# Bitwise Algorithms

[**‘Recent Articles’ on Bit Magic**](https://www.geeksforgeeks.org/category/bit-magic/)  
**Topic :**

* [Basic](https://www.geeksforgeeks.org/bitwise-algorithms/#basics)
* [Intermediate](https://www.geeksforgeeks.org/bitwise-algorithms/#intermediate)
* [Hard](https://www.geeksforgeeks.org/bitwise-algorithms/#hard_bit)
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**Basic :**

1. [Find the element that appears once](https://www.geeksforgeeks.org/find-the-element-that-appears-once/)
2. [Detect if two integers have opposite signs](https://www.geeksforgeeks.org/detect-if-two-integers-have-opposite-signs/)
3. [Add 1 to a given number](https://www.geeksforgeeks.org/add-1-to-a-given-number/)
4. [Multiply a given Integer with 3.5](https://www.geeksforgeeks.org/multiply-an-integer-with-3-5/)
5. [Turn off the rightmost set bit](https://www.geeksforgeeks.org/turn-off-the-rightmost-set-bit/)
6. [Find whether a given number is a power of 4 or not](https://www.geeksforgeeks.org/find-whether-a-given-number-is-a-power-of-4-or-not/)
7. [Compute modulus division by a power-of-2-number](https://www.geeksforgeeks.org/compute-modulus-division-by-a-power-of-2-number/)
8. [Rotate bits of a number](https://www.geeksforgeeks.org/rotate-bits-of-an-integer/)
9. [Find the Number Occurring Odd Number of Times](https://www.geeksforgeeks.org/find-the-number-occurring-odd-number-of-times/)
10. [Check for Integer Overflow](https://www.geeksforgeeks.org/check-for-integer-overflow/)
11. [Little and Big Endian Mystery](https://www.geeksforgeeks.org/little-and-big-endian-mystery/)
12. [Count set bits in an integer](https://www.geeksforgeeks.org/count-set-bits-in-an-integer/)
13. [Count number of bits to be flipped to convert A to B](https://www.geeksforgeeks.org/count-number-of-bits-to-be-flipped-to-convert-a-to-b/)
14. [Efficient way to multiply with 7](https://www.geeksforgeeks.org/efficient-way-to-multiply-with-7/)
15. [Program to find whether a no is power of two](https://www.geeksforgeeks.org/program-to-find-whether-a-no-is-power-of-two/)
16. [Position of rightmost set bit](https://www.geeksforgeeks.org/position-of-rightmost-set-bit/)
17. [Binary representation of a given number](https://www.geeksforgeeks.org/binary-representation-of-a-given-number/)
18. [Find position of the only set bit](https://www.geeksforgeeks.org/find-position-of-the-only-set-bit/)
19. [How to swap two numbers without using a temporary variable?](https://www.geeksforgeeks.org/swap-two-numbers-without-using-temporary-variable/)
20. [Swap two nibbles in a byte](https://www.geeksforgeeks.org/swap-two-nibbles-byte/)
21. [How to turn off a particular bit in a number?](https://www.geeksforgeeks.org/how-to-turn-off-a-particular-bit-in-a-number/)
22. [Russian Peasant (Multiply two numbers using bitwise operators)](https://www.geeksforgeeks.org/russian-peasant-multiply-two-numbers-using-bitwise-operators/)
23. [Add two bit strings](https://www.geeksforgeeks.org/add-two-bit-strings/)
24. [Write your own strcmp that ignores cases](https://www.geeksforgeeks.org/write-your-own-strcmp-which-ignores-cases/)
25. [Check if two numbers are equal without using arithmetic and comparison operators](https://www.geeksforgeeks.org/check-if-two-numbers-are-equal-without-using-arithmetic-and-comparison-operators/)
26. [Find XOR of two number without using XOR operator](https://www.geeksforgeeks.org/find-xor-of-two-number-without-using-xor-operator/)
27. [XOR counts of 0s and 1s in binary representation](https://www.geeksforgeeks.org/xor-counts-0s-1s-binary-representation/)
28. [Calculate XOR from 1 to n](https://www.geeksforgeeks.org/calculate-xor-1-n/)
29. [Multiply a number with 10 without using multiplication operator](https://www.geeksforgeeks.org/multiply-number-10-without-using-multiplication-operator/)
30. [Equal Sum and XOR](https://www.geeksforgeeks.org/equal-sum-xor/)
31. [Swap three variables without using temporary variable](https://www.geeksforgeeks.org/swap-three-variables-without-using-temporary-variable/)
32. [Check if a number has bits in alternate pattern](https://www.geeksforgeeks.org/check-if-a-number-has-bits-in-alternate-pattern/)
33. [Count minimum bits to flip such that XOR of A and B equal to C](https://www.geeksforgeeks.org/count-minimum-bits-flip-xor-b-equal-c/)
34. [Efficient method for 2’s complement of a binary string](https://www.geeksforgeeks.org/efficient-method-2s-complement-binary-string/)
35. [Toggle case of a string using Bitwise operators](https://www.geeksforgeeks.org/toggle-case-string-using-bitwise-operators/)
36. [Toggling k-th bit of a number](https://www.geeksforgeeks.org/toggling-k-th-bit-number/)
37. [Convert decimal fraction to binary number](https://www.geeksforgeeks.org/convert-decimal-fraction-binary-number/)
38. [Toggle all the bits of a number except k-th bit](https://www.geeksforgeeks.org/toggle-bits-number-except-k-th-bit/)
39. [Set the rightmost unset bit](https://www.geeksforgeeks.org/set-rightmost-unset-bit/)
40. [Convert a binary number to octal](https://www.geeksforgeeks.org/convert-binary-number-octal/)
41. [Check in binary array the number represented by a subarray is odd or even](https://www.geeksforgeeks.org/check-binary-array-number-represented-subarray-odd-even/)
42. [Toggle the last m bits](https://www.geeksforgeeks.org/toggle-last-m-bits/)
43. [1 to n bit numbers with no consecutive 1s in binary representation](https://www.geeksforgeeks.org/1-to-n-bit-numbers-with-no-consecutive-1s-in-binary-representation/)
44. [Toggle bits in the given range](https://www.geeksforgeeks.org/toggle-bits-given-range/)
45. [Unset bits in the given range](https://www.geeksforgeeks.org/unset-bits-given-range/)
46. [Find the largest number with n set and m unset bits](https://www.geeksforgeeks.org/find-largest-number-n-set-m-unset-bits/)
47. [Find the smallest number with n set and m unset bits](https://www.geeksforgeeks.org/find-smallest-number-n-set-m-unset-bits/)
48. [Sum of numbers with exactly 2 bits set](https://www.geeksforgeeks.org/sum-numbers-exactly-2-bits-set/)
49. [Check if binary representation of a given number and its complement are anagram](https://www.geeksforgeeks.org/check-binary-representation-given-number-complement-anagram/)
50. [Josephus Problem Using Bit Magic](https://www.geeksforgeeks.org/josephus-problem-using-bit-magic/)

