//name: Eza Rasheed
//id: er6qt
//date: 2-10-19
//filename: floatingpoint.pdf

Floating Point Conversion Work:

> For userid 'er6qt':
>
> Your magic (32 bit) floating point number is -19.53125
> This is the number that needs to be converted to (little endian) binary, and expressed in hexadecimal.
>
> Your other magic floating-point number is, in hex, 0x00809f40
> This is the number that needs to be converted to a (32 bit) floating point number.
> Note that the hexadecimal printed above is in little-endian format!

Format taken from Bloomfield slide 9.17: Converting a Float from Decimal to Binary

-19.53125 (Floating point number → little-endian binary (in hexadecimal))

- **Sign** is 1 (it's a negative number)
- **Exponent**:
  - -19.53125/2^4 = -19.53125/16 = -1.220703125(exactly)
  - Exponent is 4 + 127 = 131 ($1000\ 0011_b$)
131/2 = 1
65/2 = 1
32/2 = 0
16/2 = 0
8/2 = 0
4/2 = 0
2/2 = 0
1/2 = 1

- **Mantissa**:
  - -1.220703125 – 1 = -2.220703125

- Getting the parts of the mantissa:

-19.53125 = $19\frac{17}{32} = \frac{625}{32}$

$\frac{625}{512}$ -1 = $\frac{625}{512} - \frac{512}{512} = \frac{113}{512}$

- From 113/512 we can subtract 1/8, yielding 49/512
- From 49/512 we can subtract 1/16, yielding 17/512
- From 17/512 we can subtract 1/32, yielding 1/512
- From 1/512 we can subtract 1/512, yielding zero

- Thus, the parts of the mantissa are $\frac{1}{8} + \frac{1}{16} + \frac{1}{32} + \frac{1}{512}$
- -2.220703125 = $\frac{1}{8} + \frac{1}{16} + \frac{1}{32} + \frac{1}{512}$
- = 0011 1000 1000 0000 0000 000 (Big-endian format)

- In binary, it's:
  - **1100 0001 1001 1100 0100 0000 0000 0000**
- Switch to little-endian format:
  - 00000000 01000000 10011100 11000001
- Express in hexadecimal:
  - 0000 0000 0100 0000 1001 1100 1100 0001 (Little-endian format)
  - **0x00409cc1** or **0x409cc1 (ANSWER)**

NEXT CONVERSION:

0x00809f40 (Binary (in hexadecimal) → floating point number)

- Convert back to little-endian binary representation:
  - 0x00809f40
  - 0000 0000 1000 0000 1001 1111 0100 0000
- Convert to big-endian binary:
  - 01000000 10011111 10000000 00000000
- Get value of exponent and subtract from 127:
  - 0**1000000 1**0011111 10000000 00000000
  - $2^7 + 2^0$ = 128 + 1 = 129
  - 129 – 127 = 2 (exponent)
- Add mantissa fraction values together:
  - 01000000 1**0011111 10000000 00000000**
  - $\frac{1}{8} + \frac{1}{16} + \frac{1}{32} + \frac{1}{64} + \frac{1}{128} + \frac{1}{256}$ = 0.125 + 0.0625 + 0.03125 + 0.015625 + 0.0078125 + 0.00390625 = 0.24609375 (value that would be used when finding mantissa)
- Add 1 to get back to exponent value:
  - 0.24609375 + 1 = 1.24609375 (exactly)
- Multiply by exponent to get floating point decimal:
  - 1.24609375 * 2^2 = 1.24609375 * 4 = **4.984375 (ANSWER)**