Full Name(s): Johnny Simmonds
Student(s) ID(s): 10155711
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For this assignment I designed a track using B-Spline subdivision and arc length parametrization . In order to move the cart around the track I used the first algorithm from the paper provided with a little modification at the end. The modification was adding the new position to the returned value to put the cart back into track space. Some of the features of my implementation of the roller coaster are, rendering pillars to help show the height of the track and rendering bars that connect the rails of the track that make it easier to see the way the track is oriented. The main resource I used was the paper provided with a few looks at stackoverflow for understanding different c++ features.

Issues:

The main issue that I ran into was during the implementation of the frenet frame, In particular calculating the normal vector. The normal is suppose to be $(velocity)^2 * k + gravity$. I didn't realize the $(velocity)^2$ was a factor from following the paper, as at one point it shows that centripetal acceleration = kn(direction of the curvature). After going over the paper a few times (and asking questions to confirm!) I eventually realized that the removal of $(velocity)^2$ was only in the case of a constant velocity and that without it the cart didn't properly tilt around turns.

Another issue was that the track was not being drawn properly where the the cart was tilting. I assumed that the binormal of the tilted cart was what I needed to draw the track properly. Using the binormal and adding to one rail and subtracting it from the other rail would give the correct curvature. After many hours of redoing the calculation and trying different values for the binormal, I realized that I needed the correct velocity at each point in order to calculate the correct binormal. Once I added the correct velocities in at each point the curvature and look of the track became correct.