Introduction to Computer Architecture

CISC 3310 Principles of Computer Architecture
Lab Activity

Data Representation - Exercises

Signed Numbers

- CB, Chapter 2, Exercise 24 - Using a “word” of 3 bits, list all the possible signed binary numbers and their decimal equivalents that are representable in:

  a) Signed magnitude

  b) One’s complement

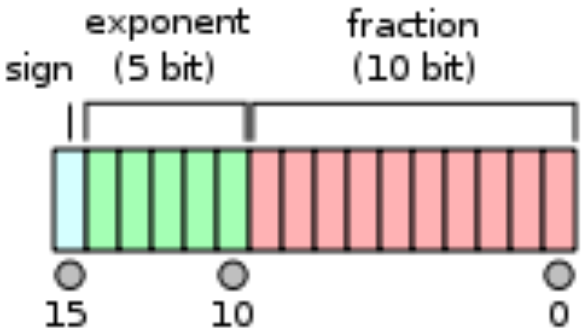
  c) Two’s complement

- CB, Chapter 2, Exercise 25 – repeat the previous question using a “word” of 4 bits

- CB, Chapter 2, Exercise 26 - From the results of the previous two questions, generalize the range of values (in decimal) that can be represented in any given x number of bits the three number representations.

Example: Using IEEE 754 Floating Point Standard *half-precision binary floating point*

- IEEE 754 *half-precision binary floating point* (or binary16 for short) uses 5 bits for exponents => we get a 15 bias
  - Can represent any exponent between -15 and 16
- Uses 10 bits for the binary fraction



https://en.wikipedia.org/wiki/Half-precision_floating-point_format
https://slideplayer.com/slide/9002568/

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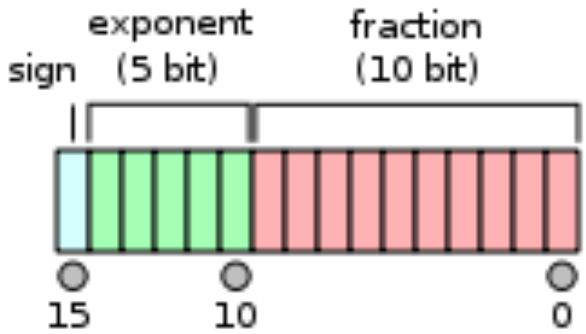
- Floating Number X calculation:

$$x = (-1)^{S} \times (1 + \text{Fraction}) \times 2^{(\text{Exponent} - \text{Bias})}$$



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Floating Point Numbers

- Convert 100.25_{10} to IEEE 754 *half-precision binary floating point*
- Convert 1010011010000000 in IEEE 754 *half-precision binary floating point* representation to a decimal number

Questions?