Step-1

Fibonacci sequence: Fibonacci sequence is given as follows:

0, 1, 1, 2, 3, 5, 8, 13, â€¦

Let the Fibonacci matrix be as follows:

$$A=\begin{bmatrix}1 & 1\\ 1 & 0\end{bmatrix}$$

To compute A^2, A^3 and A^4. Also, calculate F_{20} using the text and calculator.

Step-2

To compute A^2, A^3 and A^4 do the following calculations:

$$A=\begin{bmatrix}1 & 1\\ 1 & 0\end{bmatrix}$$

$$A\cdot A=\begin{bmatrix}1 & 1\\ 1 & 0\end{bmatrix}\cdot\begin{bmatrix}1 & 1\\ 1 & 0\end{bmatrix}$$

$$A^2=\begin{bmatrix}2 & 1\\ 1 & 1\end{bmatrix}$$

$$A^2\cdot A=\begin{bmatrix}2 & 1\\ 1 & 1\end{bmatrix}\cdot\begin{bmatrix}1 & 1\\ 1 & 0\end{bmatrix}$$

$$A^3=\begin{bmatrix}3 & 2\\ 2 & 1\end{bmatrix}$$

$$A^3\cdot A=\begin{bmatrix}3 & 2\\ 2 & 1\end{bmatrix}\cdot\begin{bmatrix}1 & 1\\ 1 & 0\end{bmatrix}$$

$$A^4=\begin{bmatrix}5 & 3\\ 3 & 2\end{bmatrix}$$

Step-3

Therefore, values of A^2, A^3 and A^4 are as follows:

$$A^2 = \begin{bmatrix} 2 & 1 \\ 1 & 1 \end{bmatrix}$$

$$A^3 = \begin{bmatrix} 3 & 2 \\ 2 & 1 \end{bmatrix}$$

$$A^4 = \begin{bmatrix} 5 & 3 \\ 3 & 2 \end{bmatrix}$$

Step-4

To calculate Fibonacci 20th number put $n = 20$ in the following:

$$F_n = \frac{1}{\sqrt{5}}\left[\left(\frac{1+\sqrt{5}}{2}\right)^n - \left(\frac{1-\sqrt{5}}{2}\right)^n\right]$$

And solve it using calculator:

$$F_{20} = \frac{1}{\sqrt{5}}\left[\left(\frac{1+\sqrt{5}}{2}\right)^{20} - \left(\frac{1-\sqrt{5}}{2}\right)^{20}\right]$$
$$= 6764.99$$
$$\approx 6765$$

Step-5

Therefore, $\boxed{F_{20} = 6765}$.