Software Engineering 2 Assignment

Extension of the Library specification example

Due Date: 25/04/2018

Date Completed: 03/04/2018

Completed by:

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DT228/2

Table of Contents

Lib1.use:

```
model Library

--All the books associated with the system

enum BookStatus { available, unavailable, onreserve}

class Book
  attributes
    title : String
    author : String
    status : BookStatus init = #available
    ShortTerm : Boolean init = false
    no_copies : Integer init = 2
    no_onshelf : Integer init = 2
  operations
    borrow()
    begin
       self.no_onshelf := self.no_onshelf - 1;
       if (self.no_onshelf = 0) then
             self.status := #unavailable
       end
    end
    pre copiesOnShelf: no_copies >0
    post: no_onshelf = no_onshelf@pre - 1

    return()
    begin
       self.no_onshelf := self.no_onshelf + 1;
       self.status := #available
```

```
  end
  pre copiesOnShelf: no_copies >= 0
  post: no_onshelf = no_onshelf@pre + 1

  newCopy(c : Copy)
  begin
    insert (c,self) into CopyOf;
    c.status := 'onShelf';
    self.no_copies := self.no_copies + 1;
    self.no_onshelf := self.no_onshelf + 1;
    c.ShortTerm := self.ShortTerm
  end

  statemachines
    psm States
    states
      newTitle : initial
      available      [no_onshelf > 0]
      unavailable    [no_onshelf = 0]
    transitions
      newTitle ->  available  { create }
      available -> unavailable { [no_onshelf = 1] borrow() }
      available -> available { [no_onshelf > 1] borrow() }
      available -> available { return() }
      unavailable -> available { return() }
    end
end

class Journal
 attributes
  title : String
```

```
    author : String
    onShelf : Boolean init = true
  operations
    borrow()
    begin
      self.onShelf := false
    end
    pre no_onshelfTrue: onShelf = true
    post: onShelf = false

    return()
    begin
      self.onShelf := true
    end
    pre no_onshelfFalse: onShelf = false
    post: onShelf = true

end

class Copy
  attributes
    status : String
    ReservedBy : String init = 'NA'
    ShortTerm : Boolean
    weeksDesired: Integer init = 0
  operations
    borrow()
    begin
      self.status := 'onLoan';
      self.book.borrow()
    end
```

```
    pre cond1: if ShortTerm = true then weeksDesired <= 1 else weeksDesired <= 3 endif
    pre cond2 : weeksDesired > 0
    return()
    begin
       self.status := 'onShelf';
       self.book.return()
    end
end

--All the people associated with the system
class Member
  attributes
    name : String
    address : String
    no_onloan : Integer init = 0
    status : String init = 'Active'
    fine : Integer init = 0
  operations
    borrow(c : Copy)
    begin
       insert (self, c) into HasBorrowed;
       c.ReservedBy := 'NA';
       self.no_onloan := self.no_onloan + 1;
       c.borrow()
    end

    return(c : Copy)
    begin
       delete (self, c) from HasBorrowed;
       self.no_onloan := self.no_onloan - 1;
       c.return()
```

```
    end

    --Testing this function in !openter !opexit
    Reserve(c : Copy)
    --begin
        --c.status := 'Reserved';
        --c.ReservedBy := self.name;
    --end

    CancelReserve(c : Copy)
    begin
        c.status := 'onShelf';
        c.ReservedBy := 'NA'
    end
end


class Staff
  attributes
    name : String
    address : String
    no_onloan : Integer init = 0
    fine : Integer init = 0
  operations
  --journal work
    JournalBorrow(j : Journal)
    begin
        insert (self, j) into JournalBorrowed;
        self.no_onloan := self.no_onloan + 1;
        j.borrow()
    end
```

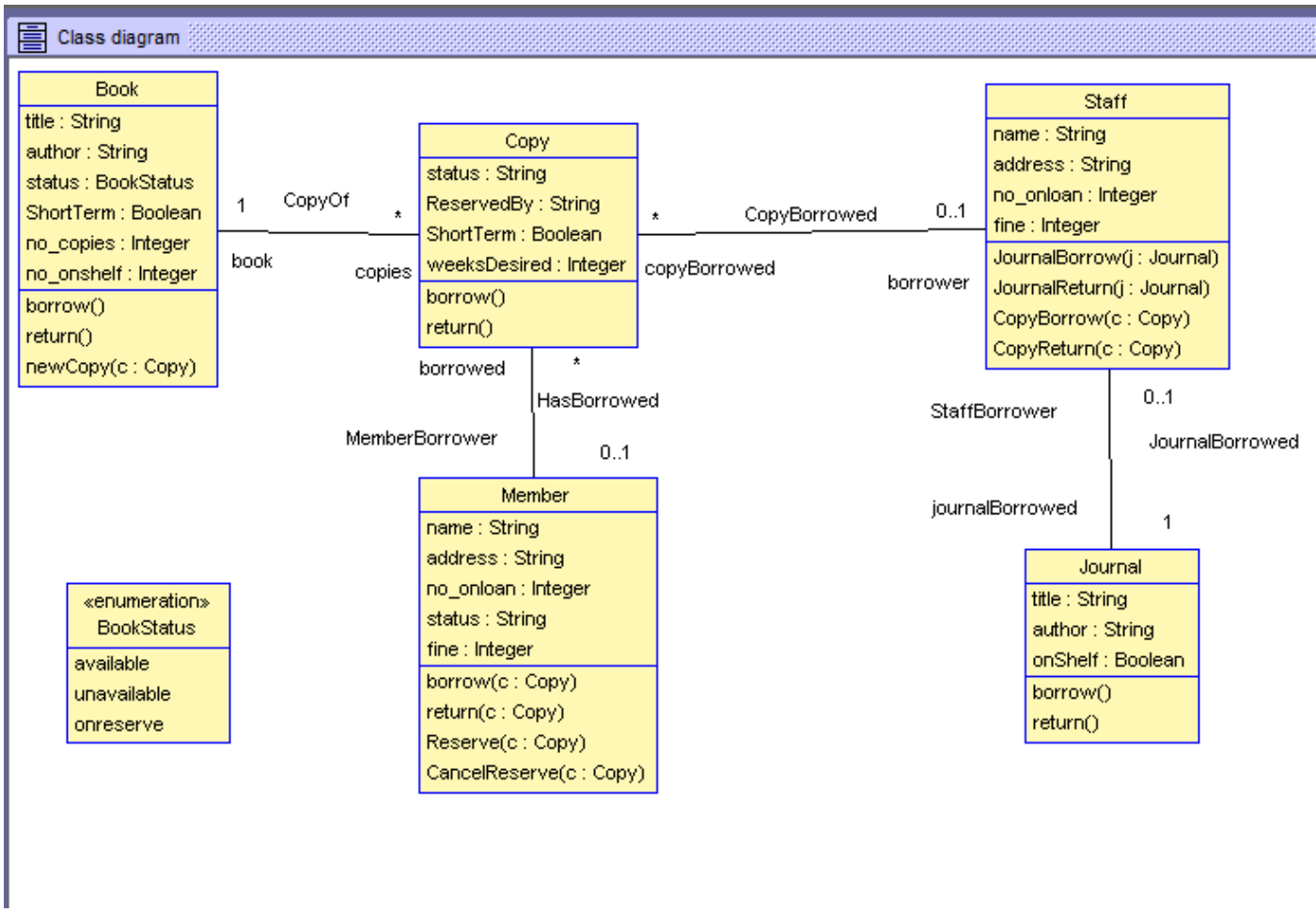
```
    JournalReturn(j : Journal)
    begin
        delete (self, j) from JournalBorrowed;
        self.no_onloan := self.no_onloan - 1;
        j.return()
    end

    --book work
    CopyBorrow(c : Copy)
    begin
        insert (self, c) into CopyBorrowed;
        self.no_onloan := self.no_onloan + 1;
        c.borrow()
    end

    CopyReturn(c : Copy)
    begin
        delete (self, c) from CopyBorrowed;
        self.no_onloan := self.no_onloan - 1;
        c.return()
    end
end

--associations
association HasBorrowed between
    Member[0..1] role MemberBorrower
    Copy[*] role borrowed
end

association CopyBorrowed between
```

```
    Staff[0..1] role borrower
    Copy[*] role copyBorrowed
end

association JournalBorrowed between
    Staff[0..1] role StaffBorrower
    Journal[1] role journalBorrowed
end

association CopyOf between
    Copy[0..*] role copies
    Book[1] role book
end



--constraints in the programme

constraints

--All members functions
context Member::borrow(c:Copy)
    pre limit: self.no_onloan < 6
    pre status: c.status <> 'onLoan'
    pre Resereved:if c.ReservedBy <> 'NA' then c.ReservedBy = self.name else c.ReservedBy = 'NA'
endif
    pre cond1: self.borrowed->excludes(c)
    post cond2: self.borrowed->includes(c)
    post status2: c.status = 'onLoan'

context Member::return(c:Copy)
    pre status: c.status = 'onLoan'
```

```
    pre cond1: self.borrowed->includes(c)
    post cond2: self.borrowed->excludes(c)
    post status2: c.status = 'onShelf'


context Member::Reserve(c : Copy)
    pre status: c.status = 'onShelf'
    post status2 :  c.status = 'Reserved'

context Member::CancelReserve(c:Copy)
    pre status: c.status = 'Reserved'
    post status2 :  c.status = 'onShelf'

--All staff functions
context Staff::JournalBorrow(j : Journal)
    pre limit: self.no_onloan < 12
    pre status1: j.onShelf = true
    pre cond1: self.journalBorrowed->excludes(j)
    post cond2: self.journalBorrowed->includes(j)
    post status2: j.onShelf= false

context Staff::JournalReturn(j : Journal)
    pre status1: j.onShelf = false
    pre cond1: self.journalBorrowed->includes(j)
    post cond2: self.journalBorrowed->excludes(j)
    post status2: j.onShelf= true

context Staff::CopyBorrow(c:Copy)
    pre limit: self.no_onloan < 12
    pre status1: c.status = 'onShelf'
    pre cond1: self.copyBorrowed->excludes(c)
```

