Hexadecimal Numbers

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These slides introduce hexadecimal numbers

Hexadecimal Numbers

- Base 16 (hexadecimal)
  - Used as a short hand for binary
    - ones, 16s, 256s, 4096s
    - 16ths, 256ths
  - Base 16 → 16 individual digits
    - Range of individual digit: 0 → 9,A→F
    - 10=A, 11=B, 12=C, 13=D, 14=E, 15=F
  - Each position to the left of the hexadecimal point is 16X the previous position
  - Each position to the right of the hexadecimal point is 1/16 the previous position

2	B	0	E	.	3	A	2
4096s	256s	16s	Ones	hexadecimal point	16ths	256ths	4096ths

2	B	0	E	.	3	A	2
digit x 16^3	digit x 16^2	digit x 16^1	digit x 16^0	hexadecimal point	digit x 16^{-1}	digit x 16^{-2}	digit x 16^{-3}

Hexadecimal Numbers

- Hexadecimal Numbers
  - 0-9
    - Represent them with their decimal values
  - 10-15
    - Represent them with letters of the alphabet
    - 10 <-> A (or a)
    - 11 <-> B (or b)
    - 12 <-> C (or c)
    - 13 <-> D (or d)
    - 14 <-> E (or e)
    - 15 <-> F (or f)

Hexadecimal Numbers

- Use hexadecimal (hex) as a shorthand for binary
  - Indicate the number is hexadecimal by using 0x1234
  - Group sets of 4 binary bits (nibble) and represent them with the hexadecimal equivalent
    - 1011 → 0xB 0110 → 0x6 1110 → 0xE
    - 10110110 → 0xB6 01101110 → 0x6E
    - 1011011001101110 → 0xB66E
  - Often it is easier if a space is inserted when writing these
    - 1011 0110 0110 1110 → 0xB66E

Hexadecimal Numbers

- Hexadecimal does not differentiate between signed and unsigned numbers
  - Binary ←→ Hex
    - Just do the conversion
  - Decimal ←→ Hex
    - Must convert to/from signed/unsigned binary first
  - When it is not obvious from the context you need to indicate the binary representation that the hex represents
    - Address = 0xB66E → binary equivalent is unsigned binary → 46,702
    - Data value = 0xB66E → binary equivalent is 2's complement → -18,834
    - Random_var = 0xB66E(signed) → -18,834

Hexadecimal Numbers

- Multiple ways to indicate a hex value
  - 12CDh — h at end
  - h12CD — h at beginning
  - $12CD — $ at beginning
  - 0x12CD — 0x at beginning
  - We will use 0x

