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How to find nth term of fibonacci sequence

How to find the nth term sequence. How to find nth sequence.

Fibonacci numbers are generated by setting $F_0 = 0$, $F_1 = 1$, and then using the recursive formula $F_n = F_{n-1} + F_{n-2}$ to get the rest. So begins the sequence: 0, 1, 2, 3, 5, 8, 13, 21, 34, ... This sequence of Fibonacci numbers rises on all mathematics and also in nature. However, if I wanted the hundredth term of this sequence, it would take a lot of intermediate recursive calculations to get a result. Is there an easier way? Yes, there is an exact formula for the n-th term! $F_n = \frac{\phi^n - (-\phi)^{-n}}{\sqrt{5}}$, where $\phi = \frac{1 + \sqrt{5}}{2}$ is the so-called golden medium, and $\phi^{-1} = \frac{1 - \sqrt{5}}{2}$ is an associated gold number, also equal to $-1/\phi$. This formula is attributed to Binet in 1843, although known by Euler before him. The math behind the fact: The formula can be proven by induction. It can also be demonstrated using the eigenvalues of a 2×2 matrix that encodes the recurrence. You can learn more about recurrence formulas in a fun course called Discrete Mathematics. How to Cite this Page: Su, Francis E., et al. "Fibonacci Number Formula." Fun Facts of Mathematics. < . Fun facts suggested by: Arthur Benjamin And here's an ultra-fast solution with a low memory footprint. He will easily respond to all your requests. And, it is very flexible with the use of algorithms from the standard library. So, we're going to use a pre-calculation compile time of all Fibonacci numbers that fit a long unsigned 64-bit value. But first a theory. An important property of the Fibonacci series is that the values grow strongly exponential. Thus, all the existing construction into integer data types will overflow pretty fast. With Binet's formula it is possible to calculate that the 93rd Fibonacci number is the last one that fits into an unsigned 64 bit value. Now, calculating 93 values during compilation is a very simple task. And it doesn't produce any overhead runtime. And a memory consumption of 752 Bytes! That's totally acceptable. We will first define the default approach for calculating a Fibonacci number as a function of constexpr: // Constexpr function to calculate the nth Fibonacci number constexpr unsigned long getFibonacciNumber (int index, unsigned long f1 = 0, unsigned long f2 = 1) without exception { // Initialize the first two unassigned numbers along f1 { 0 }, f2 { 1 }; // by calculating the Fibonacci value while (index > 0) { // get the next value of the unsigned Fibonacci sequence f3 = f2 + f1; // Move to the next number f1 = f2; f2 = f3; } f2 return; } With this, the computed compilation numbers can be easily. Then, we fill an std::array with all the Fibonacci numbers. We also use a constexpr and make it a model with a set of variadic parameters. We use std::integer_sequence to create a Fibonacci number for indexes 0,1,2,3,4,5,..... and not complicated: model constexpr auto generateArrayHelper(std::integer_sequence<int, int...> seq) noexcept (back std::array<int, int...> arr;); This function will be fed with an integer sequence 0,1,2,3,4, ... and return an STD::Array with the corresponding fibonacci numbers. We know that we can store a maximum of 93 values. And then we make a next function, which we call the above with the integer sequence 1,2,3,4, ..., 92,93, like so: constexpr auto GenerateArray () noexcept {RETURN GENERTEAREARYHELPER (STD::Make_INTEGER ESEDENCE ()); } And now, finally, constexpr auto Fib = GenerateArray (); it will give us a compilation-time std::array with the name fib containing all the fibonacci numbers. And if we need the number I Fibonacci, then we can just write FIB [I]. There will be no calculation at run time. I don't think there is a faster way to calculate the Nth Fibonacci Number. Please see the full program below: #include #include #include // ----- // All of the following Be executed during compilation TIME // ConstexPR function to calculate unsigned NTH Fibonacci Number ConstexPR unsigned Long Long GetFibONACCINUMBINO (Size_T index) { // Initialize the first two unsigned long universal numbers f1 {0}, f2 {1}; // Calculate the fibonacci value while (index > 0) { // Get the next value of the unsigned fibonacci sequence of length f3 = f2 + f1; // move to the next number f1 = f2; f2 = f3; } return f2; } // Automatically build a fibonacci array NumbersCompile Time // Generate an STD::Array with N Elements Template Constexpr Auto GenerateArrayHelper (STD::Integer_sequence) noexcept {return std::array<int, int...>({getfibonacci(Mysindices) ...}); }; // max index for fibonacci that for an unsigned 64-bit value (Binets formula) ConstexPR Size_T MAXINDEXFOR64BITVALUE = 93; // Generate the required number of elements Constexpr Auto GenerateArray () noexcept {Return GenerateArrayHelper (std::make_integer_sequence ()); } // This is a constexpr series of all Fibonacci numbers Constexpr Auto Fib = GenerateArray (); // ----- // test int main () { // Print all possible Fibonacci numbers for (size_t i {0}; i

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