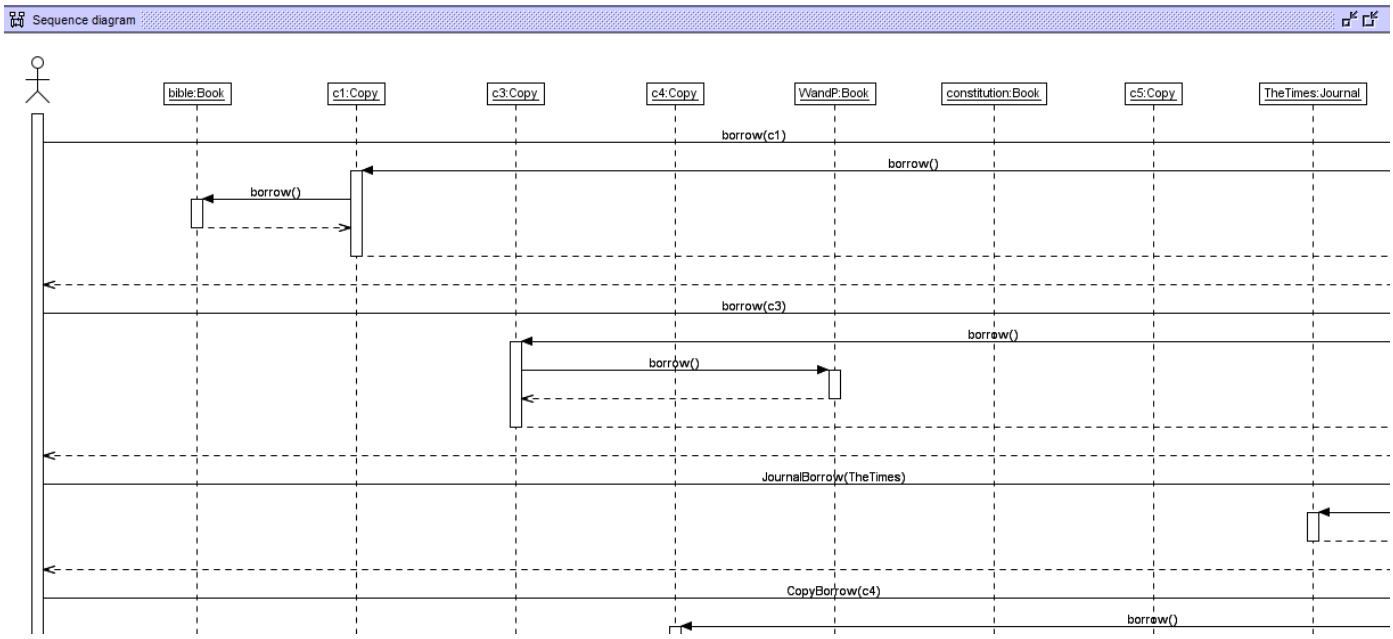
```
    post cond2: self.copyBorrowed->includes(c)
    post status2: c.status = 'onLoan'

context Staff::CopyReturn(c:Copy)
    pre status: c.status = 'onLoan'
    pre cond1: self.copyBorrowed->includes(c)
    post cond2: self.copyBorrowed->excludes(c)
    post status2: c.status = 'onShelf'

context Copy
    inv exist: book->size() > 0
```

