Computer Systems

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Interpret IEEE floating point numbers  
  
  
 This C program provides the conversion between decimal numbers and their IEEE 754 binary representations. It achieves this through two functions: decimalToBinary, which converts decimal numbers to their binary form, and binaryToDecimal, which reverses the process. The main function acts as the interface, allowing users to select their desired conversion and providing the appropriate output. Overall, this program offers a straightforward tool for users to perform IEEE 754 binary conversions efficiently.

#include <stdio.h>

#include <math.h>

void decimalToBinary(float num) {

int \*binaryNum = (int\*)&num;

int binary[32];

for (int i = 0; i < 32; ++i) {

binary[31 - i] = (\*binaryNum >> i) & 1;

}

printf("IEEE 754 representation of %f is: ", num);

for (int i = 0; i < 32; ++i) {

printf("%d", binary[i]);

}

printf("\n");

}

float binaryToDecimal(char \*binary) {

int sign = (binary[0] == '1') ? -1 : 1;

int exponent = 0;

double mantissa = 0.0;

int bias = 127;

for (int i = 1; i <= 8; i++) {

exponent = exponent \* 2 + (binary[i] - '0');

}

for (int i = 9; i <= 31; i++) {

mantissa += (binary[i] - '0') \* pow(2, 8 - i);

}

if (exponent == 255 && mantissa != 0) {

return NAN;

} else if (exponent == 255 && mantissa == 0 && sign == 1) {

return INFINITY;

} else if (exponent == 255 && mantissa == 0 && sign == -1) {

return -INFINITY;

} else if (exponent > 0 && exponent < 255) {

return sign \* pow(2, exponent - bias) \* (mantissa + 1);

} else if (exponent == 0 && mantissa != 0) {

return sign \* pow(2, 1 - bias) \* mantissa;

} else if (exponent == 0 && mantissa == 0 && sign == 1) {

return 0.0;

} else if (exponent == 0 && mantissa == 0 && sign == -1) {

return -0.0;

}

}

int main() {

int choice;

printf("1. Convert decimal to IEEE 754 binary\n");

printf("2. Convert IEEE 754 binary to decimal\n");

printf("Enter your choice: ");

scanf("%d", &choice);

if (choice == 1) {

float num;

printf("Enter a decimal number: ");

scanf("%f", &num);

decimalToBinary(num);

} else if (choice == 2) {

char binary[33];

printf("Enter a binary number: ");

scanf("%s", binary);

printf("Decimal: %f\n", binaryToDecimal(binary));

} else {

printf("Invalid choice\n");

}

return 0;

}