2) (5 pts) ANL (Algorithm Analysis)

An algorithm to process input data about n cities takes O($n2^n$) time. For *n* = 10, the algorithm runs in 5 milliseconds. How many ***seconds*** should the algorithm take to run for an input size of *n* = 20?

Let the algorithm with input array size n have runtime $T(n) = cn2^n$, where c is some constant.

Using the given information, we have:

$$T(10) = c(10)2^{10} = 5ms$$

$$c = \frac{5ms}{10 \times 2^{10}}$$

$$c = \frac{1ms}{2 \times 2^{10}}$$

$$c = \frac{1ms}{2^{11}}$$

Now, solve for the desired information:

$$T(20) = c(20)2^{20}$$

$$= \frac{1ms}{2^{11}} \times 20 \times 2^{20}$$

$$= 20 \times 2^9 ms = 20 \times 512ms = 10240ms = 10.24\ seconds$$

Grading: 2 pts solving for c, 2 pts for plugging 20 and canceling to get to 10240 ms, 1 pt to answer in seconds.