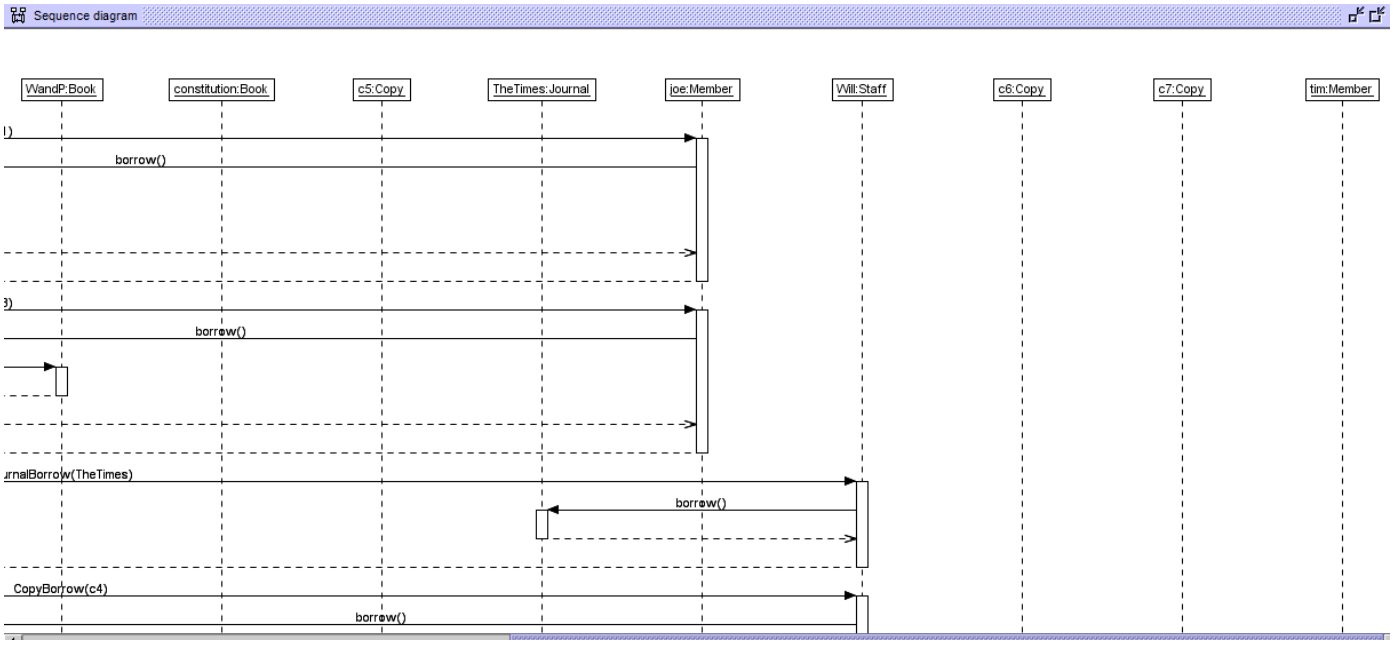
Class Diagram

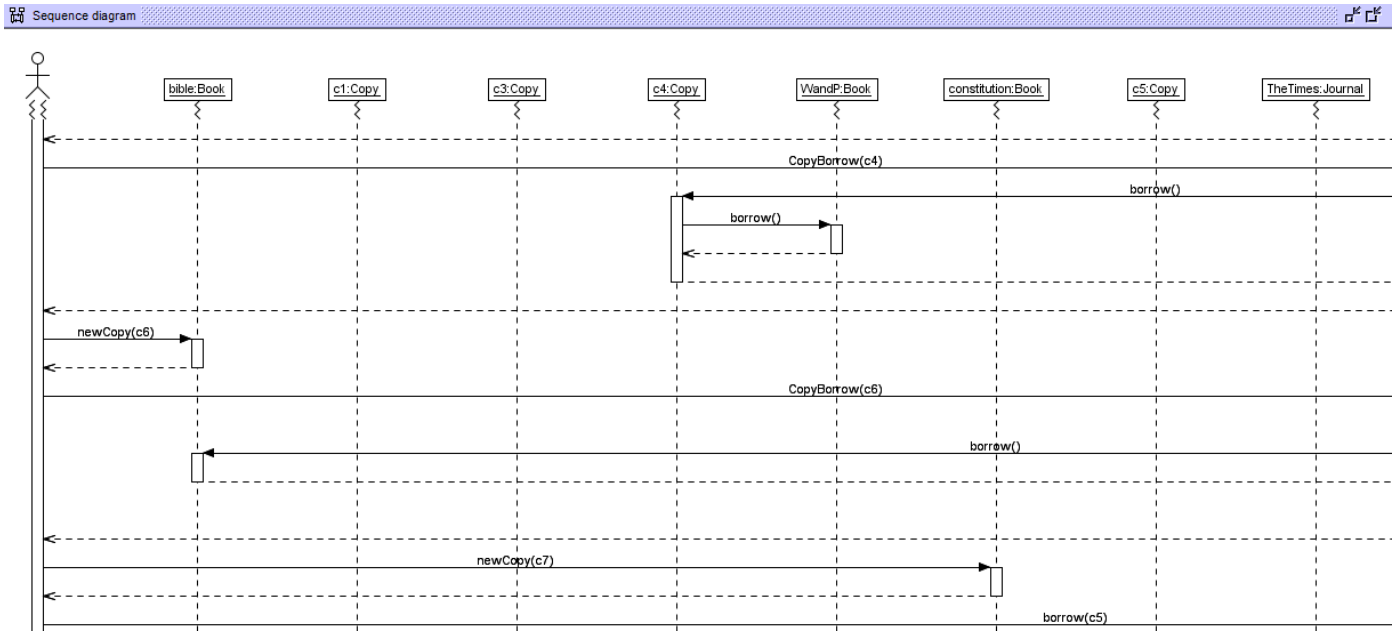


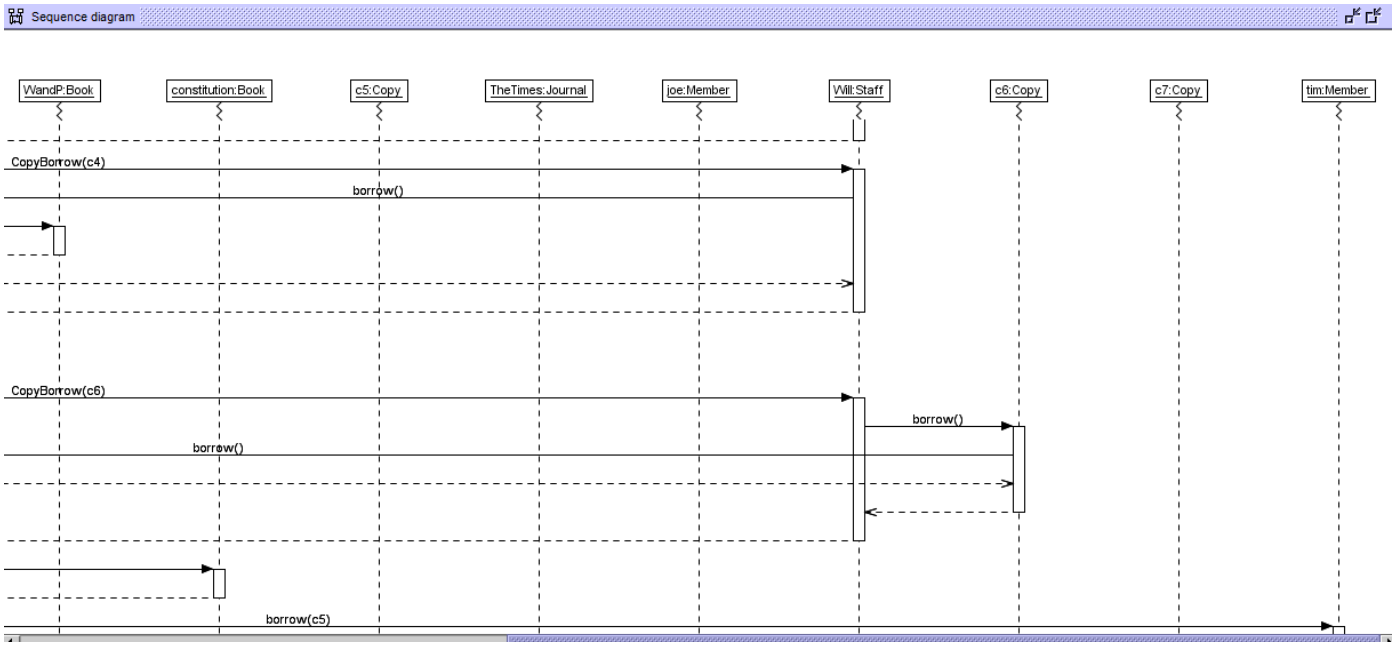
Sequence Diagrams

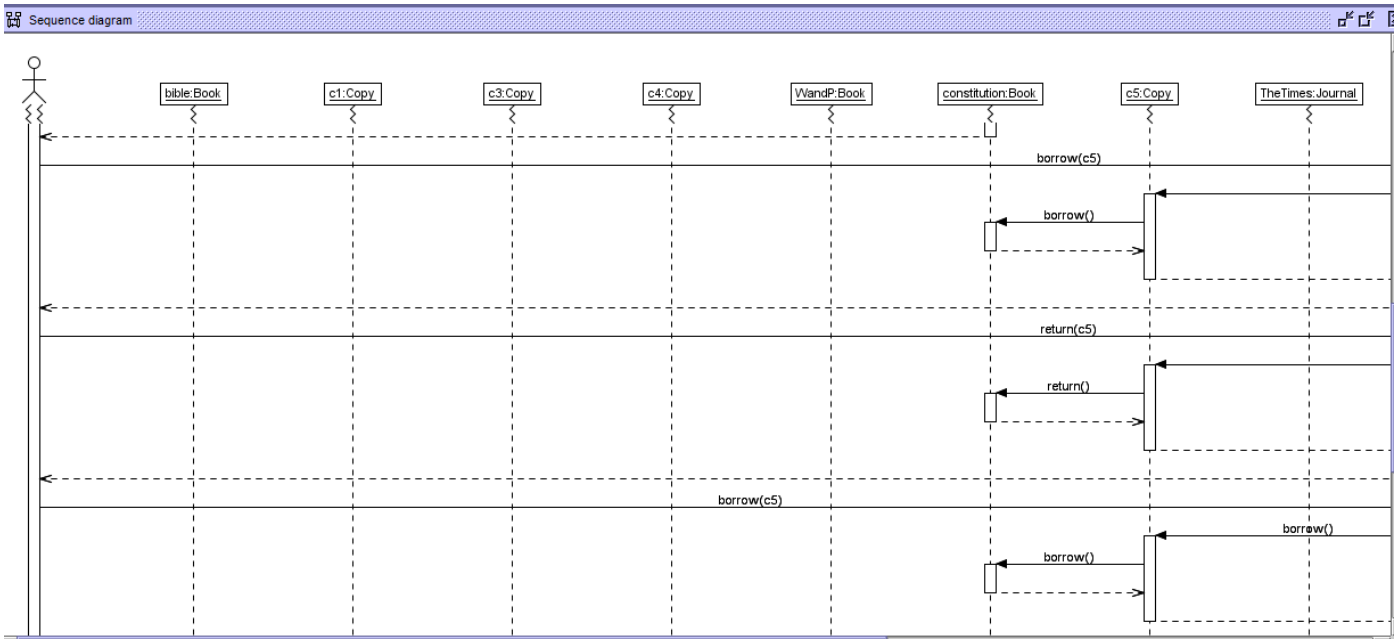
1)

