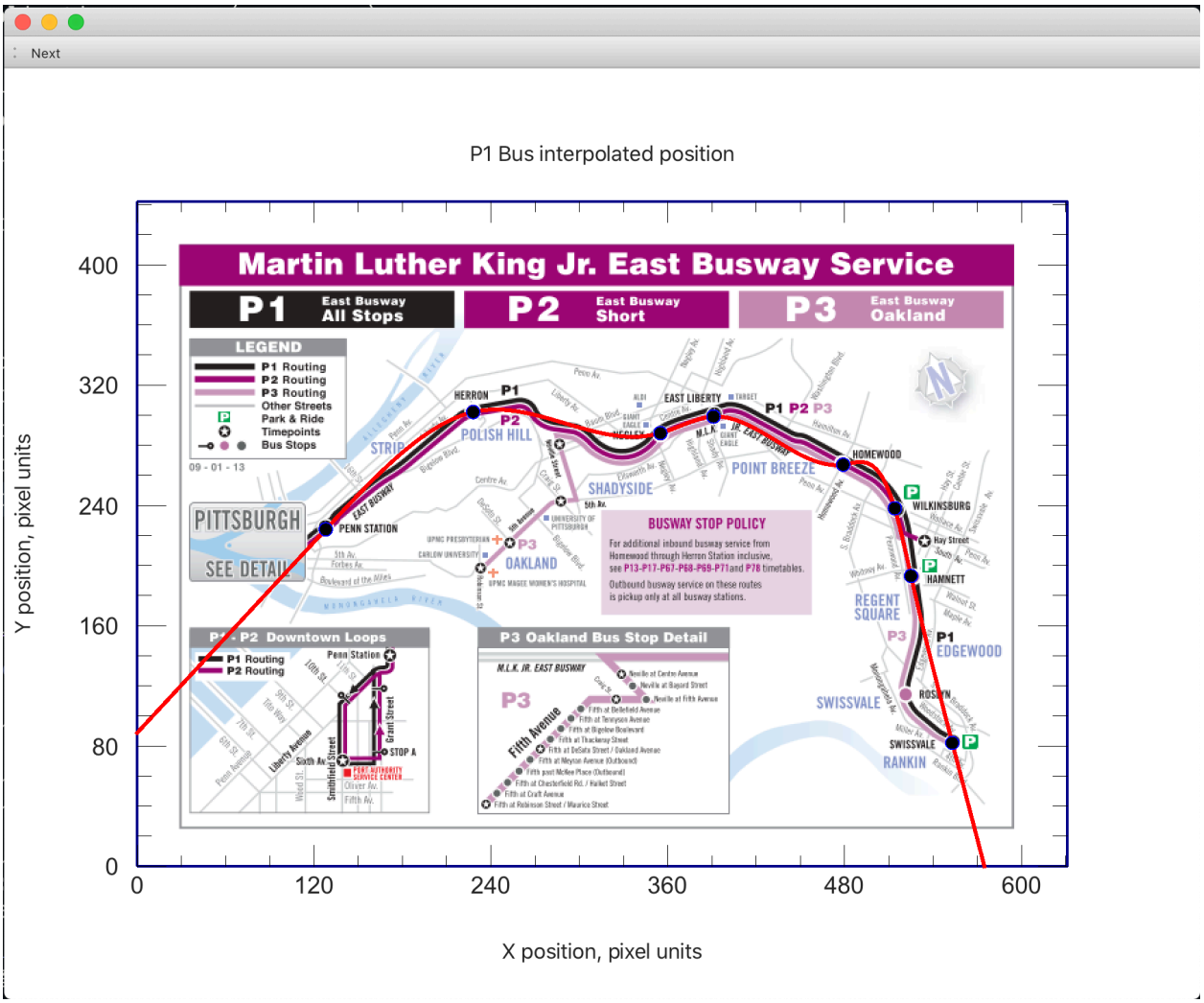
The position function for each metal ball is the linear combination of normal modes. And if we know the position and mass for every metal ball, it is easy to calculate the position of centre of mass. I chose the position functions for the first three metal balls and the centre of mass to plot, the results are showed in follow:



The position of centre of mass does not vary in time because there is no external force applied in this system.

