1. What is the purpose of the radix point in binary representation, and how is it used in the floating-point notation to represent values with a fractional part?

Answer: The radix point in binary representation serves a similar role to the decimal point in decimal numbers. It separates the whole number part from the fractional part of a value. In floating-point notation, the radix point is used to store values with fractional parts. A binary value is divided into three fields: sign bit, exponent field, and mantissa field. The radix point's position is determined by the exponent, allowing the representation of fractional values.

2. How does the 2's complement notation represent negative integers, and what is the significance of the sign bit in this representation?

Answer: In 2's complement notation, negative integers are represented by starting with all 1s and counting down to the desired negative value, with the leftmost bit as the sign bit. The sign bit is crucial because it indicates whether the number is positive (0) or negative (1). The rest of the bits represent the magnitude of the number.

3. What is the problem of overflow in 2's complement notation, and how can it be addressed in computer systems?

Answer: Overflow occurs in 2's complement notation when the result of an addition exceeds the maximum representable value with the available bits. To address overflow, computer systems can use longer bit patterns, such as 32 bits instead of 16 bits, to accommodate larger numbers. If overflow still occurs, alternative units or representations can be used, like calculating answers in different units (e.g., kilometers instead of meters).

4. What is the normalized form in floating-point notation, and why is it important in ensuring unique representations for values?

Answer: The normalized form in floating-point notation requires that the mantissa field starts with the leftmost 1 in the binary representation of the value. This rule ensures that there is only one representation for each value, eliminating the possibility of multiple representations for the same number. Normalized form also guarantees that all nonzero values will have a mantissa that starts with 1, making the representation consistent and unambiguous.