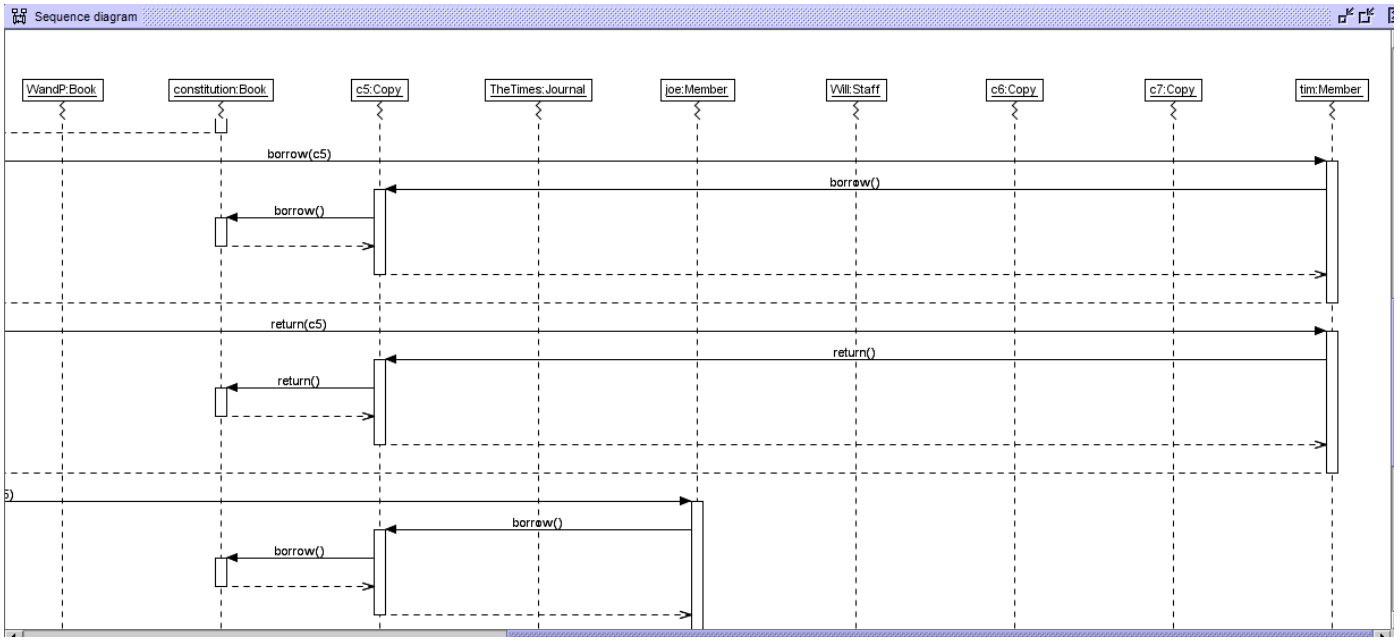


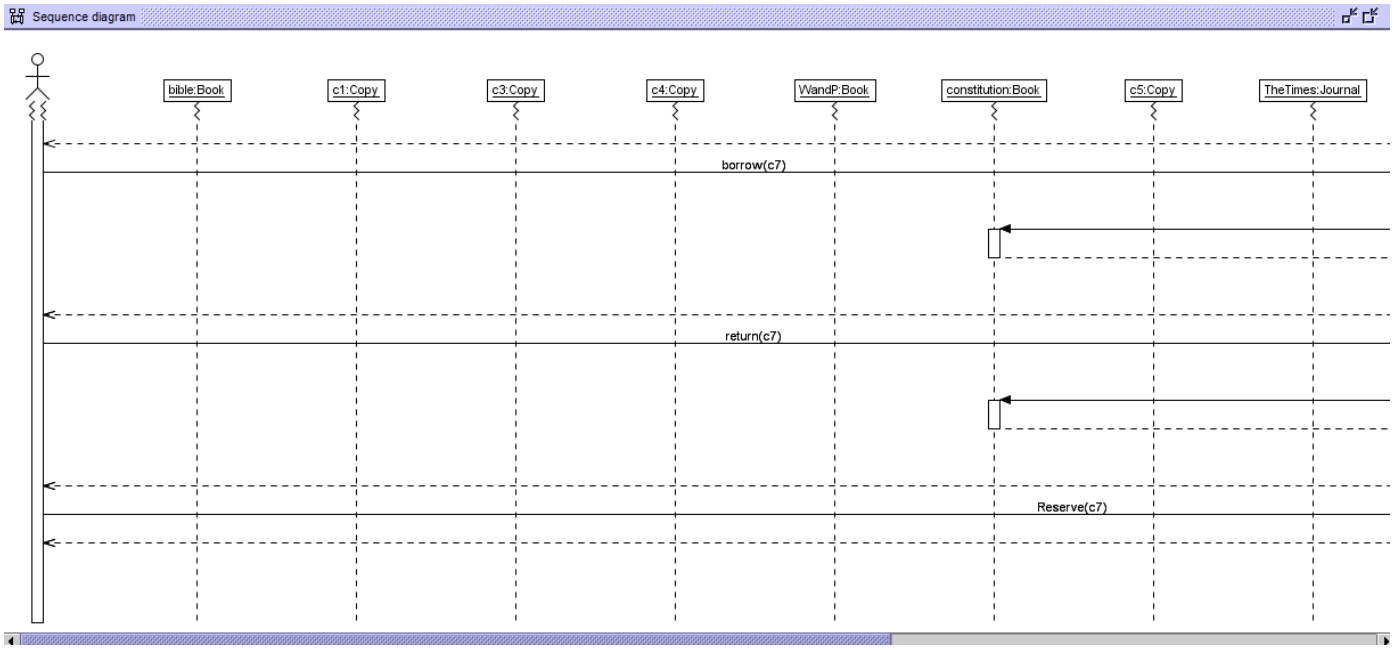


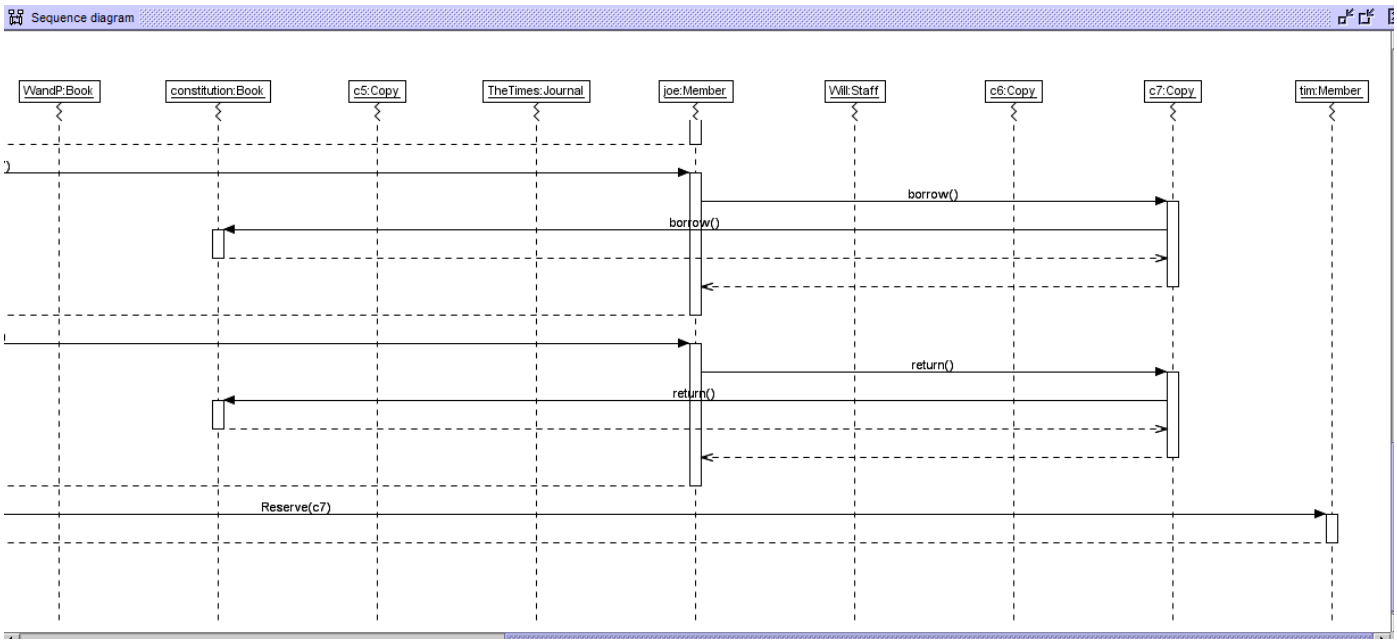

Sequence diagram
bible:Book
c1:Copy
c3:Copy
c4:Copy
WandP:Book
constitution:Book
c5:Copy
TheTimes:Journal
CopyBorrow(c4)
borrow()
borrow()
newCopy(c6)
CopyBorrow(c6)
borrow()
newCopy(c7)
borrow(c5)


Sequence diagram
WandP:Book
constitution:Book
c5:Copy
TheTimes:Journal
joe:Member
Will:Staff
c6:Copy
c7:Copy
tim:Member
CopyBorrow(c4)
borrow()
CopyBorrow(c6)
borrow()
borrow()
borrow(c5)


Sequence diagram
bible:Book
c1:Copy
c3:Copy
c4:Copy
WandP:Book
constitution:Book
c5:Copy
TheTimes:Journal
borrow(c5)
borrow()
return(c5)
return()
borrow(c5)
borrow()
borrow()


Sequence diagram
WandP:Book
constitution:Book
c5:Copy
TheTimes:Journal
joe:Member
Will:Staff
c6:Copy
c7:Copy
tim:Member
borrow(c5)
borrow()
borrow()
return(c5)
return()
return()
borrow()
borrow()


Sequence diagram
bible:Book
c1:Copy
c3:Copy
c4:Copy
WandP:Book
constitution:Book
c5:Copy
TheTimes:Journal
borrow(c7)
return(c7)
Reserve(c7)


Sequence diagram
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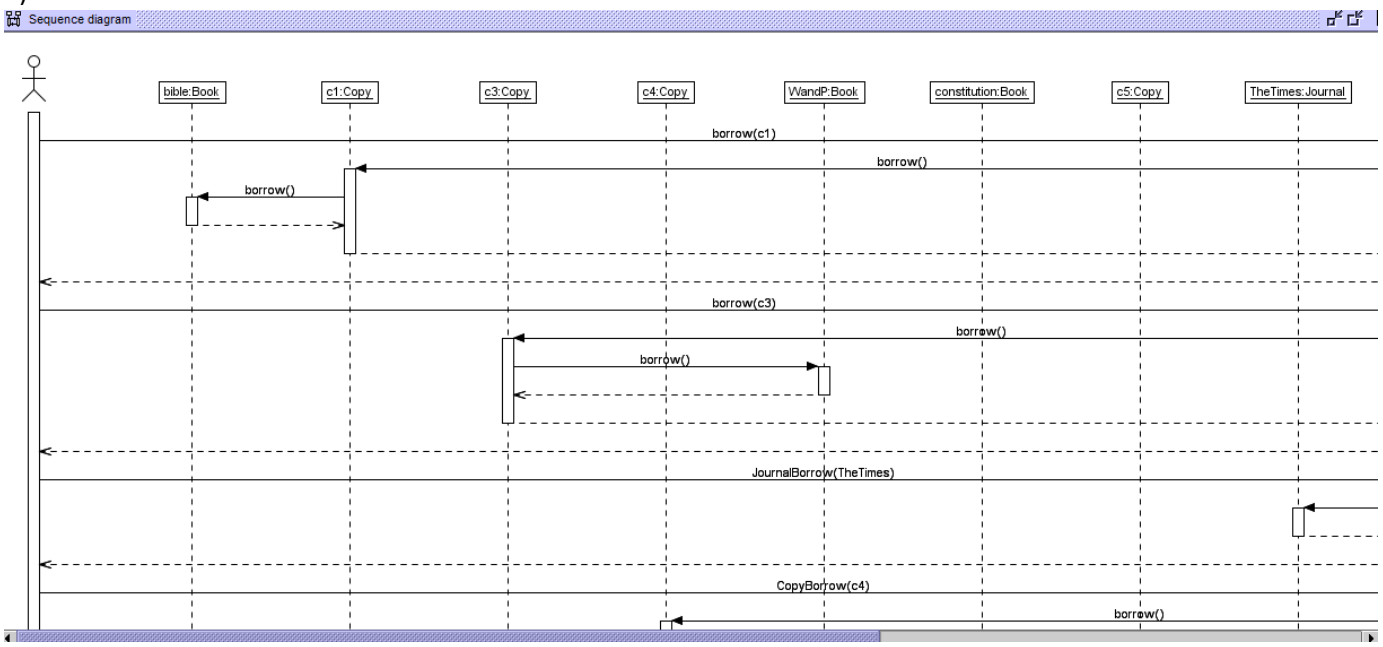
c5:Copy
TheTimes:Journal
joe:Member
Will:Staff
c6:Copy
c7:Copy
tim:Member
borrow()
borrow()
return()
return()
Reserve(c7)

