Assignment 4

Convert the decimal value -47.7 to IEEE single-precision Floating-Point binary representation.

**Steps to Follow:**

1. Convert the absolute value of the decimal number to binary.
2. Determine the sign bit.
3. Normalize the binary representation.
4. Convert the exponent to binary and bias it.
5. Combine the sign bit, exponent, and mantissa.
6. **The absolute value of 47.7 in binary is:**
   1. **47 (integer part) = 101111**

Divide by the base 2 to get the digits from the remainders:

|  |  |  |
| --- | --- | --- |
| Division by 2 | Quotient | Remainder (Digit) |
| (47)/2 | 23 | 1 |
| (23)/2 | 11 | 1 |
| (11)/2 | 5 | 1 |
| (5)/2 | 2 | 1 |
| (2)/2 | 1 | 0 |
| (1)/2 | 0 | 1 |

* 1. **0.7 (fractional part) = 0.1011001... (This repeats)**

Multiply by the base 2

|  |  |  |
| --- | --- | --- |
| Multiply by 2 | Quotient | Remainder (Digit) |
| (0.7)\*2 | 1.4 | 1 |
| (0.4)\*2 | 0.8 | 0 |
| (0.8)\*2 | 1.6 | 1 |
| (0.6)\*2 | 1.2 | 1 |
| (0.2)\*2 | 0.4 | 0 |
| (0.4)\*2 | 0.8 | 0 |
| (0.8)\*2 | 1.6 | 1 |

* 1. **Concatenating these two parts gives the binary representation:**

(101111.1011001...)2​

1. **Determine the sign bit:**
   1. For negative numbers, the sign bit is 1.
2. **Normalize the binary representation:**
   1. In this case, 101111.1011001...2 ​ is already normalized
3. **Convert the exponent to binary and bias it:**
   1. The exponent is 0 since it's represented as 2^0.
   2. Bias: 2^(8-1) - 1 = 127
   3. Exponent + Bias = 0 + 127 = 127 in binary = 01111111
4. **Combine the sign bit, exponent, and mantissa:**
   1. Sign bit: 1
   2. Exponent: 01111111
   3. Mantissa: 01111010110011001100110 -- (truncated to 23 bits due to IEEE single-precision format)
5. **The IEEE single-precision floating-point binary representation of -47.7 is:**
   1. 1 01111111 01111010110011001100110