**Assignment 3**

1. Yes.

The fractional part plays role in defining the precision of a number.

Number precision is defined as the maximum number of digits/bits present in a number. The mantissa/significand is composed of an implicit (meaning no need to store it) leading bit (left of radix point) and the fraction bits (to the right of radix point).

For example, we have a number which is represented as 1.121 \* 10^3(1101). Now,

Mantissa - 1.121 implicit leading bit - 1 fraction bits - .121

Precision - 4 (containing 4 bits i.e. one leading bit and three fraction bits). Precision is important to avoid loss of information.

1. For binary numbers, in single precision floating point, we generally represent a number as [‘m’ is fractional part and ‘e’ is exponent]so, this number with the leading 1 in the mantissa i.e. 1.m is called a normalized number. The minimum being say, .[emin is minimum exponent e.g. -128 for 32 bit precision in IEEE754]

So, a subnormal number is a number which are smaller than this which can be represented, but without a leading 1 in the mantissa.

These numbers are represented as . Here, the precision decreases as the number of leading zeroes increase in the mantissa.

< Normal Numbers >| < Subnormals > | < Subnormals > | < Normal Numbers >

0

Number line representation

1. The first two methods defined by IEEE round to the nearest value and the remaining 3 methods are called direct rounding.
2. Round to nearest, ties to even.

If the number is midway, it is rounded to the nearest value with an even Least Significant Digit.

e.g. +7.5 is rounded to +8.0

+8.5 is also rounded to +8.0 as nearest even number is +8.0

-7.5 is rounded to -8.0

-8.5 is also rounded to -8.0 as nearest even number is -8.0

1. Round to nearest, away from zero

The number lying midway is rounded to nearest number (even or odd, doesn’t matter), which is at more distance from 0.

e.g. +7.5 is rounded to +8.0

+8.5 is rounded to +9.0

-7.5 is rounded to -8.0

-8.5 is rounded to -9.0

1. Rounding towards zero

e.g. +7.5 is rounded to +7.0

+8.5 is rounded to +8.0

-7.5 is rounded to -7.0

-8.5 is rounded to -8.0

1. Rounding towards +∞ also called rounding up or ceiling

e.g. +7.5 is rounded to +8.0

+8.5 is rounded to +9.0

-7.5 is rounded to -7.0

-8.5 is rounded to -8.0

1. Rounding towards also called rounding down or flooring

e.g. +7.5 is rounded to +7.0

+8.5 is rounded to +8.0

-7.5 is rounded to -8.0

-8.5 is rounded to -9.0