2)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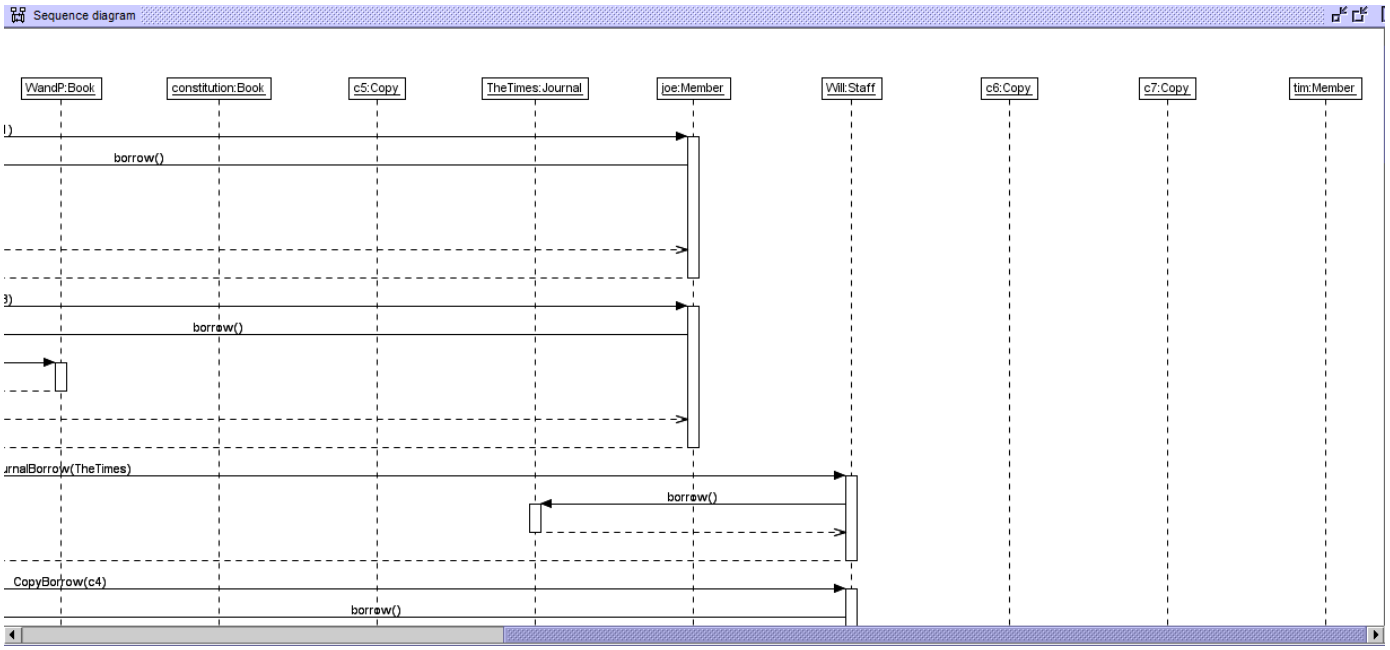
c3:Copy
c4:Copy
WandP:Book
constitution:Book
c5:Copy
TheTimes:Journal
borrow(c1)
borrow()
borrow()
borrow(c3)
borrow()
borrow()
JournalBorrow(TheTimes)
CopyBorrow(c4)
borrow()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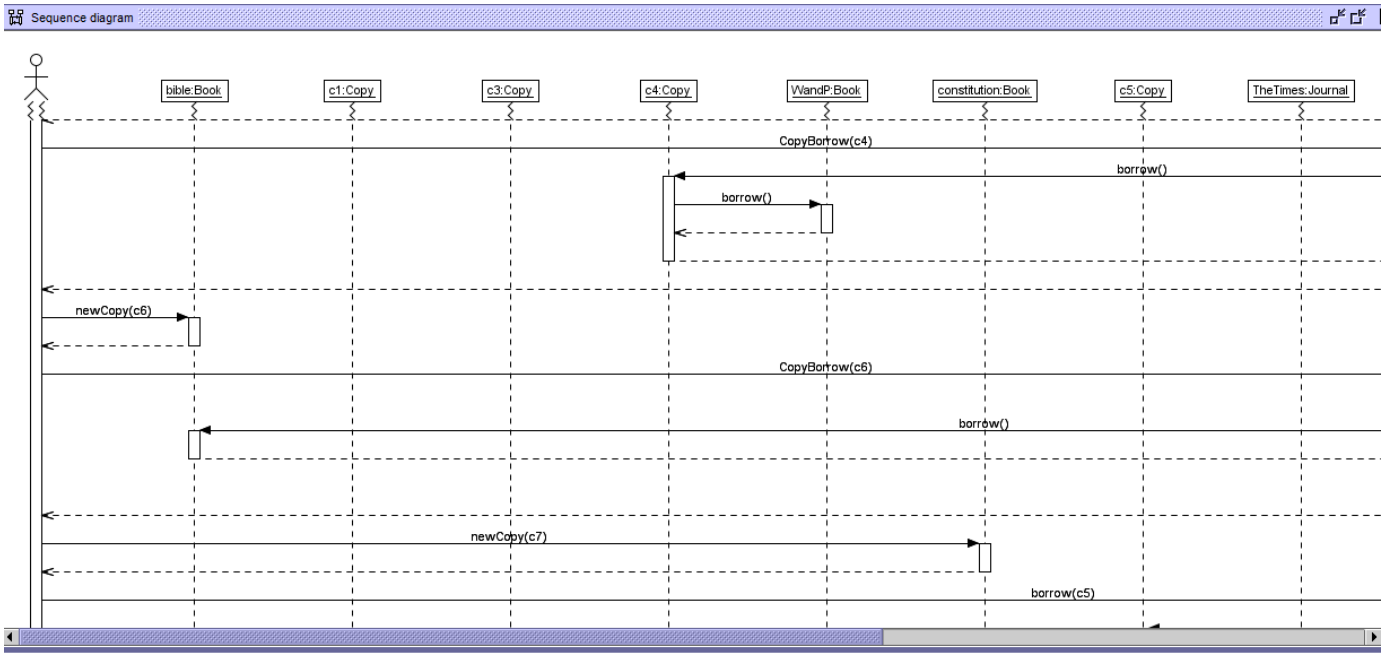
Will:Staff
c6:Copy
c7:Copy
tim:Member
borrow()
borrow()
borrow()
CopyBorrow(c4)
borrow()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c4:Copy
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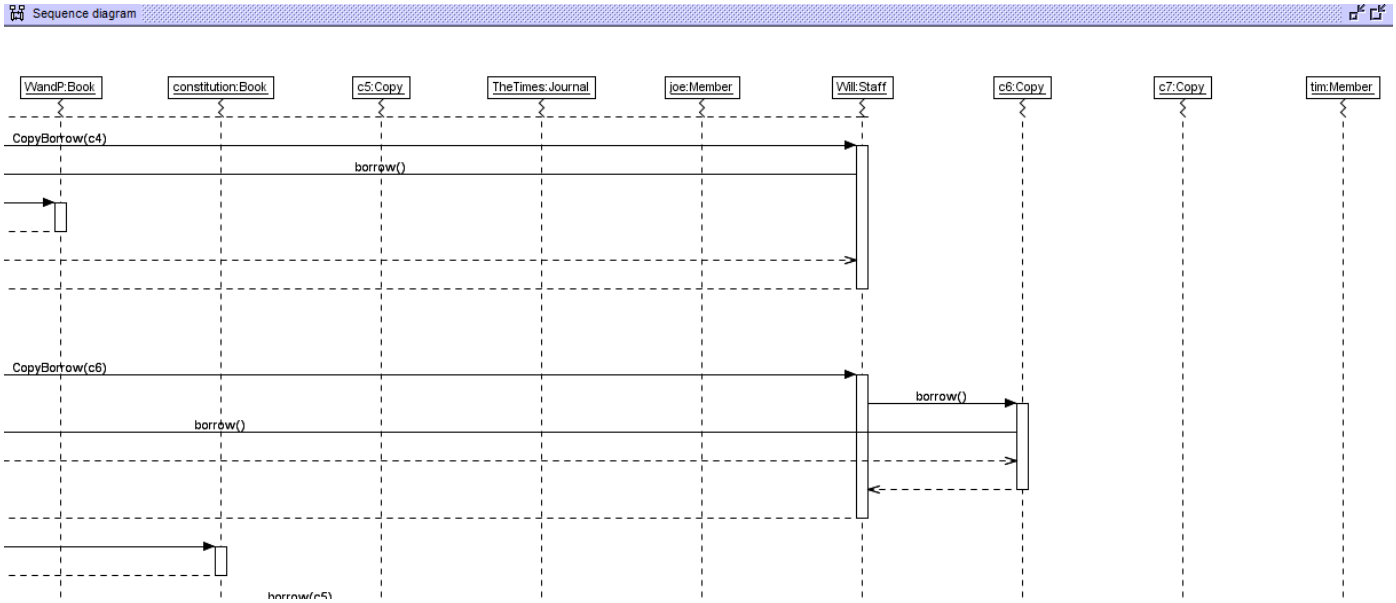
constitution:Book
c5:Copy
TheTimes:Journal
CopyBorrow(c4)
borrow()