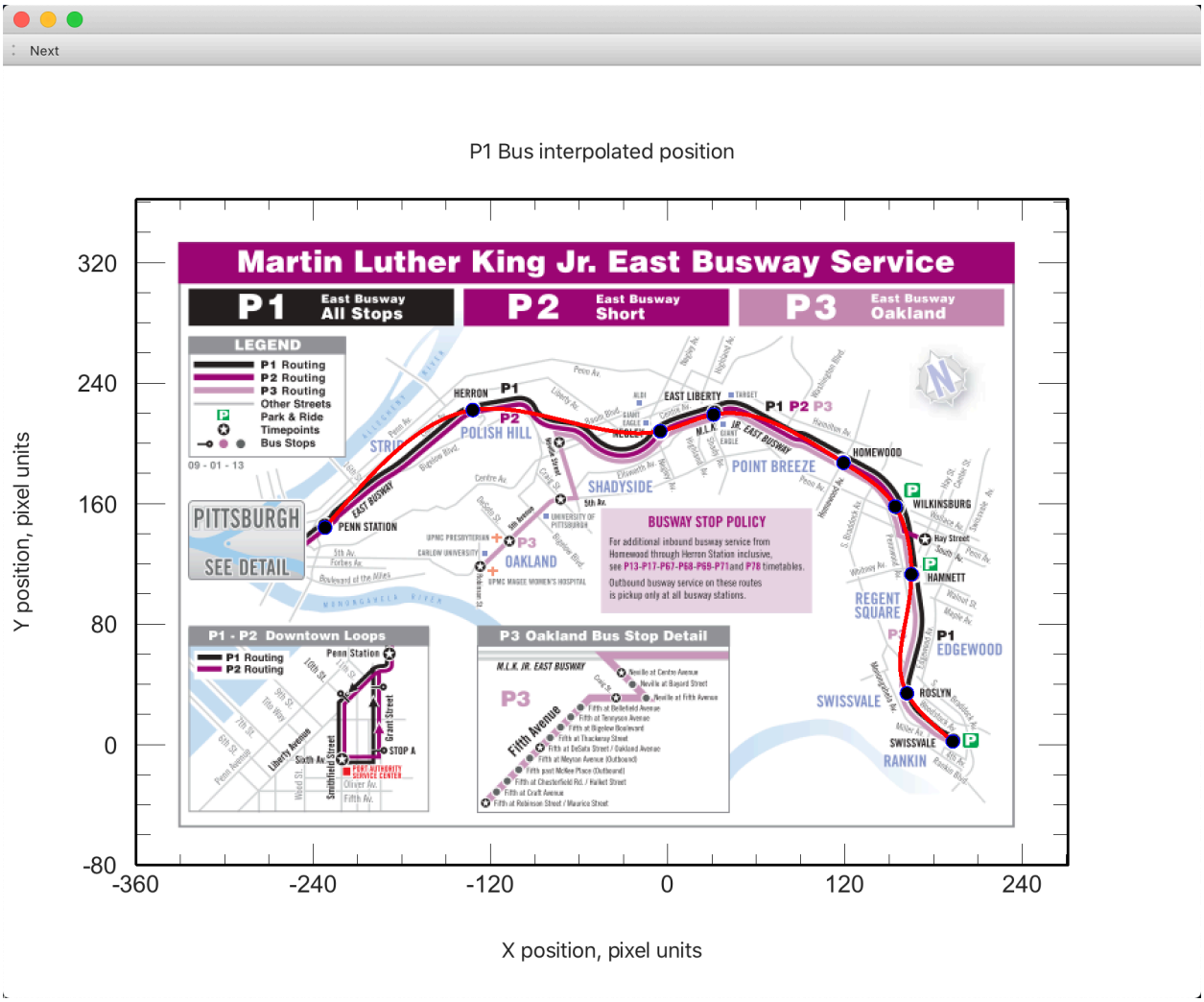
EX3.

In this question, I first read the coordinates of all bus station from the diagram, and then I used the *CibicSpinePolynomial* to interpolate the bus route. I omit the second to last point because the second to last and third to last almost have the same horizontal coordinate. The polynomial interpolation will not work in Cartesian coordinates if two point have the same horizontal coordinate.



EX4

In this question, I first change the origin of the coordinates. Then I treat the x and y coordinates as the function of T(angular coordinate). After interpolate two function of T, I use the *PlotOrbit* to plot the final results. I think the interpolation in polar coordinates is a litter better than its counterpart in Cartesian coordinates.



EX5.

In this question, I use the *CubicSpinePolynomial* and *InterpolatingPolynomial* to interpolate the price of Lafite. Because the price in the case of *Interpolating Polynomial* (red line) grows so fast, I set the x_max=2015. In this case, the price of Lafite in 2014 is around $8400, and I would earn $3700 if I sell it in 2015. In the case of *CubicSpine Polynomial* (orange line), the price of Lafite in 2014 is around $3100, and I would earn $700 if I sell it in 2015.