2) (10 pts) ANL (Summations and Algorithm Analysis)

a) (8 pts) Give a summation that represents the value returned by the following function, and then derive its closed form:

```
int something_to_ponder_over(unsigned int n)
{
   int i, retval = 0, pow = 1;
   for (i = 0; i < n; i++)
   {
      retval += pow;
      pow *= 14;
   }
   return retval;
}
```

The summation representing the return value is:

$$\sum_{i=0}^{n-1} 14^i$$

This is a geometric sum and can be solved as follows (or one might have the formula committed to memory, or get the formula from the formula sheet):

$$S = \sum_{i=0}^{n-1} 14^i = 14^0 + 14^1 + 14^2 + \cdots + 14^{n-1}$$

$$14S = 14^1 + 14^2 + 14^3 + \cdots + 14^n + 14^n$$

Now, subtracting S from 2S, most of the terms cancel out, leaving us with:

$$14S - S = 14^n - 14^0$$

Since 14S – S = 13S, we've solved for the summation:

$$S = (14^n - 1)/13$$

Grading: Award 5 points for the initial summation (2 pts for the correct bounds, 3 pts for the 14^i term). Award 3 points for deriving the closed form. Award partial credit as appropriate.

b) (2 pts) Using big-oh notation, what is the runtime of the function given in part (a)?

O(n) Grading: All or nothing