

# Queue

*length*

*Querying the Queue About Its Size*

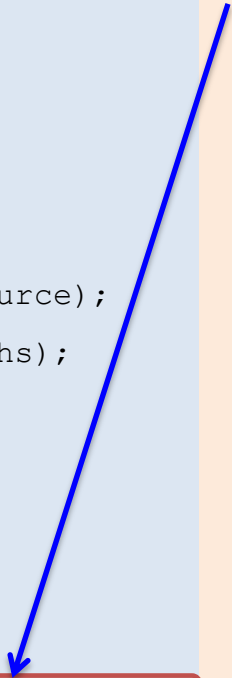
One of the 5 Queue Specific Operations

# The Queue Component

Let's look at the *length* operation

All C++ *container* components have an operation that allows the client to determine the number of items stored in the container, for Queue this operation is *length*

```
template <class T>
class Queue1
{
public: // Standard Operations
    Queue1();
    ~Queue1();
    void clear (void);
    void transferFrom (Queue1& source);
    Queue1& operator = (Queue1& rhs);
// Queue1 Specific Operations
    void enqueue (T& x);
    void dequeue (T& x);
    void replaceFront (T& x);
    T& front (void);
    Integer length (void);
private: // representation
    // ...
};
```



```

template <class T>
class Queue1
{
public: // Standard Operations
    Queue1();
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    void clear (void);
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    Queue1& operator = (Queue1& rhs);
    // Queue1 Specific Operations
    void enqueue (T& x);
    void dequeue (T& x);
    void replaceFront (T& x);
    T& front (void);

    Integer length (void);
    //! restores self
    //! ensures: length = |self|

private: // representation
    // ...
};

```

length

The job of *length* is to return an integer that represents the number of items currently stored in the queue

# length

```
template <class T>
class Queue1
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    void clear (void);
    void transferFrom (Queue1& source);
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// Queue1 Specific Operations
    void enqueue (T& x);
    void dequeue (T& x);
    void replaceFront (T& x);
    T& front (void);
    Integer length (void);
    //! restores self
    //! ensures: length = |self|

private: // representation
    // ...
};
```

*length*'s ensures clause indicates:

- That the integer returned is equal to the length of *self*

# length

```
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    void clear (void);
    void transferFrom (Queue1& source);
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    void enqueue (T& x);
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    Integer length (void);
    //! restores self
    //! ensures: length = |self|

private: // representation
    // ...
};
```

*restores self*

- Is concise notation for: *self = #self*
- Without this concise notation, the ensures clause would be written as follows:

*ensures: length = |self| and  
self = #self*

# length

```
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// Queue1 Specific Operations
    void enqueue (T& x);
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    void replaceFront (T& x);
    T& front (void);

    Integer length (void);
        //! restores self
        //! ensures: length = |self|

private: // representation
    // ...
};
```

*length* is called in the client below and the lines following the call contain comments based on *length*'s spec

*Example client:*

```
{
1  typedef Queue1<Integer> IntegerQueue;
2  IntegerQueue q1;
3  Integer z;
4  // ...
5  // Suppose q1 = <137,18,100,2,44>
6  z = q1.length();
7  // z = length = |self|
8  // self = #self
}
```

# length

```
template <class T>
class Queue1
{
public: // Standard Operations
    Queue1();
    ~Queue1();
    void clear (void);
    void transferFrom (Queue1& source);
    Queue1& operator = (Queue1& rhs);
// Queue1 Specific Operations
    void enqueue (T& x);
    void dequeue (T& x);
    void replaceFront (T& x);
    T& front (void);
    Integer length (void);
        //! restores self
        //! ensures: length = |self|
private: // representation
    // ...
};
```

Substitute:

- q1 for *self*

This gives us

*Example client:*

```
{
1  typedef Queue1<Integer> IntegerQueue;
2  IntegerQueue q1;
3  Integer z;
4  // ...
5  // Suppose q1 = <137,18,100,2,44>
6  z = q1.length();
7  // z = length = |q1|
8  // q1 = #q1
}
```

# length

```
template <class T>
class Queue1
{
public: // Standard Operations
    Queue1();
    ~Queue1();
    void clear (void);
    void transferFrom (Queue1& source);
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    void enqueue (T& x);
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    void replaceFront (T& x);
    T& front (void);
    Integer length (void);
        //! restores self
        //! ensures: length = |self|
private: // representation
    // ...
};
```

Now substitute:

- <137,18,100,2,44> for #q1

This gives us

*Example client:*

```
{
1  typedef Queue1<Integer> IntegerQueue;
2  IntegerQueue q1;
3  Integer z;
4  // ...
5  // Suppose q1 = <137,18,100,2,44>
6  z = q1.length();
7  // z = length = |<137,18,100,2,44>|
8  // q1 = <137,18,100,2,44>
}
```



# length

```
template <class T>
class Queue1
{
public: // Standard Operations
    Queue1();
    ~Queue1();

    void clear (void);
    void transferFrom (Queue1& source);
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// Queue1 Specific Operations
    void enqueue (T& x);
    void dequeue (T& x);
    void replaceFront (T& x);

    T& front (void);

    Integer length (void);
        //! restores self
        //! ensures: length = |self|

private: // representation
    // ...
};
```

Evaluate:  $|<137,18,100,2,44>|$

This produces a 5, so *length* returns: 5

So variable *z* is assigned 5

And *q1*'s value remains unchanged

*Example client:*

```
{
1  typedef Queue1<Integer> IntegerQueue;
2  IntegerQueue q1;
3  Integer z;
4  // ...
5  // Suppose q1 = <137,18,100,2,44>
6  z = q1.length();
7  // z = 5
8  // q1 = <137,18,100,2,44>
}
```