CSIS 200 Final

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The end goal of this project is to find the chances of escaping a velociraptor. Along the way to reach an answer we found when the raptor would catch a human if the human has a head start, when the raptor will be close enough to bite the human (1m), and the chances the raptor will succeed in biting the human 3 different times. All this data allowed us to calculate the chance the a human would be able to escape a raptor.

I. ANALYSIS

A. Question 1

The first step was to plot both the velociraptor's and the humans position over time. I did this by calculating position using the equation $P = \frac{1}{2}at^2 + vt + P_0$ with a being acceleration, v being velocity, P_0 being initial position, and t being time. In this situation the velociraptor had an velocity of 30 m/s and an acceleration of 0. The human had a much slower velocity of only 3 m/s, also had a acceleration of 0, but had a head start of 30 m so initial position of 30. Using this information we can calculate the raptor's position using the equation $P_R = 18 * t$ and the human's position using $P_H = 3 * t + 30$.

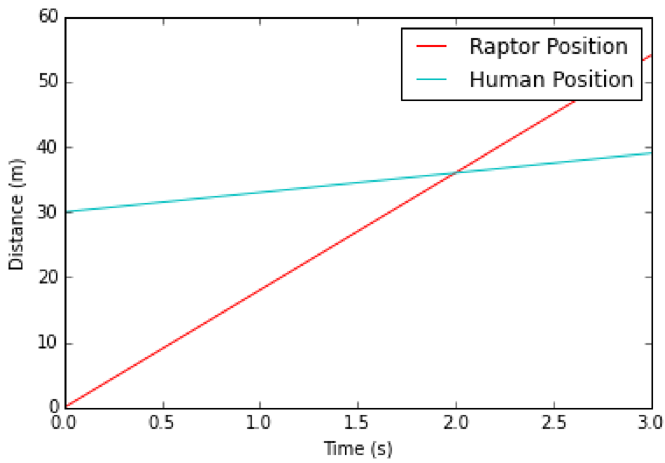

FIG. 1: A graph of the raptor's position and the human's position.

B. Question 2

Next I calculated at what time the raptor would catch the human, or at what time their positions are the same. Using python I told my program to plug every value of time into both position equations and tell me when they were equal. Algebraically we can do $30 * t = 3 * t + 30$ and then solve for t. Both ways give us an answer of 2 seconds. This means that the human only travels 6m before the raptor catches up.

C. Question 3

The raptor will bite before it is at the same position as the human, so now we need to find when the raptor is 1m away from the human. I used python to plug in each value for time and tell me when the difference between the position of the human and the position of the raptor was between .95 and 1. I had to use this range because the time has a repeating decimal and none of the times that the code checks will have repeating decimals. Doing this by hand we can use $P_H - P_R = 1$ and solve for t again. This equation becomes $3 * t + 30 - 18 * t = 1$ then we can simplify to $15 * t = 29$. This gives us an answer of 1.9333 s until the raptor is 1m away.

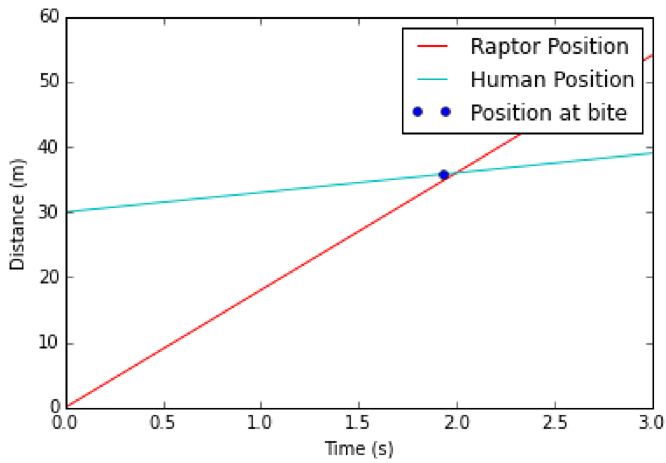

FIG. 2: A graph of the raptor's position and the human's position with a blue dot at the point when the raptor is 1m behind.

D. Question 4

Now that the raptor is 1m behind the human it will start to try to bite. It will only try to bite 3 times before giving up. The first bite has a 20% chance to succeed, the second has a 15% chance, and the third has a 7% chance. If the raptor fails all 3 bites the human will escape. I used a Monte Carlo method to find the chance of survival. I made a function that generated 3 random numbers from 0-100, then checked if the first number was above or below 20. If the first number was above 20 it would check the next number, if the first number was below 20 then the bite would succeed and the code would return false. Then the same process would happen for the second and third number but with 15 and 7 respectively. If each of the numbers is above the chance of being bit then the function would return true. I then ran the function 1000 times and every time the function returned false a variable would increase by one. I then subtracted the number of times it returned false from the total number of trials and divided by the total number of trials. This gave me the chance of survival. This chance of survival was on average around 62%. We can also calculate the chance algebraically. The chance of survival would be $0.8 * 0.85 * 0.93$ which gives us an answer of 63.24%.