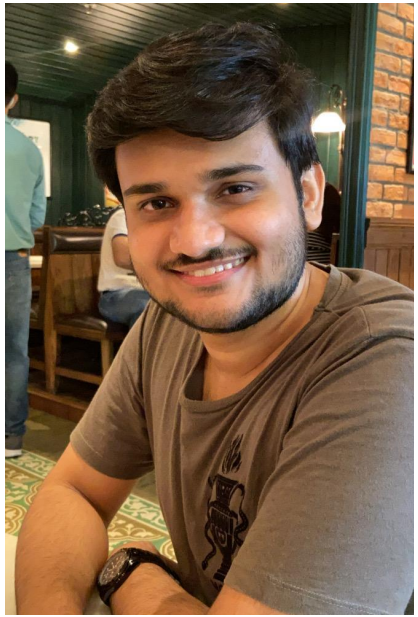
Number System Introduction

With Sanket Singh

Let’s crack Competitive Programming together!

Sanket Singh



- Software Development Engineer @ **LinkedIn**
- Former Software Developer @ **Interviewbit/Scaler**
- Former Product Engineer @ **Coding Blocks**
- Cracked **Google** Summer Of Code 2019 under **Harvard University**
- Offers From **Linkedin, Sprinklr, Dunzo, Works Application(Singapore), Interviewbit, Grofers, Splash Learn**
- **No. 1** Educator in Unacademy Competitive Programming Track
- Former Research Intern @ **ISRO (Indian Space Research Organisation)**
- Taught 7,500+ programmers in Data Structures, Algorithms and Fundamentals of Computer Science
- Got **Rank 1** in Codechef Long Challenges
- Won **Infosys** Digital Make-a-thon

1. How many zeros does an even number have at the end in it’s binary representation?

A. 0
B. At least 1
C. At least 2
D. At least 3

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Last digit can be thought of as “remainder when divided by 2” and so it must be 0.

6 has exactly one 0, i.e. (110) in the binary representation.

Answer is at least 1

2. If you list the binary representation of all numbers from 0, how often does the third bit from the end change?

A. Changes after 8 numbers
B. Changes after 2 numbers
C. Changes after 3 numbers
D. Changes after 4 numbers

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The last three digits follow the cycle 000 -> 001 -> 010 -> 011 -> 100 -> 101 -> 110 -> 111 -> (repeat from 000) and so changes after every 4 numbers.

3. What is the next number after 10101111 (in binary)? Give the answer in binary.

A. 10101110
B. 1001011111
C. 10110000
D. 10111111

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Add by 1 in binary

4. What is the value of (1101011) + (1101)? (Numbers are in binary). Give answer in binary.

A. 1110101011
B. 1111000
C. 1100110
D. 1101100

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Binary addition

5. How many **natural** numbers are there whose binary representation has maximum 5 digits? Hint: The answer if binary is replaced by decimal is 99999 (numbers from 1 to 99999)

A. 2^5-1
B. 10^5-1
C. 2^5
D. 10^5

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2^5 is the first number with more than 5 digits, all numbers from 1 to 2^5-1 have at most 5 digits

6. What is the value of $2^0 + 2^1 + \ldots 2^{19}$?
   Hint: convert to binary
   use 2^20 = 1048576

A. 1048575
B. 1048576
C. 524288
D. 524287

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Hint: convert to binary
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B. 1048576
C. 524288
D. 524287

The given number in binary is (11...1) repeated 19 times. If we add 1 to it, we should get 100...0 (0 repeated 20 times) which is 2^20. So the answer should be 2^20 - 1 = 1048575

7. If there are exactly “x” zeros at the end of a number “a” in binary and “y” zeros at the end of number “b” in binary, how many zeroes are there at the end of “a + b” in binary?

Note: “4” has 2 zeros in binary (100).

A. x+y
B. max(x, y)
C. x * y
D. min(x, y)

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This is true for any base!

8. If x is a number such that 6 AND x = 6 then

A. X must be greater than 6
B. X must be less than or equal to 6
C. X must be 6
D. X must be greater than or equal to 6

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If x < 6 then 6 AND x < 6

9. If A OR B and A AND B are same, then (A XOR B) must be

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B. 1
C. max(A, B)
D. can be anything

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In every position, either both A and B are 0 or both are 1. Therefore, it is true only when A = B, in which case A XOR B = 0

10. If A XOR B and A OR B are same, then (A AND B) must be

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B. A XOR B
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Look at each bit, if both numbers in a bit are 1, then XOR will be 0 and OR will be 1. In all other cases XOR and OR are the same. Therefore at least one among a and b contain 0 in every bit. This makes the AND value 0.