

Fundamental Algorithms

1. Exchanging (Swapping)

- **Used in Sorting Algorithms (Bubble Sort, Quick Sort).**
 - **Swapping Two Variables Without a Third Variable:**
 - plaintext
 - CopyEdit
 - $A = A + B$
 - $B = A - B$
 - $A = A - B$
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2. Counting Algorithm

- **Counts occurrences of an item in a dataset.**
 - Example: Counting even numbers in a list.
 - plaintext
 - CopyEdit
 - $Count = 0$
 - For each number in the list
 - If number is even
 - $Count = Count + 1$
 - End For
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3. Summing Algorithm

- **Computes the sum of a series of numbers.**
 - Example: Sum of first N natural numbers.
 - plaintext
 - CopyEdit
 - $Sum = 0$
 - For $i = 1$ to N
 - $Sum = Sum + i$
 - End For
 - Print Sum
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4. Factorial Computation

- **Factorial of N ($N! = N \times (N-1) \times \dots \times 1$)**
 - **Recursive Factorial Algorithm:**
 - plaintext
 - CopyEdit
 - Function Factorial(N)
 - If $N = 0$ Return 1
 - Else Return $N * \text{Factorial}(N-1)$
 - End Function
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5. Fibonacci Sequence

- **Each term is the sum of the two preceding terms.**
 - **Fibonacci Formula:** $F(n) = F(n-1) + F(n-2)$
 - Example Pseudocode:
 - plaintext
 - CopyEdit
 - Function Fibonacci (N)
 - If N = 0 Return 0
 - If N = 1 Return 1
 - Return Fibonacci (N-1) + Fibonacci (N-2)
 - End Function
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6. Reversing a Number

- **Extract digits and reverse their order.**
 - Example Pseudocode:
 - plaintext
 - CopyEdit
 - Reverse = 0
 - While Number > 0
 - Digit = Number mod 10
 - Reverse = Reverse * 10 + Digit
 - Number = Number / 10
 - End While
 - Print Reverse
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7. Digit-Base Conversion

- **Convert a decimal number to another base (Binary, Octal, Hexadecimal).**
 - Example (Decimal to Binary):
 - plaintext
 - CopyEdit
 - While Number > 0
 - Remainder = Number mod 2
 - Store Remainder
 - Number = Number / 2
 - End While
 - Print Reverse of Stored Remainders
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8. Character to Number Conversion

- **Converts characters (digits in ASCII) to integers.**
 - Example (Converting '5' to Integer 5):
 - plaintext
 - CopyEdit
 - Number = Character - '0'
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Factorial Methods

1. Finding Square Root (Newton-Raphson Method)

- **Approximates square root of a number.**
 - Example Pseudocode:
 - plaintext
 - CopyEdit
 - `Guess = Number / 2`
 - Repeat Until Converged
 - `Guess = (Guess + Number / Guess) / 2`
 - Print Guess
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2. Greatest Common Divisor (GCD)

- **Finds largest number that divides two numbers evenly.**
 - **Euclidean Algorithm:**
 - plaintext
 - CopyEdit
 - Function GCD(A, B)
 - While B \neq 0
 - Temp = B
 - B = A mod B
 - A = Temp
 - End While
 - Return A
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3. Prime Number Check

- **A number is prime if it is only divisible by 1 and itself.**
 - Example Pseudocode:
 - plaintext
 - CopyEdit
 - Function IsPrime(N)
 - If $N \leq 1$ Return False
 - For i = 2 to sqrt(N)
 - If $N \bmod i = 0$ Return False
 - End For
 - Return True
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4. Prime Factorization

- **Finds prime numbers that multiply to give N.**
 - Example Pseudocode:
 - plaintext
 - CopyEdit
 - Function PrimeFactorization(N)
 - For i = 2 to sqrt(N)
 - While $N \bmod i = 0$
 - Print i
 - $N = N / i$
 - End While
 - If $N > 1$ Print N
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Pseudocode & Flow Charts

Pseudocode Example (Find GCD of Two Numbers)

```
plaintext
CopyEdit
Start
Input A, B
While B ≠ 0
    Temp = B
    B = A mod B
    A = Temp
End While
Print A (GCD)
End
```

Flow Chart Symbols

Symbol	Meaning
Oval	Start/End
Rectangle	Process (Calculation)
Diamond	Decision (If/Else)
Parallelogram	Input/Output

This **Algorithm Cheat Sheet** covers **sorting, searching, number operations, factorial methods, pseudocode, and flowcharts**. Let me know if you need more details!

40