SICP 1.16 Solution

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https://github.com/qiao/sicp-solutions

Let $T(n)$ denote the time used to compute $exp(n)$.

For the original procedure, we have:

$$\begin{aligned} T(n) &= T(n/2) + c \\ &= T(n/4) + c + c \\ &= T(n/8) + c + c + c \\ &= T(n/16) + c + c + c + c \\ &= \cdots \\ &= c \log n \\ &= \Theta(\log n) \end{aligned}$$

For the modified procedure, we have:

$$\begin{aligned} T(n) &= 2T(n/2) + c \\ &= 4T(n/4) + 2c + c \\ &= 8T(n/8) + 4c + 2c + c \\ &= \cdots \\ &= 2^{\log n} c \\ &= n \cdot c \\ &= \Theta(n) \end{aligned}$$