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# Solution for CS302 Assignment

## Problem Statement:

Convert the following 32-bit Binary Floating-Point Number into a Decimal Number:

11000100110110101011010110110011

## Solution:

### Break Down the IEEE 754 Format

A 32-bit binary floating-point number is divided into:  
- Sign bit (1 bit): Determines the sign of the number.  
- Exponent (8 bits): Encodes the exponent in biased form.  
- Mantissa (23 bits): Fractional part of the number.  
  
Given Binary Number: 11000100110110101011010110110011  
  
Divide the Number:  
- Sign bit (S): 1  
- Exponent (E): 10001001  
- Mantissa (M): 10110101011010110110011

### Interpret the Sign Bit

The sign bit 1 indicates that the number is negative.

### Decode the Exponent

Convert the exponent to decimal:  
10001001 (binary) = 137 (decimal)  
  
Subtract the bias (127 for 32-bit format):  
Exponent = 137 - 127 = 10

### Reconstruct the Mantissa

The normalized form of a floating-point number is:  
(-1)^S × 1.Mantissa × 2^Exponent  
  
The implicit leading 1 is added to the mantissa:  
Mantissa = 1.10110101011010110110011

### Apply the Exponent

Shift the decimal point in the mantissa by the exponent value 10:  
1.10110101011010110110011 × 2^10 = 1101101010.11010110110011

### Convert the Binary to Decimal

Convert the integer part:  
1101101010 (binary) = 874 (decimal)  
  
Convert the fractional part:  
0.11010110110011 (binary) = 1 × 2^(-1) + 1 × 2^(-2) + 0 × 2^(-3) + 1 × 2^(-4) + ... = 0.83203125 (approx)  
  
Combine integer and fractional parts:  
874 + 0.83203125 = 874.83203125

### Apply the Sign

Since the sign bit is 1, the number is negative:  
Final Answer = -874.83203125

### Final Answer:

The final decimal value of the given 32-bit binary floating-point number is:

-874.83203125