Fixed Point Numbers

- The binary integer arithmetic you are used to is known by the more general term of Fixed Point arithmetic.
  - *Fixed Point* means that we view the decimal point being in the same place for all numbers involved in the calculation.
  - For integer interpretation, the decimal point is all the way to the right

```
  $C0          192.
+ $25        +  37.
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  $E5          229.
```

Unsigned integers, decimal point to the right.

A common notation for fixed point is 'X.Y', where X is the number of digits to the left of the decimal point, Y is the number of digits to the right of the decimal point.

Fixed Point (cont).

- The decimal point can actually be located anywhere in the number -- to the right, somewhere in the middle, to the right

Addition of two 8 bit numbers; different interpretations of results based on location of decimal point

$11	17	4.25	0.07
+ $1F	+ 31	+ 7.75	+ 0.12
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$30	48	12.00	0.19
	xxxxxxxx.0	xxxxxx.yy	0.yyyyyyyy
	decimal point to right. This is 8.0 notation.	two binary fractional digits. This is 6.2 notation.	decimal point to left (all fractional digits). This is 0.8 notation.

Algorithm for converting X.Y binary to decimal, decimal to X.Y format.

Assume that 0x73A represents a 8.4 (12 bits) fixed point number, what is its decimal representation?

Four bits to right of decimal point, so divide by $2^4 = 16$

0x73A/16 = 1850 /16 = 115.625.

Convert the number 34.7 to its closest representation in 8.4 (12 bit) format:

Four bits to right of decimal point, so multiply by $2^4 = 16$, truncate

34.7 * 16 = 555.2 = 555 = 0x22B