borrow()
newCopy(c6)
CopyBorrow(c6)
borrow()
newCopy(c7)
borrow(c5)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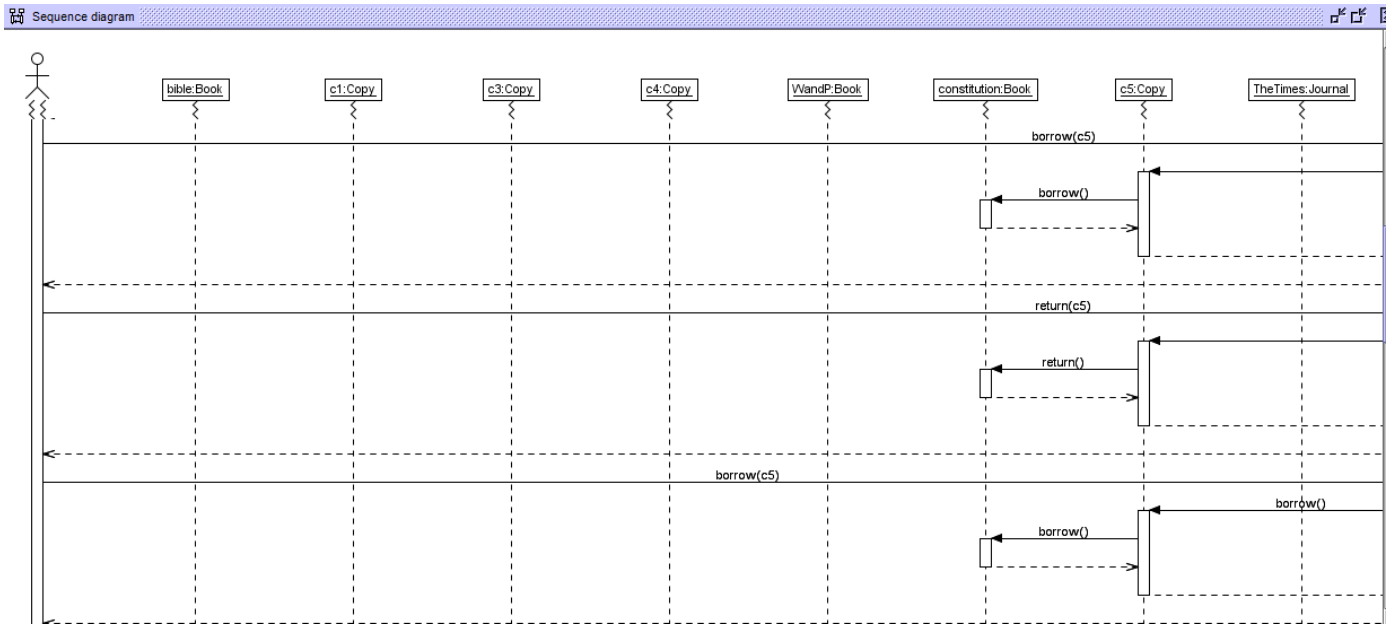
TheTimes:Journal
joe:Member
Will:Staff
c6:Copy
c7:Copy
tim:Member
CopyBorrow(c4)
borrow()
CopyBorrow(c6)
borrow()
borrow()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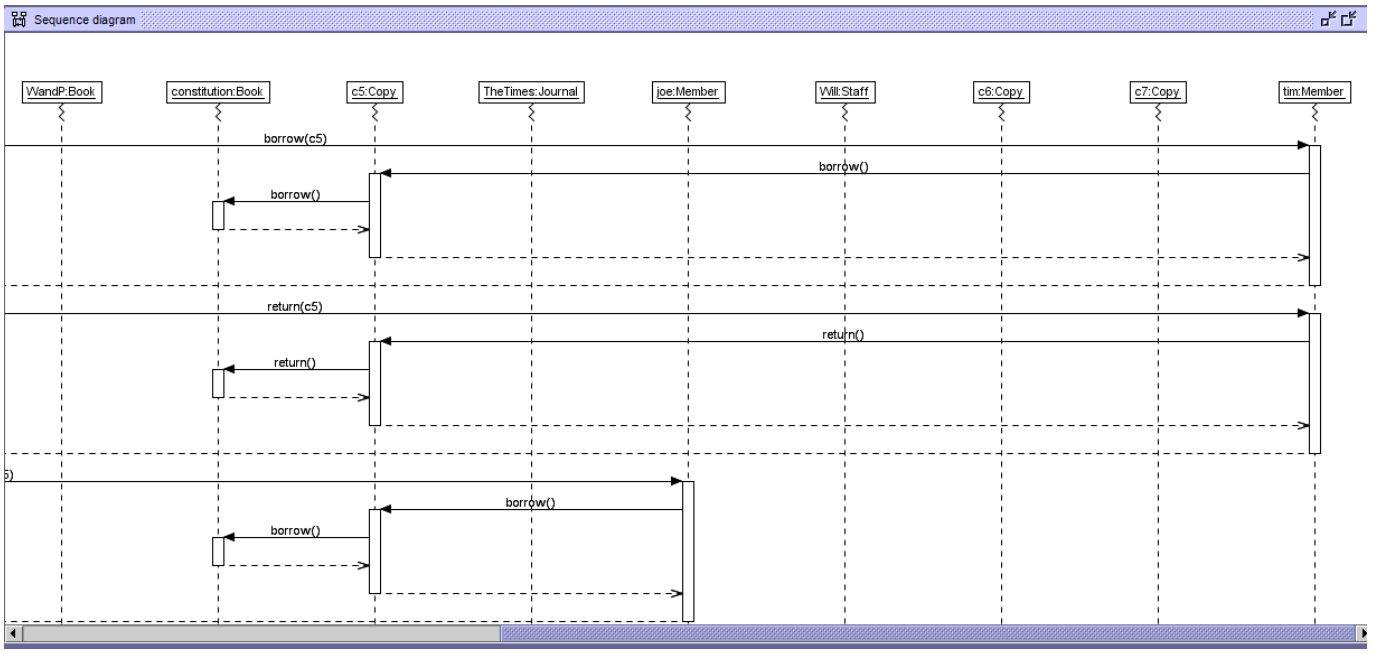
return(c5)
return()
borrow(c5)
borrow()
borrow()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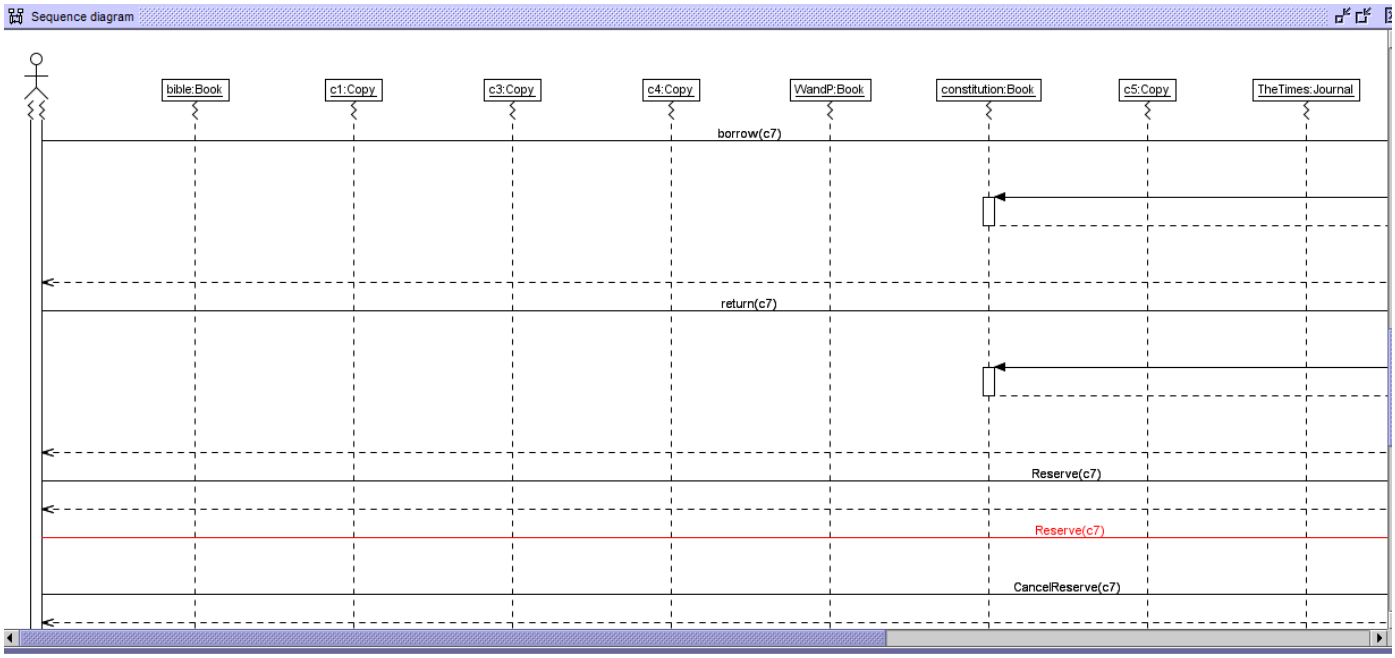
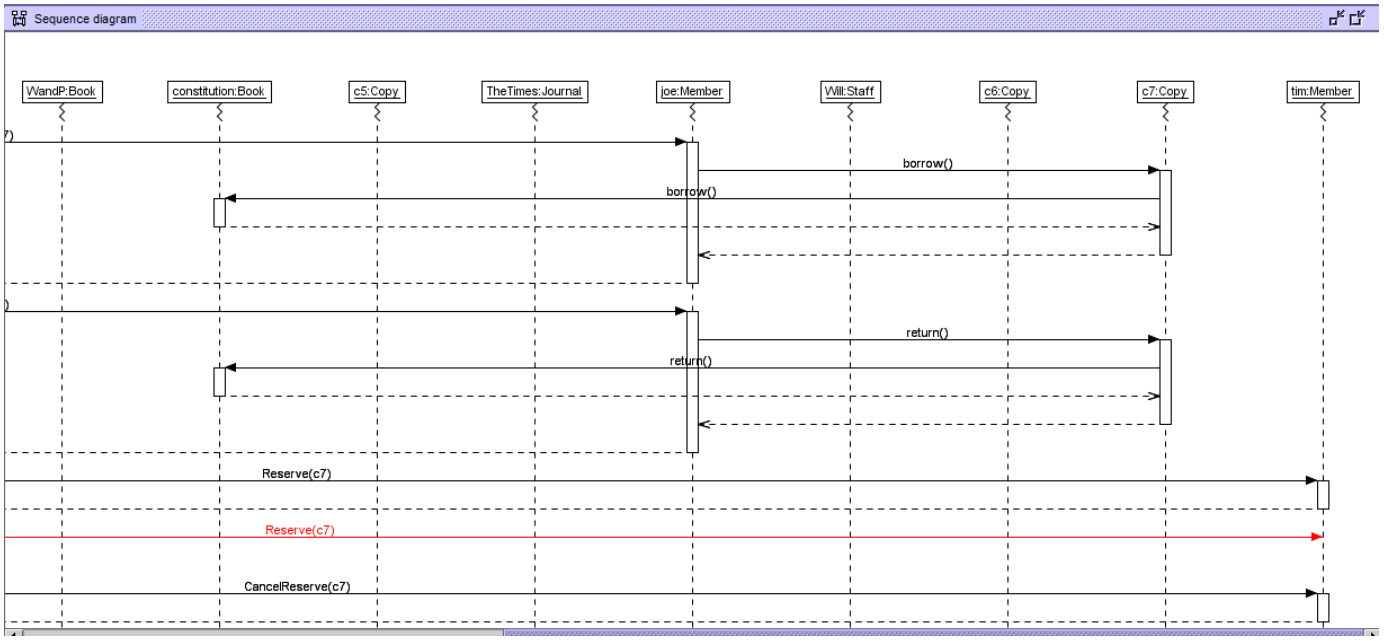
Will:Staff
c6:Copy
c7:Copy
tim:Member
borrow(c5)
borrow()
borrow()
return(c5)
return()
return()
borrow()
borrow()


