
EIE/ENE 334

Microprocessors



Lecture 11:

The Cortex-M0 Programming II

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Adapted from

<http://webstaff.kmutt.ac.th/~dejwoot.kha/>

Fractional notation: Q-format

Example: (signed Q3.13 or Q13 notation)

To represent $e = 2.71828$

1-bit for sign:

2-bits for integer part:

13-bits for fractional:

$$e \times 2^{13} = 22,268.1647 \sim 0x56FC$$

Note: $22268 \times 2^{-13} = 2.71826$

Q13: $-3 < n < +3$

Fractional notation: Q-format

Example: (signed Q3.13 or Q13 notation)

To represent $n = -2.71828$

$$|n| \times 2^{13} = 22,268.1647 \sim 0x56FC$$

Negation \Rightarrow **0xA904** (a two's complement)

Fractional notation: Q-format

Example: $-2.71826 \times 2.71826 = -7.3889374276$
(signed Q3.13 or Q13 notation)

```
LDR R2,=0x56FC          ; Q13-> 2.71826
LDR R3,=0xFFFFA904      ;      -> -2.71826
MOVS R4,R3
MULS R4,R2,R4
```

```
; R4=0xE271B7F0 => 0x1D8E4810 (Negation)
    = -495863824 × 2-26 (Q26)
    = -7.3889
```

Fractional notation: Q-format

Exercise: (signed Q15 notation)

Write the following decimal values in Q15 notation

a] 0.4567

b] -0.9865

Exercise: (signed, two's complement Q8)

Write the following signed, two's complement Q8 values in decimal:

a] 0x9FA1

b] 0x76B2

Fractional notation: Q-format

Exercise:

Write a program that counts the number of zeros in a 32-bit value.

Exercise:

Write a program that converts a binary value between 0 and 15 into its ASCII representation.