**Programming Project 3 Report**

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**Academic Integrity Statement:** I pledge that I have neither given nor received unauthorized help on this programming assignment.

The goal of the program is to determine the best year for the user to leave the increasingly freezing Earth. The user inputs the longest amount of time (in years) that they are willing to wait on Earth before they leave, as well as what percent that rockets get closer to light speed each year. The program outputs a chart detailing for every year that passes that they are willing to wait four things. The year they would leave, how fast the rockets are going that year, the year according to Earth time they would arrive at the new planet, and the year according to their time they would arrive at the planet, according to the Lorenzo factor. For error handling, I had to ensure that the longest time they could wait was a positive integer, and the percentage of how much faster the rockets get was a positive integer between zero and one hundred.

For my data, I broke up my program into three functions. I had my main function which handled all the output and some calculations as needed. Then I had a function to calculate what year they would arrive on the new planet according to Earth time, and another function to determine what year they would arrive on the planet according to the Lorenzo factor. Almost everything besides the year they would leave were doubles, and I used setprecision to ensure that they were only two decimal points long. For my algorithms, I basically just copied and pasted my Lorenzo factor into my second function. The pros of that choice were that I knew it was the correct calculation, and it saved me some time having to rewrite it. The cons of my choice is I am not sure it completely translated into what I needed, because my numbers were a little off, and it was slightly confusing because that program used different variables than the one I was using in this program. For my first function, I just converted the speed of the rocket to km/year instead of km/s and divided that by how far the new planet was, then added the departure year to it. I think that was probably the best way to go about it because it was simple, and got the job done. However again I think I might have had a rounding error somewhere because my numbers were always one decimal point off.

For implementation, I started with just the basic skeleton of a program, then I added the beginning statements. Then I added a for loop that would print out my chart. It counted the departure year for me, and while I was working on it I just put default numbers in the sections I had not finished yet. After I got the year counter working correctly, and the formatting as I wanted it, I started on the speed of the rocket. That was easy, just a small calculation at the end of my for loop. Then I went to my earthETA function, where I calculated how long, in Earth time the trip would take. Once that was working correctly, I went on to my yourETA function, and lastly, once that was working, I added my statement at the end that told the user the best time to leave Earth.

For testing, I would write one column of my output chart at a time. I would test and ensure that was working correctly, and when it did I moved on to the next column. For normal inputs, I used the sample code provided for me, and for special cases I ensured my while loops worked to ensure I got a valid input. Here is some sample code from my program.

Input. Output

The distance to planet Not-So-Cold is 100 trillion km.

The current average rocket speed is 10000 km/sec.

What percentage closer to the speed of light will rockets get each year? (0 to 100):8.3

What is the longest you will wait to get on the rocket before the cold becomes unbearable? 14

Start Year| Avg Speed| EarthETA| Your ETA|

2018| 10000.00| 2335.10| 2333.95

2019| 34052.74| 2112.12| 2109.97

2020| 56109.09| 2076.51| 2073.22

2021| 76334.78| 2062.54| 2058.15

2022| 94881.73| 2055.42| 2050.02

2023| 111889.28| 2051.34| 2045.00

2024| 127485.20| 2048.87| 2041.67

2025| 141786.67| 2047.36| 2039.36

2026| 154901.11| 2046.47| 2037.74

2027| 166927.05| 2046.00| 2036.60

2028| 177954.85| 2045.82| 2035.81

2029| 188067.33| 2045.86| 2035.28

2030| 197340.48| 2046.07| 2034.98

2031| 205843.95| 2046.40| 2034.84

2032| 213641.64| 2046.84| 2034.84

To get there soonest, you should leave in 2028. You will arrive in year 2035.81 your time (year 2045.82 Earth time.)

Here is my error handling.

The distance to planet Not-So-Cold is 100 trillion km.

The current average rocket speed is 10000 km/sec.

What precentage closer to the speed of light will rockets get each year? (0 to 100):10000

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What is the longest you will wait to get on the rocket before the cold becomes unberable?-12

Invalid choice. Number must be positive12

Start Year| Avg Speed| EarthETA| Your ETA|

2018| 10000.00| 2335.10| 2333.95

2019| 53468.80| 2078.31| 2075.15

2020| 90417.28| 2055.07| 2049.91

2021| 121823.49| 2047.03| 2040.14

2022| 148518.76| 2043.35| 2034.98

2023| 171209.75| 2041.52| 2031.88

2024| 190497.09| 2040.65| 2029.93

2025| 206891.32| 2040.33| 2028.70

2026| 220826.43| 2040.36| 2027.96

2027| 232671.26| 2040.63| 2027.56

2028| 242739.37| 2041.06| 2027.44

2029| 251297.27| 2041.62| 2027.51

2030| 258571.48| 2042.26| 2027.75

To get there soonest, you should leave in 2025. You will arrive in year 2028.70 your time (year 2040.33 Earth time.)

Overall, my project was a success. The only problem I had is what I believe is a rounding error, or something slightly wrong with my calculations along the way. My earthETA was just slightly off, usually just by a decimal point. However, my yourETA was often off by a few ones or two, which was slightly concerning but I could not find what went wrong. If I were to do this program again, I would find out what is causing the errors in my yourETA and fix it. Overall this program took about three hours to complete.