Sequence diagram
bible:Book
c1:Copy
c3:Copy
c4:Copy
WandP:Book
constitution:Book
c5:Copy
TheTimes:Journal
borrow(c7)
return(c7)
Reserve(c7)
Reserve(c7)
CancelReserve(c7)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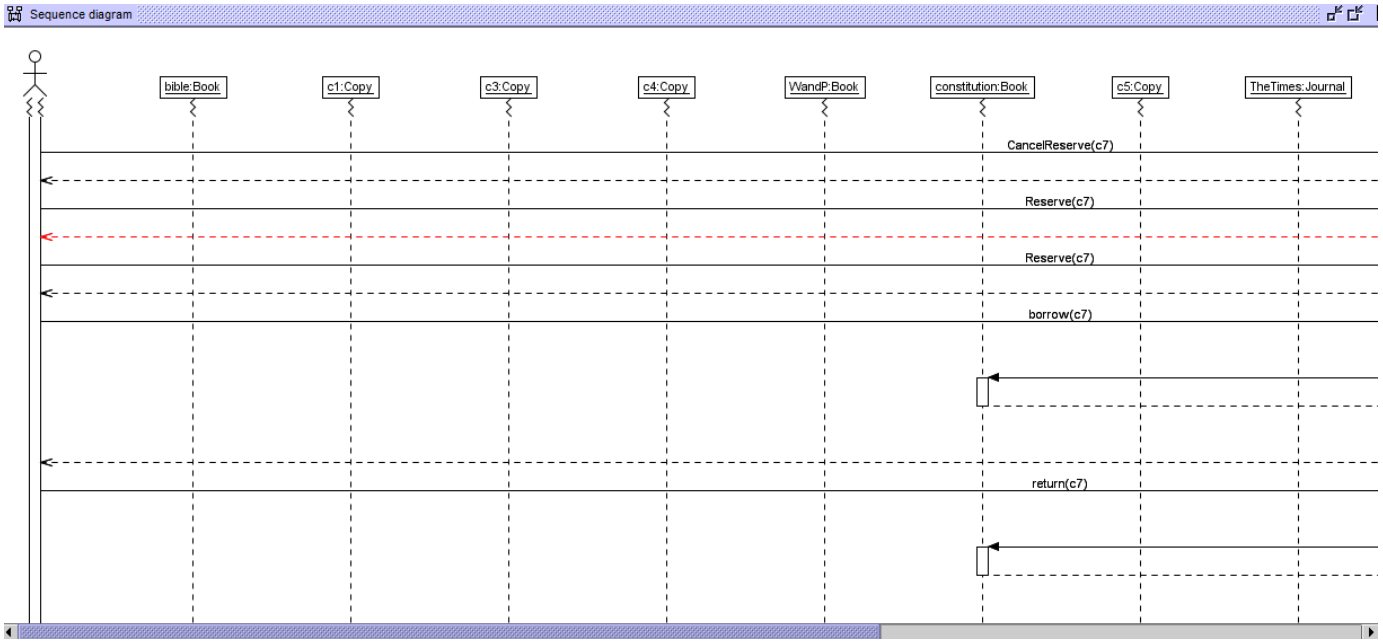
TheTimes:Journal
joe:Member
Will:Staff
c6:Copy
c7:Copy
tim:Member
borrow()
borrow()
return()
return()
Reserve(c7)
Reserve(c7)
CancelReserve(c7)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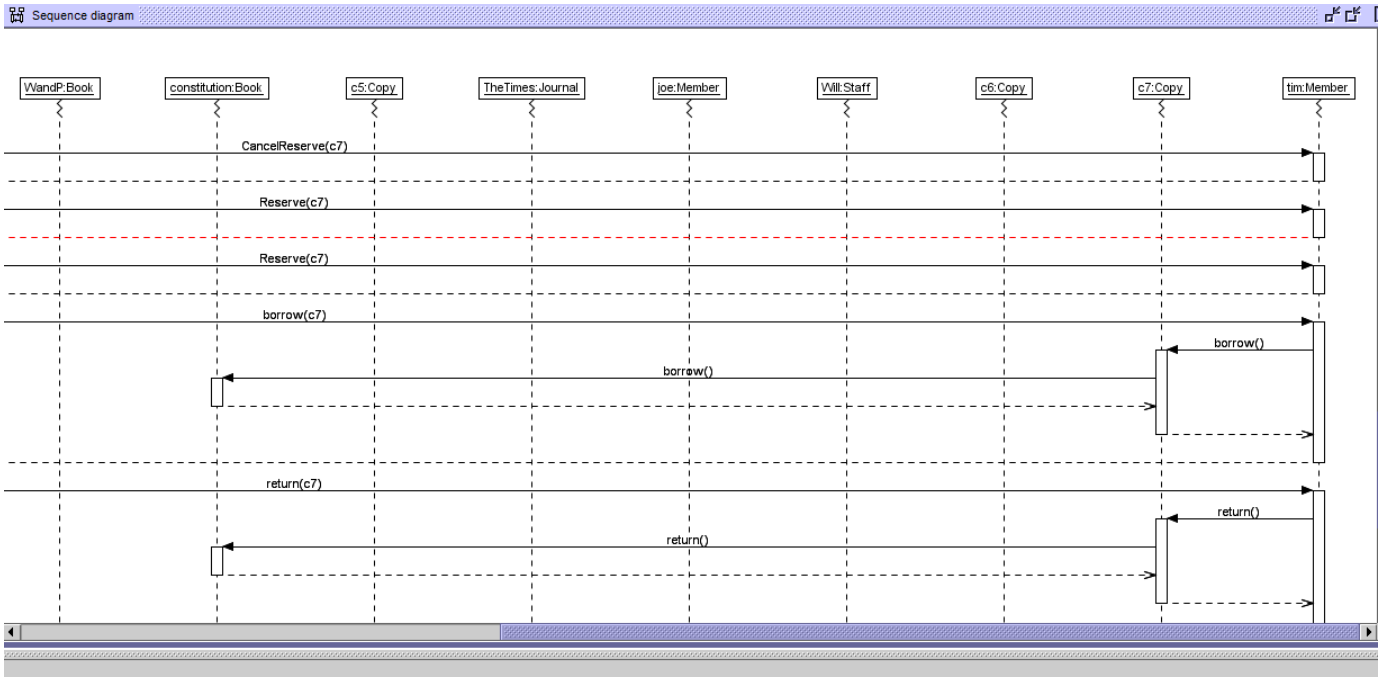
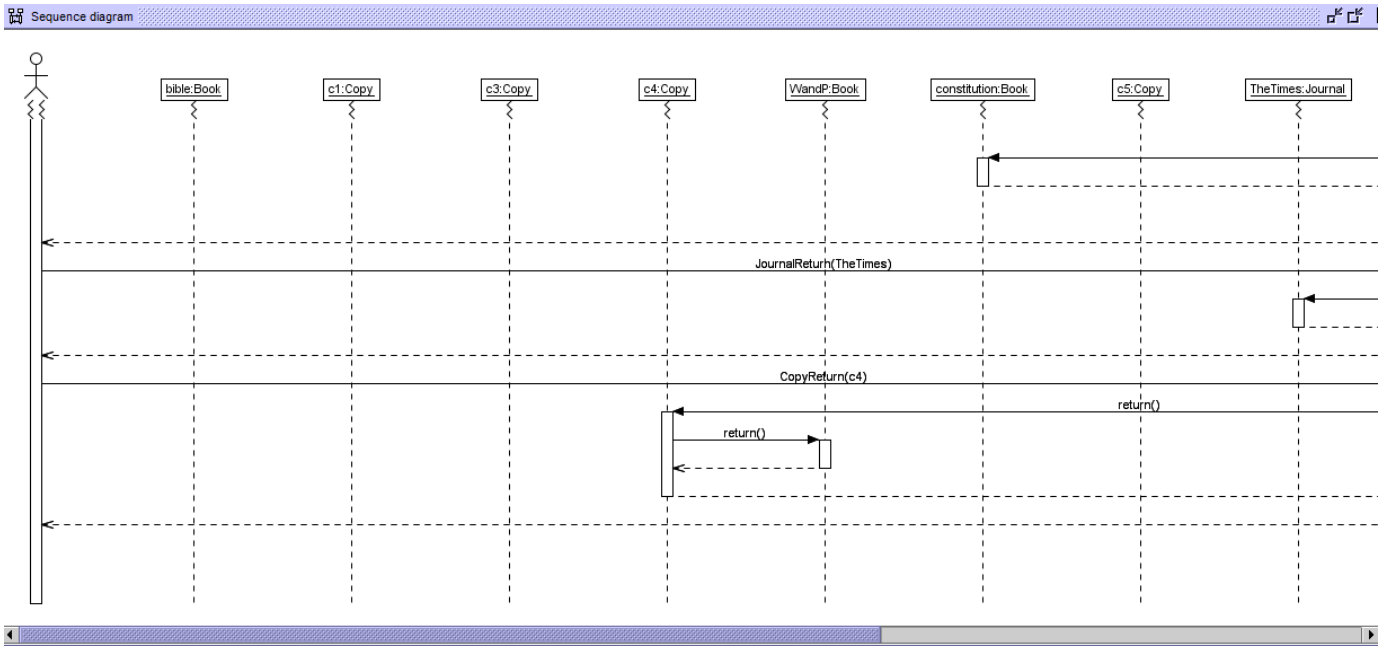
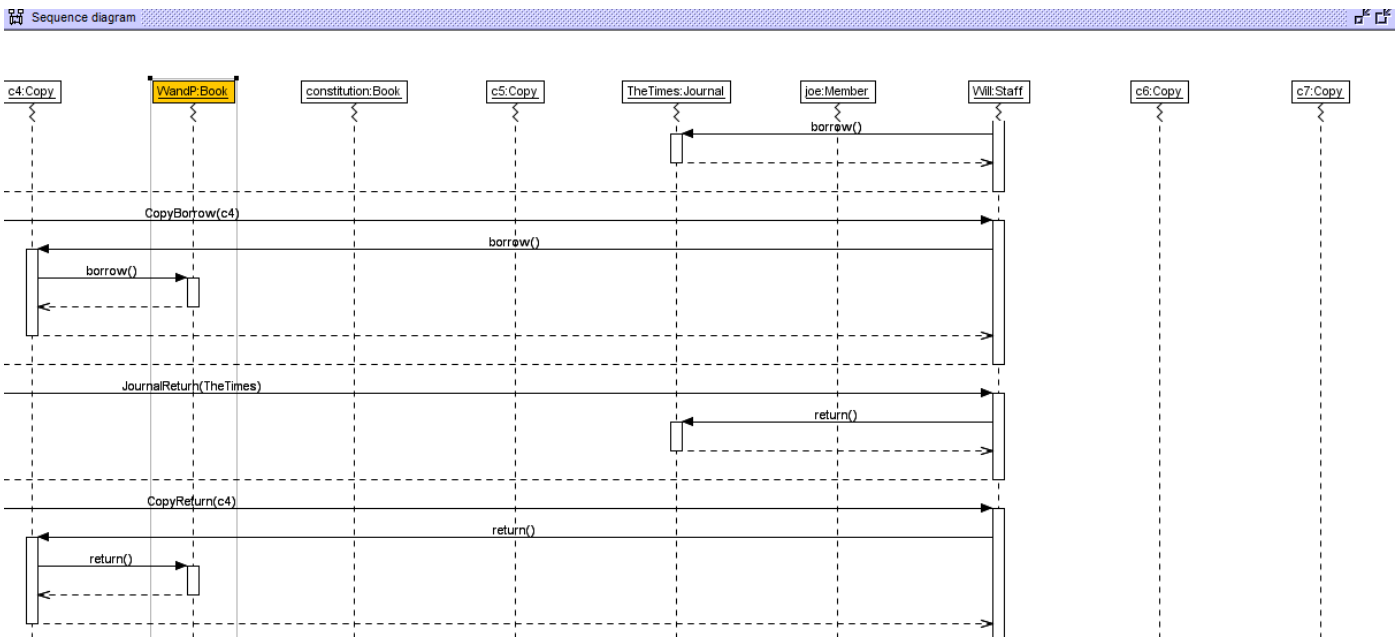
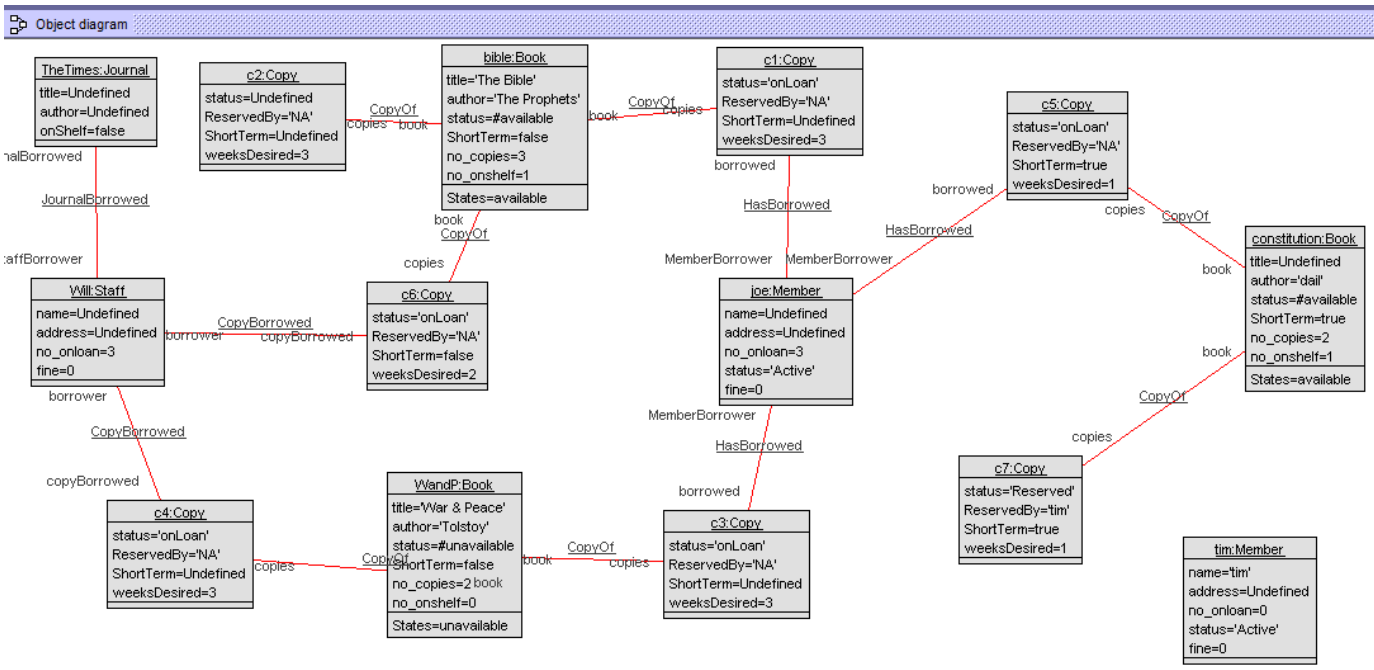
c3:Copy
c4:Copy
WandP:Book
constitution:Book
c5:Copy
TheTimes:Journal
CancelReserve(c7)
Reserve(c7)
Reserve(c7)
borrow(c7)
return(c7)

