Advent of Code 2020 Day 10 Part 2 Calculation Time

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1   Solving With Pure Recursion

The maximum number of calculations for all combinations of a set of adapters n adapters long when using pure recursion can be represented by

$$f(n) = \sum_{i=0}^{n} 3^i$$

One computation is not necessarily one clock cycle but to make it easy I will assume that it is. With my input the set was 104 adapters long, so the number of calculations equates to approximately $6.26 * 10^{49}$ calculations.

With my processor running a 4GHz we can calculate the time in years it will take to finish processing as:

$$\frac{1\,ns}{4\,computations} * \frac{6.26 * 10^{49}\,computations}{1} * \frac{1\,s}{1 * 10^9\,ns} * \frac{1\,yr}{3.15 * 10^7\,s}$$

which equates to $4.98 * 10^{32}$ years, this is put into perspective when you note that the universe is approximated to be $1.38 * 10^{10}$ years old.

I think it is safe to say that if you are doing this with straight up recursion you won't finish today's challenge before the 25th.

2   Solving with Recursion Using Memoization

When using memoization the number of calculations can be represented by approximately

$$f(n) = \sum_{i=0}^{n} n + 1$$

Which would be 105 calculations for me, which can be done in a few nanoseconds, in reality it took about 3000 microseconds.