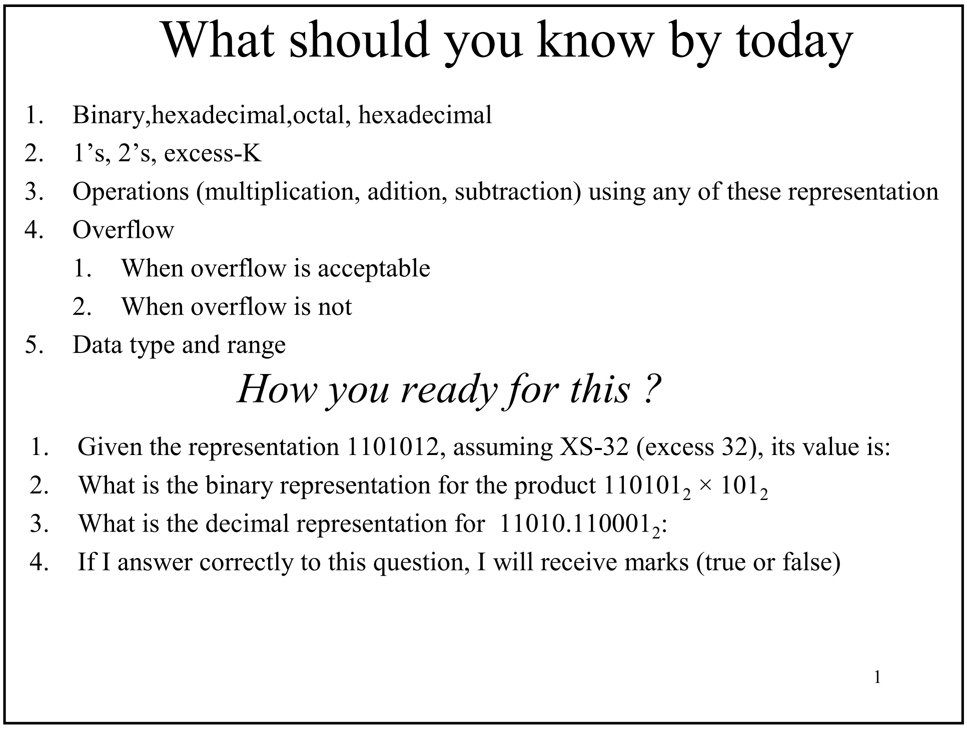
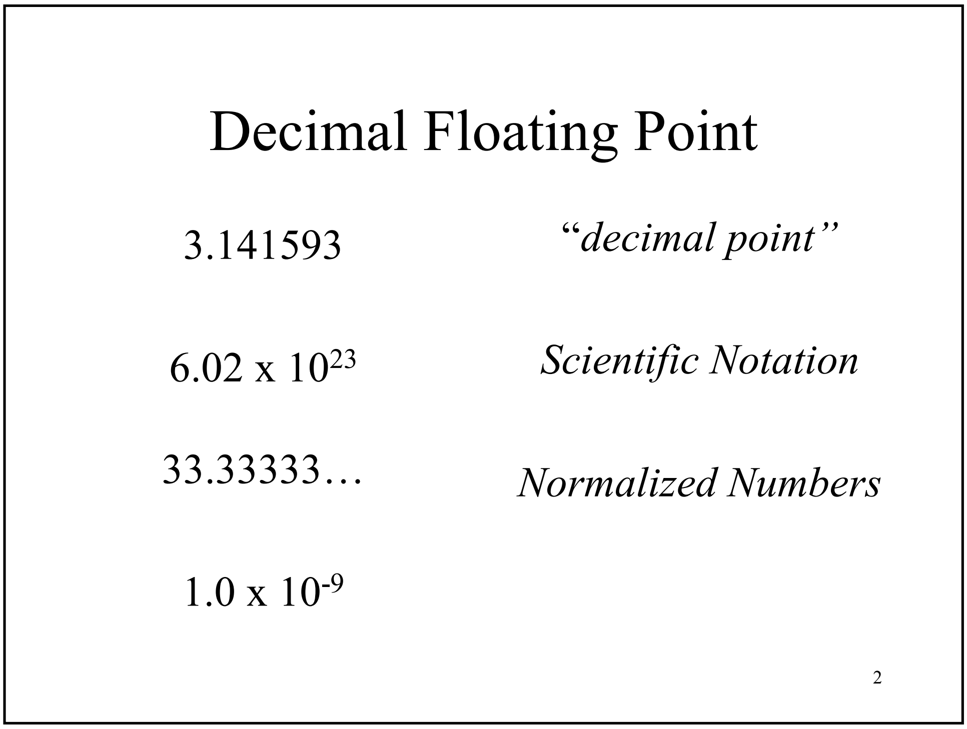


What should you know by today

1. Binary,hexadecimal,octal, hexadecimal
2. 1’s, 2’s, excess-K
3. Operations (multiplication, adition, subtraction) using any of these representation
4. Overflow
   1. When overflow is acceptable
   2. When overflow is not
5. Data type and range

How you ready for this ?

1. Given the representation 1101012, assuming XS-32 (excess 32), its value is:
2. What is the binary representation for the product $110101_2 \times 101_2$
3. What is the decimal representation for 11010.110001_2:
4. If I answer correctly to this question, I will receive marks (true or false)



Decimal Floating Point

3.141593 *“decimal point”*

6.02×10^{23} *Scientific Notation*

33.33333… *Normalized Numbers*

1.0×10^{-9}

Binary Floating Point

100.0100

Binary Point

1.111111…

Positional Representation
(negative powers of 2)

.001 x 2^5

Normalized Numbers

1.001 x 2^{17}

How to represent floating point numbers in binary

- We already saw that briefly in the previous lecture notes

1. Separate integer and decimal part
2. Treat both appart
3. For the integer part, you know how to do it
4. For the decimal part same idea but you have to deal with decreasing (increasing in absolute value) negative power of 2
5. Write the number in binary with a dot to separate both parts

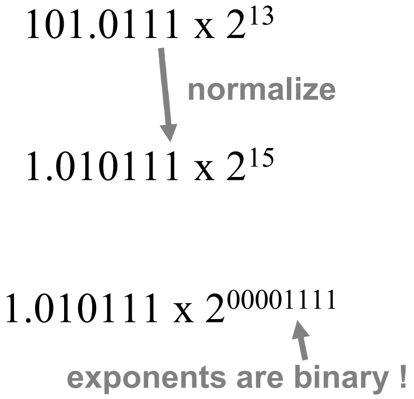
Easy ?

1. Represent in base 10 the following binary number 11010.110001
2. Represent 8.25_{10} using the following binary convention bbbb.bbb

Binary Normalization

Normalized: one *digit*
to the left of the binary point.
It must be a 1!

We still use the term *digit*,
although we mean “0” or “1”.



101.0111×2^{13}

normalize

1.010111×2^{15}

$1.010111 \times 2^{00001111}$

exponents are binary !

Representation and Choices

- For each binary floating point number we need:
  - sign
  - significand (mantissa).
  - exponent
    - need a signed exponent!
- Suppose we want to store floating point numbers in 32 bits.
  - we need to decide how many bits should be used for the significand and how many for the exponent.
  - There is a tradeoff between *range* and *accuracy*.
- Large Range – large and small exponents
- High Accuracy – make the most out of the significand.
- We want it to be *easy* to compare two numbers.