**Intermediate :**

1. [Swap bits in a given number](https://www.geeksforgeeks.org/swap-bits-in-a-given-number/)
2. [Add two numbers without using arithmetic operators](https://www.geeksforgeeks.org/add-two-numbers-without-using-arithmetic-operators/)
3. [Smallest of three integers without comparison operators](https://www.geeksforgeeks.org/smallest-of-three-integers-without-comparison-operators/)
4. [A Boolean Array Puzzle](https://www.geeksforgeeks.org/a-boolean-array-puzzle/)
5. [Compute the integer absolute value (abs) without branching](https://www.geeksforgeeks.org/compute-the-integer-absolute-value-abs-without-branching/)
6. [Compute the minimum or maximum of two integers without branching](https://www.geeksforgeeks.org/compute-the-minimum-or-maximum-max-of-two-integers-without-branching/)
7. [Find the two non-repeating elements in an array of repeating elements](https://www.geeksforgeeks.org/find-two-non-repeating-elements-in-an-array-of-repeating-elements/)
8. [Write an Efficient C Program to Reverse Bits of a Number](https://www.geeksforgeeks.org/write-an-efficient-c-program-to-reverse-bits-of-a-number/)
9. [Smallest power of 2 greater than or equal to n](https://www.geeksforgeeks.org/smallest-power-of-2-greater-than-or-equal-to-n/)
10. [Write an Efficient Method to Check if a Number is Multiple of 3](https://www.geeksforgeeks.org/write-an-efficient-method-to-check-if-a-number-is-multiple-of-3/)
11. [Write a C program to find the parity of an unsigned integer](https://www.geeksforgeeks.org/write-a-c-program-to-find-the-parity-of-an-unsigned-integer/)
12. [Swap all odd and even bits](https://www.geeksforgeeks.org/swap-all-odd-and-even-bits/)
13. [Check if a number is multiple of 9 using bitwise operators](https://www.geeksforgeeks.org/divisibility-9-using-bitwise-operators/)
14. [Check if binary representation of a number is palindrome](https://www.geeksforgeeks.org/check-binary-representation-number-palindrome/)
15. [Generate n-bit Gray Codes](https://www.geeksforgeeks.org/given-a-number-n-generate-bit-patterns-from-0-to-2n-1-so-that-successive-patterns-differ-by-one-bit/)
16. [Check if a given number is sparse or not](https://www.geeksforgeeks.org/check-if-a-given-number-is-sparse-or-not/)
17. [Euclid’s Algorithm when % and / operations are costly](https://www.geeksforgeeks.org/euclids-algorithm-when-and-operations-are-costly/)
18. [Find nth Magic Number](https://www.geeksforgeeks.org/find-nth-magic-number/)
19. [How to swap two bits in a given integer?](https://www.geeksforgeeks.org/how-to-swap-two-bits-in-a-given-integer/)
20. [Calculate 7n/8 without using division and multiplication operators](https://www.geeksforgeeks.org/calculate-7n8-without-using-division-and-multiplication-operators/)
21. [Calculate square of a number without using \*, / and pow()](https://www.geeksforgeeks.org/calculate-square-of-a-number-without-using-and-pow/)
22. [Generate 0 and 1 with 25% and 75% probability](https://www.geeksforgeeks.org/generate-0-1-25-75-probability/)
23. [Find even occurring elements in an array of limited range](https://www.geeksforgeeks.org/find-even-occurring-elements-array-limited-range/)
24. [Cyclic Redundancy Check and Modulo-2 Division](https://www.geeksforgeeks.org/modulo-2-binary-division/)
25. [Copy set bits in a range](https://www.geeksforgeeks.org/copy-set-bits-in-a-range/)
26. [Check if a number is Bleak](https://www.geeksforgeeks.org/check-if-a-number-is-bleak/)
27. [Count strings with consecutive 1’s](https://www.geeksforgeeks.org/count-strings-with-consecutive-1s/)
28. [Gray to Binary and Binary to Gray conversion](https://www.geeksforgeeks.org/gray-to-binary-and-binary-to-gray-conversion/)
29. [Find Next Sparse Number](https://www.geeksforgeeks.org/given-a-number-find-next-sparse-number/)
30. [Sum of bit differences among all pairs](https://www.geeksforgeeks.org/sum-of-bit-differences-among-all-pairs/)
