**Quiz Questions**

1. **What is the result of 5 & 3 in binary operations?**
   * A) 7
   * B) 1
   * C) 2
   * D) 0

**Answer:** B) 1

1. **What is the result of 10 | 4 in binary operations?**
   * A) 10
   * B) 14
   * C) 8
   * D) 12

**Answer:** B) 14

1. **What is the bitwise NOT operation of 5 in a 4-bit system?**
   * A) 0b1110
   * B) 0b0101
   * C) 0b1010
   * D) 0b0110

**Answer:** A) 0b1110

1. **What does the << operator do in bit manipulation?**
   * A) Logical right shift
   * B) Logical left shift
   * C) Bitwise AND
   * D) Bitwise OR

**Answer:** B) Logical left shift

1. **What is the result of 7 ^ 3 in binary operations?**
   * A) 4
   * B) 5
   * C) 1
   * D) 6

**Answer:** B) 5

**Intermediate Questions**

1. **Given x = 12, what is the result of x >> 2?**
   * A) 3
   * B) 6
   * C) 12
   * D) 48

**Answer:** B) 3

1. **What is the number of bits required to represent the number 29 in binary?**
   * A) 4
   * B) 5
   * C) 6
   * D) 8

**Answer:** C) 5

1. **Which of the following represents the operation to set the bit at position 3 of the integer n?**
   * A) n & ~(1 << 3)
   * B) n | (1 << 3)
   * C) n ^ (1 << 3)
   * D) n << 3

**Answer:** B) n | (1 << 3)

1. **What is the result of ~0 in a 32-bit system?**
   * A) 0
   * B) -1
   * C) 1
   * D) 255

**Answer:** B) -1

1. **How would you toggle the bit at position 5 of a number n?**
   * A) n & ~(1 << 5)
   * B) n | (1 << 5)
   * C) n ^ (1 << 5)
   * D) n << 5

**Answer:** C) n ^ (1 << 5)

**Advanced Questions**

1. **What is the result of the expression a & (-a) where a is a positive integer?**
   * A) The least significant bit set to 1
   * B) The most significant bit set to 1
   * C) The bitwise complement of a
   * D) a itself

**Answer:** A) The least significant bit set to 1

1. **If n is a power of 2, which of the following is true?**
   * A) n & (n - 1) == 0
   * B) n & (n + 1) == 0
   * C) n | (n - 1) == 0
   * D) n ^ (n - 1) == 0

**Answer:** A) n & (n - 1) == 0

1. **What does the expression a ^ (a >> 1) calculate in a binary number?**
   * A) The binary Gray code of a
   * B) The bitwise negation of a
   * C) The bitwise NOT of a
   * D) The number of bits set to 1 in a

**Answer:** A) The binary Gray code of a

1. **Given n = 7, which of the following operations will clear the least significant set bit?**
   * A) n & (n - 1)
   * B) n | (n - 1)
   * C) n ^ (n - 1)
   * D) ~n & (n - 1)

**Answer:** A) n & (n - 1)

1. **What is the result of the operation (x ^ y) ^ y?**
   * A) x
   * B) y
   * C) x ^ y
   * D) 0

**Answer:** A) x

1. **Which of the following operations is used to count the number of set bits in an integer?**
   * A) x & (x - 1)
   * B) x ^ (x - 1)
   * C) x | (x - 1)
   * D) x & (x + 1)

**Answer:** A) x & (x - 1)

1. **How can you determine if an integer n is even using bit manipulation?**
   * A) n & 1 == 1
   * B) n & 1 == 0
   * C) n | 1 == 0
   * D) n ^ 1 == 0

**Answer:** B) n & 1 == 0

1. **What is the result of (x & (x - 1)) for a power of 2?**
   * A) 0
   * B) x
   * C) x - 1
   * D) x + 1

**Answer:** A) 0

1. **What is the minimum number of bits required to represent the number N in binary?**
   * A) log2(N)
   * B) log10(N)
   * C) ceil(log2(N + 1))
   * D) floor(log2(N))

**Answer:** C) ceil(log2(N + 1))

1. **How can you determine the position of the least significant set bit in an integer n?**
   * A) n & (-n)
   * B) n | (-n)
   * C) n ^ (-n)
   * D) n + (-n)

**Answer:** A) n & (-n)