The largest number which can be stored within m bits is $2^m - 1$. If the series $f_n = f_{n-1}^2$ is to be computed, the number of steps n is limited by the size of the variable storing f_n. If $f_0 = 2$, then

$$f_n = 2^{2^n}. \tag{1}$$

Since $f_n \leq 2^m - 1$, it follows that $2^n < m$. The largest n can be given a variable m bits long is then $\lfloor \log_2(m-1) \rfloor$.

A) $\lfloor \log_2(8-1) \rfloor = 2$

B) $\lfloor \log_2(16-1) \rfloor = 3$

C) $\lfloor \log_2(32-1) \rfloor = 4$