31. [Sum of Bitwise And of all pairs in a given array](https://www.geeksforgeeks.org/calculate-sum-of-bitwise-and-of-all-pairs/)
32. [Bitwise and (or &) of a range](https://www.geeksforgeeks.org/bitwise-and-or-of-a-range/)
33. [Multiples of 4 (An Interesting Method)](https://www.geeksforgeeks.org/multiples-4-interesting-method/)
34. [Length of the Longest Consecutive 1s in Binary Representation](https://www.geeksforgeeks.org/length-longest-consecutive-1s-binary-representation/)
35. [Pairs of complete strings in two sets of strings](https://www.geeksforgeeks.org/pairs-of-complete-strings-in-two-sets-of-strings/)
36. [Find profession in a special family](https://www.geeksforgeeks.org/find-profession-in-a-hypothetical-special-situation/)
37. [Print first n numbers with exactly two set bits](https://www.geeksforgeeks.org/print-first-n-numbers-with-exactly-two-set-bits/)
38. [Check if bits of a number has count of consecutive set bits in increasing order](https://www.geeksforgeeks.org/check-bits-number-count-consecutive-set-bits-increasing-order/)
39. [Subset sum queries using bitset](https://www.geeksforgeeks.org/subset-sum-queries-using-bitset/)
40. [Maximum 0’s between two immediate 1’s in binary representation](https://www.geeksforgeeks.org/maximum-0s-two-immediate-1s-binary-representation/)
41. [Count all pairs of an array which differ in K bits](https://www.geeksforgeeks.org/count-all-pairs-of-an-array-which-differ-in-k-bits/)
42. [Efficiently check if a string has duplicates without using any additional data structure](https://www.geeksforgeeks.org/efficiently-check-string-duplicates-without-using-additional-data-structure/)
43. [Count trailing zero bits using lookup table](https://www.geeksforgeeks.org/count-trailing-zero-bits-using-lookup-table/)
44. [Count smaller numbers whose XOR with n produces greater value](https://www.geeksforgeeks.org/count-smaller-numbers-whose-xor-n-produces-greater-value/)
45. [Check divisibility in a binary stream](https://www.geeksforgeeks.org/check-divisibility-binary-stream/)
46. [Multiplication of two numbers with shift operator](https://www.geeksforgeeks.org/multiplication-two-numbers-shift-operator/)
47. [Determine if a string has all Unique Characters](https://www.geeksforgeeks.org/determine-string-unique-characters/)
48. [Reverse an array without using subtract sign ‘-‘ anywhere in the code](https://www.geeksforgeeks.org/reverse-array-without-using-subtract-sign-anywhere-code/)
49. [Count numbers whose sum with x is equal to XOR with x](https://www.geeksforgeeks.org/count-numbers-whose-sum-x-equal-xor-x/)
50. [Maximum XOR value of a pair from a range](https://www.geeksforgeeks.org/maximum-xor-value-of-a-pair-from-a-range/)
51. [Numbers whose bitwise OR and sum with N are equal](https://www.geeksforgeeks.org/numbers-whose-bitwise-sum-n-equal/)
52. [Change bits to make specific OR value](https://www.geeksforgeeks.org/change-bits-make-specific-value/)
53. [Count smaller values whose XOR with x is greater than x](https://www.geeksforgeeks.org/count-smaller-values-whose-xor-x-greater-x/)
54. [Next greater integer having one more number of set bits](https://www.geeksforgeeks.org/next-greater-integer-one-number-set-bits/)
55. [Check if two numbers are bit rotations of each other or not](https://www.geeksforgeeks.org/check-two-numbers-bit-rotations-not/)
56. [Previous smaller integer having one less number of set bits](https://www.geeksforgeeks.org/previous-smaller-integer-one-less-number-set-bits/)
57. [Check if binary representations of two numbers are anagram](https://www.geeksforgeeks.org/check-binary-representations-two-numbers-anagram/)
58. [Maximize a given unsigned number number by swapping bits at it’s extreme positions](https://www.geeksforgeeks.org/maximize-given-unsigned-number-number-swapping-bits-extreme-positions/)
59. [Set bits in N equals to M in the given range](https://www.geeksforgeeks.org/set-bits-n-equals-m-given-range/)

