C# - Struct vs Class:

Advantages & Disadvantages

Struct Advantages

- **Better performance** for small data types
- **Stack allocation** - faster memory access
- **Value semantics** - copying creates independent instances
- **No garbage collection overhead**
- Good for lightweight, immutable data

Struct Disadvantages

- **No inheritance** (can't extend other structs/classes)
- **No destructor** support
- **Copying overhead** if struct is large
- **Always has a default constructor** (can't prevent it)
- Must initialize all fields

Class Advantages

- **Inheritance support** - can create class hierarchies
- **Reference semantics** - multiple variables can point to same object
- **Destructor support** (finalizers)
- **Nullable by default** (can be null)
- More flexible for complex behaviors

Class Disadvantages

- **Heap allocation** - slower than stack
- **Garbage collection overhead**
- **Reference copying** - multiple variables share same instance
- More memory overhead

When to Use Each

Use Struct When:

- Data structure is **small** (typically < 16 bytes)
- Represents a **single value** (like Point, Color, Complex Number)
- Is **immutable** (values don't change after creation)
- You need **value semantics** (independent copies)
- Examples: `DateTime`, `int`, `double`, geometric points

Use Class When:

- Data structure is **large**
- Needs **inheritance** or polymorphism
- Requires **reference semantics** (shared state)
- Has **complex behavior** or methods
- Needs a **destructor**
- Examples: `Employee`, `DatabaseConnection`, `FileStream`

Representation in Memory :

graph TD
subgraph "STRUCT - Value Type"
A[Stack Memory] --> B[c1: ComplexNum
Real=3, Img=4]
A --> C[c2: ComplexNum
Real=3, Img=4]
style B fill:#90EE90
style C fill:#90EE90
end

```
subgraph "CLASS – Reference Type"
    D[Stack Memory] --> E[c1: Reference<br/>0x1000]
    D --> F[c2: Reference<br/>0x1000]
    G[Heap Memory] --> H[ComplexNum Object<br/>Address: 0x1000<br/>Real=3,
Img=4]
    E -.->|Points to| H
    F -.->|Points to| H
    style E fill:#FFB6C6
    style F fill:#FFB6C6
```

```
    style H fill:#87CEEB
end
```

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