CSE 238/2038/2138 Systems Programming
Project 1 - Example Cases

CASE 1 (Denormalized):

Input read: -0.009765625
Byte ordering: Little Endian
Floating Point Size: 1 byte

- This is a floating point number:
  - **-0.009765625 = -0.000000101 = -1.01 * 2^{-7}**
- E = -7. Exponent is E = exp - Bias, where Bias = 2^{4-1} – 1 = 7. Therefore, the equation is -7 = exp – 7 → exp = 0, which indicates this is in denormalized form and the exp is **0**.
- The number is then **-0.101 * 2^{-6}**.
- Mantissa is **0.101** which indicates that the fraction is **101**.
- The number is negative, so the sign bit is 1.
- The number at total is **10000101** which is **0x85** in hexadecimal.
- Since it is only one byte, the printed number will be **85**.

CASE 2 (Rounding)

Input read: 20179.0
Byte ordering: Big Endian
Floating Point Size: 3 bytes

- This is a floating point number:
  - **20179.0 = 100111011010011 = 1.00111011010011 * 2^{14}**
- E = 14. Exponent is E = exp – Bias, where Bias = 2^{8-1} – 1 = 127. Therefore, the equation is 14 = exp – 127 → exp = 141 which is **10001101** in binary.
- Mantissa is **1.00111011010011**.
  - In the project document, it says *"you will only use the first 13 bits of the fraction part (for 3-byte and 4-byte data sizes). You will use "round to nearest even" method for rounding fraction bits to 13 bits."*
  - Fraction part is 14 bits in this example and we need to round it to nearest even.
  - The number **1.00111011010011** is at exactly half way since the bits to right of rounding position is "1" (the red bit at the end).
  - Therefore, it will be rounded to **1.00111011010011 ≈ 1.0011101101010**
  - For 3 bytes floating point representation, 15 bits is used for fraction part (24-1-8=15). So, the fraction part will be **001110110101000**
- The number is positive, so the sign bit is **0**.
- The number at total is **010001101001110110101000** which is **0x469DA8**.
- The byte ordering is Big Endian, so the floating point number is represented as: **46 9D A8**
- In the output file, the printed value will be: **46 9D A8**