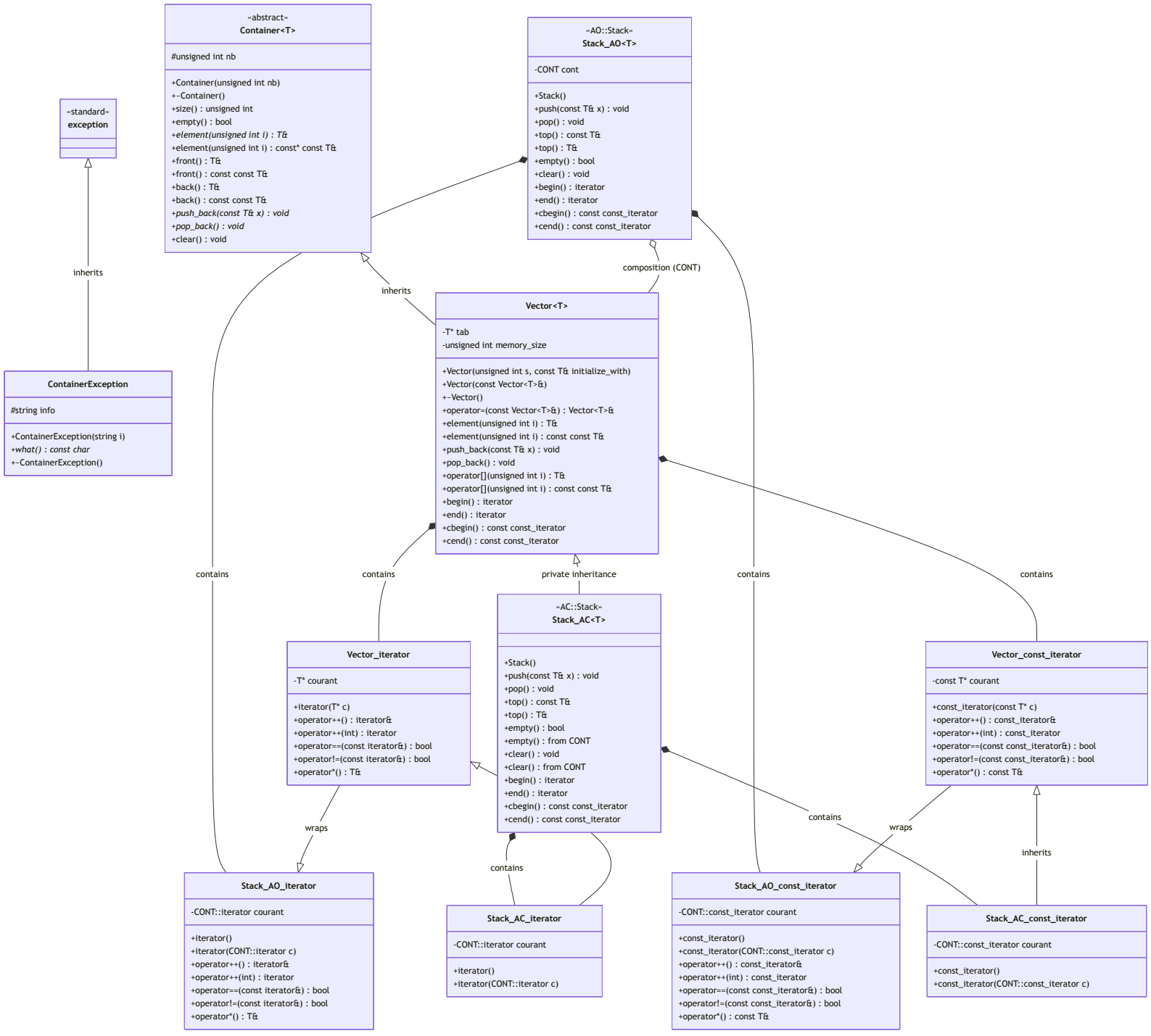
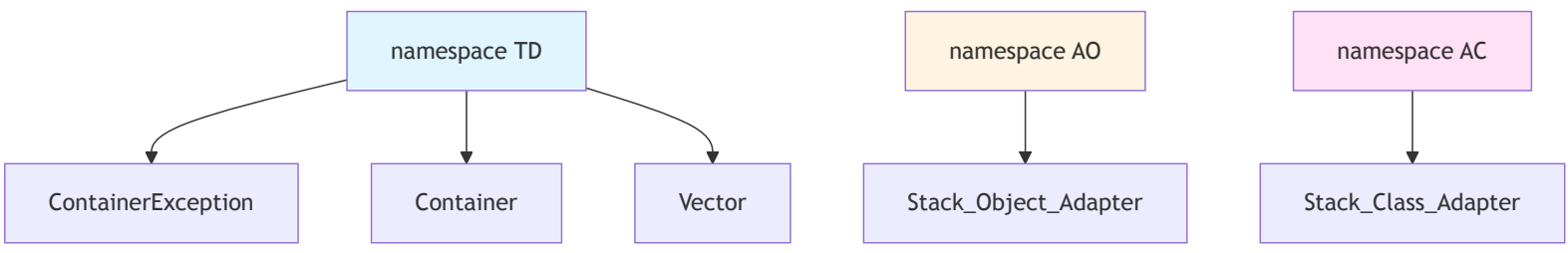
UML Class Diagram - Ex37 Container System

Class Diagram



Namespace Structure



Design Patterns

1. Template Method Pattern

- **Container**: Abstract base class defining the container interface
- **Vector**: Concrete implementation

2. Adapter Pattern - Object Adapter (AO namespace)

- **AO::Stack**: Uses composition to wrap a Container (default: Vector)
- Adapts Container interface to Stack interface
- More flexible, uses object composition

3. Adapter Pattern - Class Adapter (AC namespace)

- **AC::Stack**: Uses private inheritance from Container (default: Vector)
- Adapts Container interface to Stack interface through inheritance
- More efficient, but less flexible

4. Iterator Pattern

- All container classes provide iterator and const_iterator
- Enables sequential access to elements without exposing internal structure

Key Relationships

1. **Inheritance**:
   - `ContainerException` inherits from `std::exception`
   - `Vector<T>` inherits from `Container<T>` (public)
   - `AC::Stack<T>` inherits from `CONT` (private, typically Vector)
2. **Composition**:
   - `AO::Stack<T>` contains a `CONT` object (typically Vector)
   - Each container class contains iterator classes
3. **Template Specialization**:
   - All container classes are templated on element type `T`
   - Stack classes are also templated on container type `CONT`

Class Descriptions

ContainerException

Exception class for container operations, inherits from std::exception.

Container

Abstract base class (namespace TD) providing:

- Pure virtual methods: `element()`, `push_back()`, `pop_back()`
- Virtual methods: `front()`, `back()`
- Concrete methods: `size()`, `empty()`, `clear()`

Vector

Concrete container implementation (namespace TD) providing:

- Dynamic array with automatic growth
- Random access via `operator[]` and `element()`
- Iterator support (iterator and const_iterator)

AO::Stack

Object Adapter implementation of stack (namespace AO):

- Wraps a container object (composition)
- Provides stack interface: `push()`, `pop()`, `top()`
- Wraps container's iterators

AC::Stack

Class Adapter implementation of stack (namespace AC):

- Privately inherits from container
- Provides stack interface: `push()`, `pop()`, `top()`
- Uses `using` declarations to expose selected base class methods
- Iterators inherit from container's iterators