Problem of the Week
Problem D
Digits Multiplied

The digits of any positive integer can be multiplied together to give the *digit product* for the integer. For example, 345 has the digit product of $3 \times 4 \times 5 = 60$. There are many other positive integers that have 60 as a digit product. For example, 2532 and 14 153 both have a digit product of 60. Note that 256 is the smallest positive integer with a digit product of 60.

There are also many positive integers that have a digit product of 2160. Determine the smallest such integer.