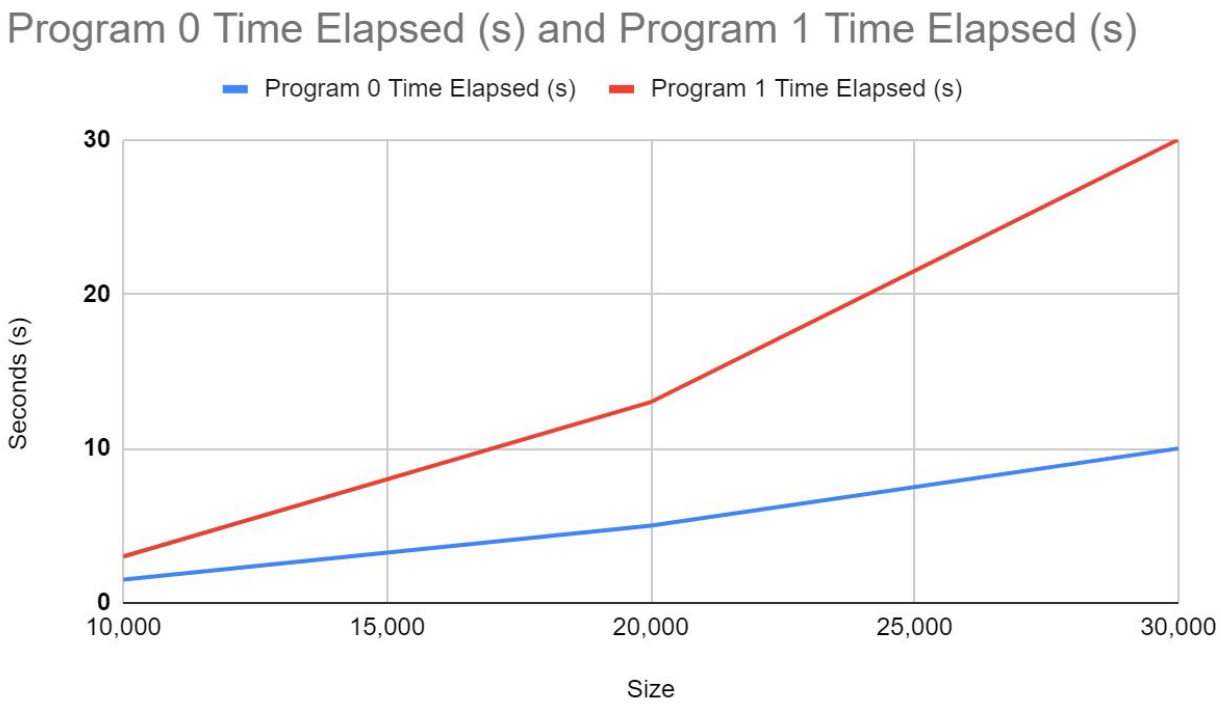
Architecture Case Study

Having a deep understanding of a computer's architecture is vital in writing code that is as efficient as possible. There are two provided programs to observe the difference that understanding can make. These two programs are relatively the same except for one line in the matrix_vector_multiply function: Program0: **y[i] += A[i*size + j] * x[j];** Program1: **y[j] += A[j*size + i] * x[i];**. The main characteristic being observed will be the elapsed run time of each program.

Results



It is apparent that program 0 has a significantly faster run time than program 1. A potential reason for this is due to how writing and reading memory occurs. The possible shortcoming of program 1 is that y[j] requires data to be written to a different location with each iteration of the inner for loop incrementing j. Program 0 writes data to y[i] instead. Thus while the inner for loop is constantly incrementing j, the location being used to store new data remains the same until the outer for loop increments i after the inner for loop reaches size.

Conclusion

Knowledge of computer design and architecture is vital in deeply understanding the hows and why of the various systems that make up all of the complicated services in use. It is with this deep understanding that these complicated systems can continue to improve. If the person who wrote program 1 was more aware of these concepts at the time of writing code, then the extreme multiplicative increase in run time would have been avoided.