

# Ponder This

**October 2014**

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**Ponder This Challenge:**

What are the last 10 decimal digits of  $2^{(3^{(4^{(5^{(6^{(7^{(8^9))}}))})})})}$ ?

This challenge is easily handled with Wolfram Alpha which gives the answer: 8170340352

This can also be done using Wolfram Alpha and a sequence of reductions mod  $10^{10}$  as follows:

$$7^{(8^9)} \bmod 10^{10} = 6763596801$$

$$6^{6763596801} \bmod 10^{10} = 4204000256$$

$$5^{4204000256} \bmod 10^{10} = 8212890625$$

$$4^{8212890625} \bmod 10^{10} = 8212890624$$

$$3^{8212890624} \bmod 10^{10} = 4919828481$$

$$2^{4919828481} \bmod 10^{10} = 8170340352$$