**Hard :**

1. [Count total set bits in all numbers from 1 to n](https://www.geeksforgeeks.org/count-total-set-bits-in-all-numbers-from-1-to-n/)
2. [Program to count number of set bits in an (big) array](https://www.geeksforgeeks.org/program-to-count-number-of-set-bits-in-an-big-array/)
3. [Next higher number with same number of set bits](https://www.geeksforgeeks.org/next-higher-number-with-same-number-of-set-bits/)
4. [Karatsuba algorithm for fast multiplication](https://www.geeksforgeeks.org/divide-and-conquer-set-2-karatsuba-algorithm-for-fast-multiplication/)
5. [Find the maximum subarray XOR in a given array](https://www.geeksforgeeks.org/find-the-maximum-subarray-xor-in-a-given-array/)
6. [Inserting m into n such that m starts at bit j and ends at bit i](https://www.geeksforgeeks.org/insertion-m-n-m-starts-bit-j-ends-bit/)
7. [Find Duplicates of array using bit array](https://www.geeksforgeeks.org/find-duplicates-of-array-using-bit-array/)
8. [Find longest sequence of 1’s in binary representation with one flip](https://www.geeksforgeeks.org/find-longest-sequence-1s-binary-representation-one-flip/)
9. [Closest (or Next) smaller and greater numbers with same number of set bits](https://www.geeksforgeeks.org/closest-next-smaller-greater-numbers-number-set-bits/)
10. [Bitmasking and Dynamic Programming | Set-2 (TSP)](https://www.geeksforgeeks.org/bitmasking-dynamic-programming-set-2-tsp/)
11. [Compute the parity of a number using XOR and table look-up](https://www.geeksforgeeks.org/compute-parity-number-using-xor-table-look/)

**Misc :**

1. [Interesting Facts about Bitwise Operators in C](https://www.geeksforgeeks.org/interesting-facts-bitwise-operators-c/)
2. [Optimization Techniques | Set 1 (Modulus)](https://www.geeksforgeeks.org/optimization-techniques-set-1-modulus/)
3. [What are the differences between bitwise and logical AND operators in C/C++?](https://www.geeksforgeeks.org/what-are-the-differences-between-bitwise-and-logical-and-operators-in-cc/)
4. [Bit Fields in C](https://www.geeksforgeeks.org/bit-fields-c/)
5. [C++ bitset and its application](https://www.geeksforgeeks.org/c-bitset-and-its-application/)
6. [C++ bitset interesting facts](https://www.geeksforgeeks.org/c-bitset-interesting-facts/)
7. [Builtin functions of GCC compiler](https://www.geeksforgeeks.org/builtin-functions-gcc-compiler/)
8. [Bit Tricks for Competitive Programming](https://www.geeksforgeeks.org/bit-tricks-competitive-programming/)