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# Inheritance

"the mechanism by which one class acquires  
the properties of another class"

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## Arrange concepts into an inheritance hierarchy

- Concepts at higher levels are more general
- Concepts at lower levels are more specific (inherit properties of concepts at higher levels)

```
graph TD; Vehicle[Vehicle] --> Wheeled_vehicle[Wheeled vehicle]; Vehicle --> Boat[Boat]; Wheeled_vehicle --> Car[Car]; Wheeled_vehicle --> Bicycle[Bicycle]; Car --> 2_door[2-door]; Car --> 4_door[4-door];
```

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```

P → Parent class  
D → Derived class  
C → Child class

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## C++ and inheritance

- The language mechanism by which one class acquires the properties (data and operations) of another class
- Base Class (or superclass): the class being inherited from
- Derived Class (or subclass): the class that inherits

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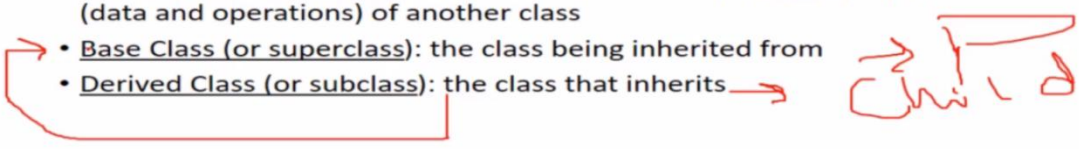
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## C++ and inheritance

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## Advantages of inheritance

- When a class inherits from another class, there are **three** benefits:
- (1) You can **reuse** the methods and data of the existing class
- (2) You can **extend** the existing class by adding new data and new methods
- (3) You can **modify** the existing class by overloading its methods with your own implementations



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## Deriving One Class from Another

CountedQue class

QueType subobject

Private data:

qFront

qRear

length

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## Inheritance and accessibility

- A class inherits the behavior of another class and enhances it in some way
- Inheritance does not mean inheriting access to another class' private members

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## What Does a Child Have?

An object of the derived class has:

- all members defined in child class
- all members declared in parent class

An object of the derived class can use:

- all `public` members defined in child class
- all `public` members defined in parent class

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## Rules for building a class hierarchy

- Derived classes are special cases of base classes
- A derived class can also serve as a base class for new classes.
- There is no limit on the depth of inheritance allowed in C++ (as far as it is within the limits of your compiler)
- It is possible for a class to be a base class for more than one derived class

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## Static vs. dynamic binding

- **Static Binding:** the determination of which method to call at **compile time**
- **Dynamic Binding:** the determination of which method to call at **run time**

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## Multiple Inheritance

- Derived classes can inherit from more than one base classes

X  
↓  
Y  
↓  
Z

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## Multiple Inheritance

- Derived classes can inherit from more than one base classes

Diagram illustrating Multiple Inheritance:

```
graph BT; Y --> X; Z --> Y;
```

The diagram shows three classes: X, Y, and Z. Class X is the base class, and Y and Z are derived classes. Y inherits from X, and Z inherits from Y. The diagram uses boxes for classes and arrows for inheritance. Handwritten symbols to the right of the boxes indicate the inheritance relationships: a 'P' with a bracket next to X, a 'P' with a bracket next to Y, and a 'C' with an upward arrow next to Z.

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