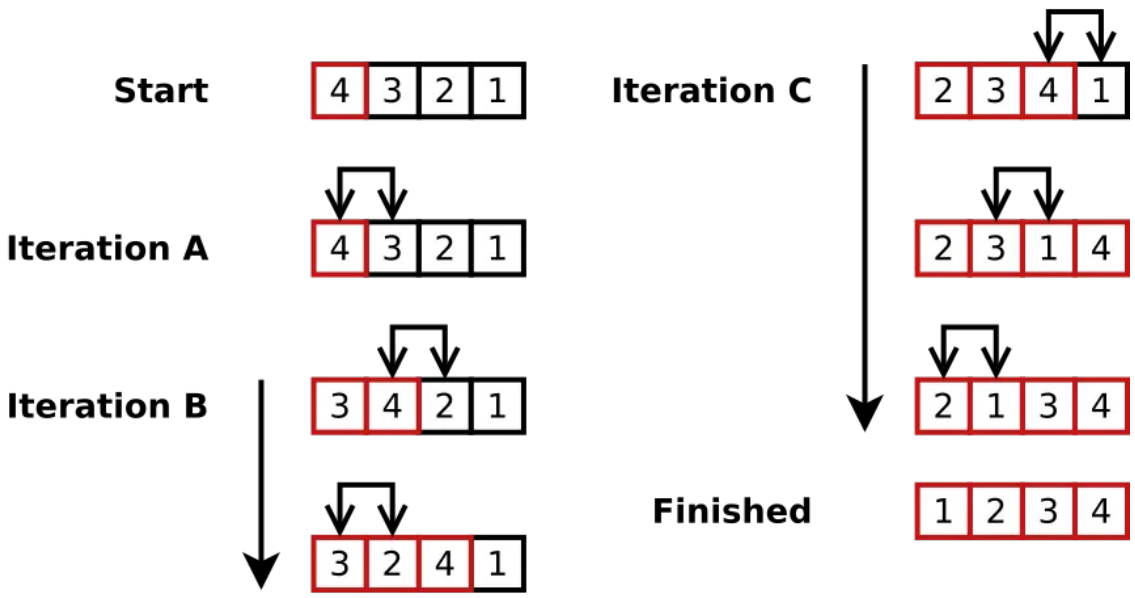
Definition:
Insertion Sort is a simple comparison-based sorting algorithm that builds the final sorted array one element at a time. It picks each element from the unsorted part and **inserts it at its correct position** in the already sorted part by shifting larger elements to the right.

✅ **C Code for Insertion Sort**

```
#include <stdio.h>

int main() {
    int arr[] = {5, 1, 4, 2, 8};
    int size = sizeof(arr) / sizeof(arr[0]);

    for(int i = 1; i < size; i++) {
        int key = arr[i];  // Naya card uthaya
        int j = i - 1;

        // Pichle sorted cards ke sath compare karo
        while(j >= 0 && arr[j] > key) {
            arr[j + 1] = arr[j];  // Bada card right shift
            j--;
        }
        arr[j + 1] = key;  // Key ko uski sahi jagah pe daal do
    }

    // Sorted array print karo
    printf("Sorted array: ");
    for(int i = 0; i < size; i++) {
        printf("%d ", arr[i]);
    }

    return 0;
}
```



🧠 Step-by-Step Breakdown

1. **Array diya**: {5, 1, 4, 2, 8}
2. Loop starts from i = 1 (kyunki pehla element already sorted maana jaata hai)
3. **Har step pe**:
    - key = arr[i] (ye hai naya card jo haath mein aaya)
    - Compare karo key ko pichle elements se
    - Jab tak koi bada element milta hai, usko right shift kar do
    - Fir key ko uss position pe insert karo

🔁 Pseudocode Algorithm (Exam Format)

1. Start
2. Input array and find its size
3. Repeat steps for i = 1 to size - 1:
    a. key = arr[i]
    b. j = i - 1
    c. While j >= 0 and arr[j] > key:
        i. arr[j + 1] = arr[j] (shift right)
        ii. j = j - 1
    d. arr[j + 1] = key
4. Print the sorted array
5. Stop

🧠 Time Complexity:

Case	Time	Reason
Best (sorted)	O(n)	No shifts needed
Average	$O(n^2)$	Moderate comparisons & shifts
Worst	$O(n^2)$	Fully reversed array

✅ When To Use Insertion Sort:

- Data set **chhota ho** (small arrays)
- Already **partially sorted ho**
- Memory efficient logic chahiye (no extra space used)

💡 Insertion Sort – Real Life Analogy

Situation:
Socho tum ek dost ke sath **taash (playing cards)** khel rahe ho.

👇 Scene:

- Tumhare haath mein already **3 sorted cards hain**: 4♣, 7♦, 9♠
- Ab tumhe **ek naya card milta hai: 6♥**

Ab kya karoge?

- Tum 6 ko uthane ke baad **left se compare karte ho**:
    - Kya 6 < 9? → Haan → 9 ko ek jagah right shift karo
    - Kya 6 < 7? → Haan → 7 ko bhi right shift karo
    - Kya 6 < 4? → Nahi → To 6 ko 4 ke baad rakh do

🎯 Yahi hai Insertion Sort!

- Har naye card ko **uski sahi jagah pe insert** karte jaate ho
- Pehle ke cards hamesha **sorted hi rehte hain**
- Aur tum **left se compare** karke card ghusa dete ho

🧠 Aam Zindagi Mein:

- School mein **notebook ke pages arrange karna**
- Files ko **alphabetical order mein set karna**
- **Bookshelf mein books sort karna** based on height or title