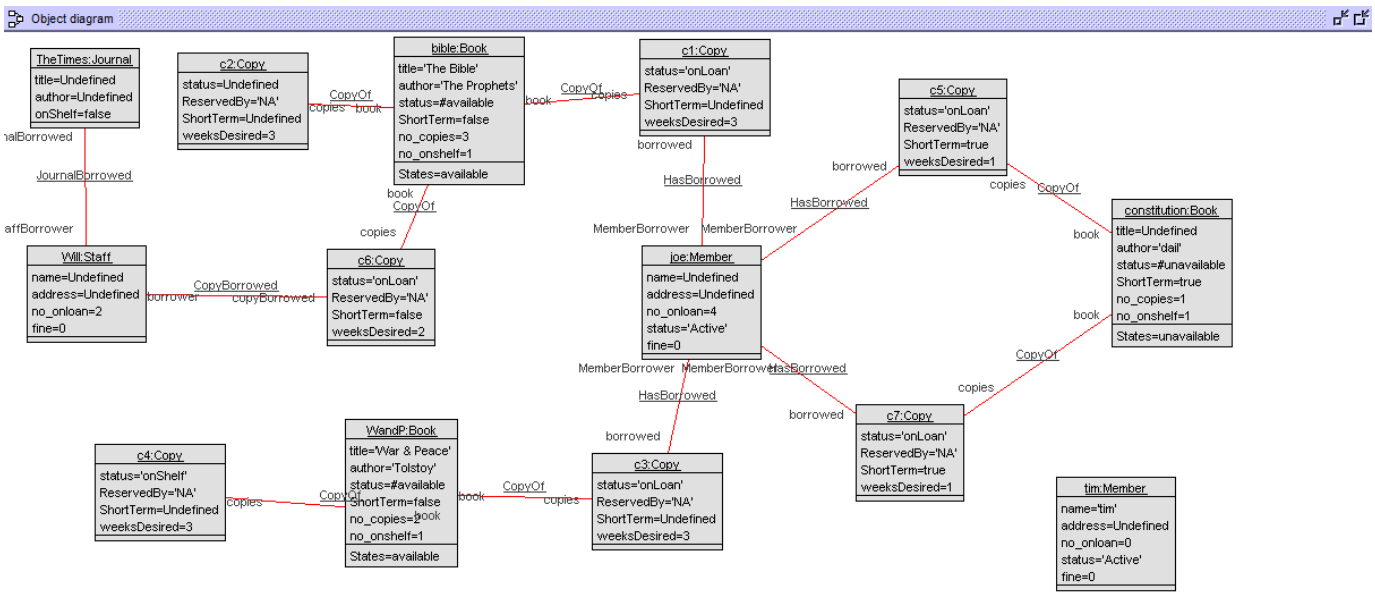

Sequence diagram
WandP:Book
constitution:Book
c5:Copy
TheTimes:Journal
joe:Member
Will:Staff
c6:Copy
c7:Copy
tim:Member
CancelReserve(c7)
Reserve(c7)
Reserve(c7)
borrow(c7)
borrow()
borrow()
return(c7)
return()
return()


Sequence diagram
bible:Book
c1:Copy
c3:Copy
c4:Copy
WandP:Book
constitution:Book
c5:Copy
TheTimes:Journal
JournalReturn(TheTimes)
CopyReturn(c4)
return()
return()

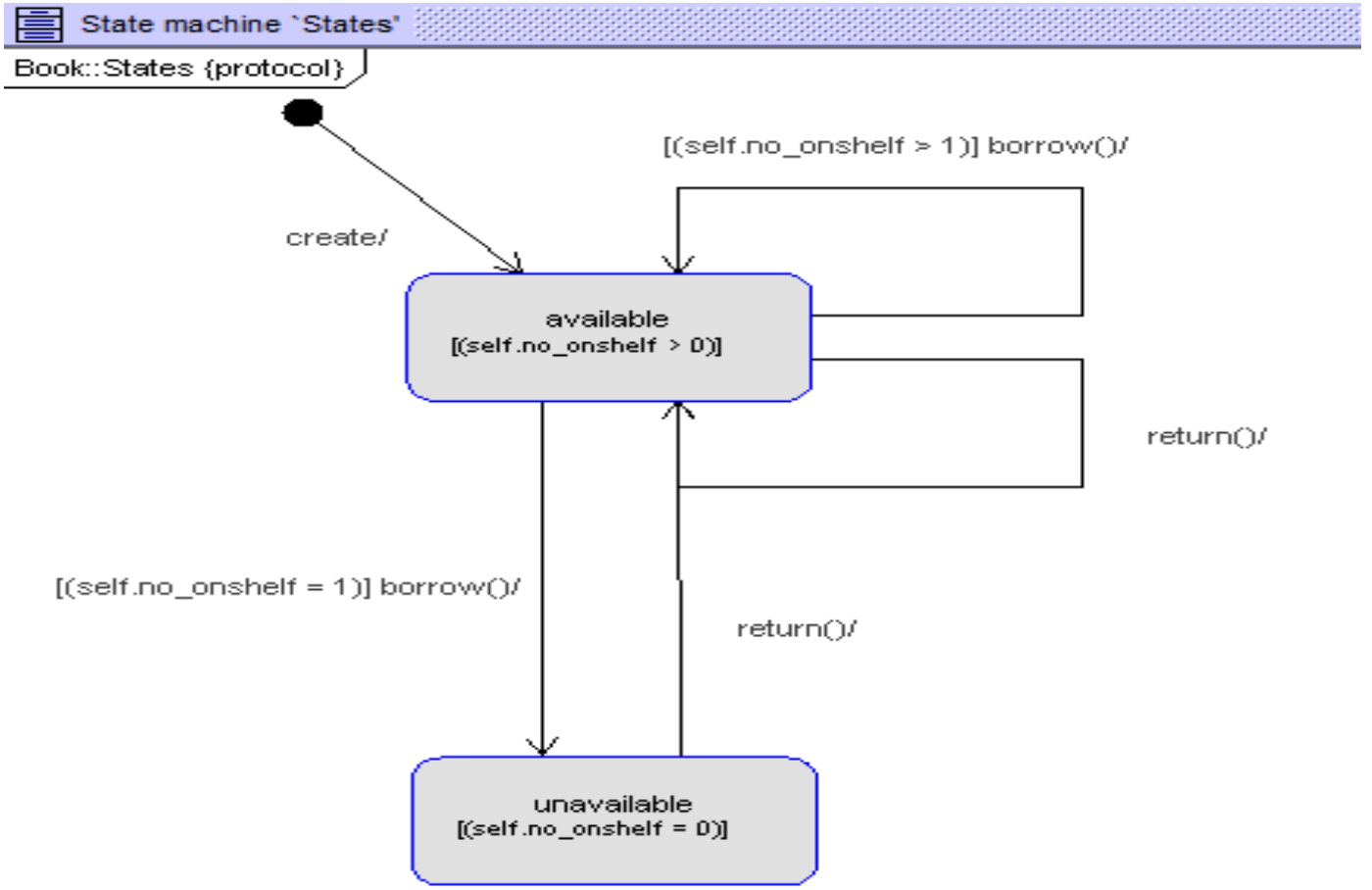

Sequence diagram
c4:Copy
WandP:Book
constitution:Book
c5:Copy
TheTimes:Journal
joe:Member
Will:Staff
c6:Copy
c7:Copy
borrow()
CopyBorrow(c4)
borrow()
borrow()
JournalReturn(TheTimes)
return()
CopyReturn(c4)
return()
return()

Object Diagrams

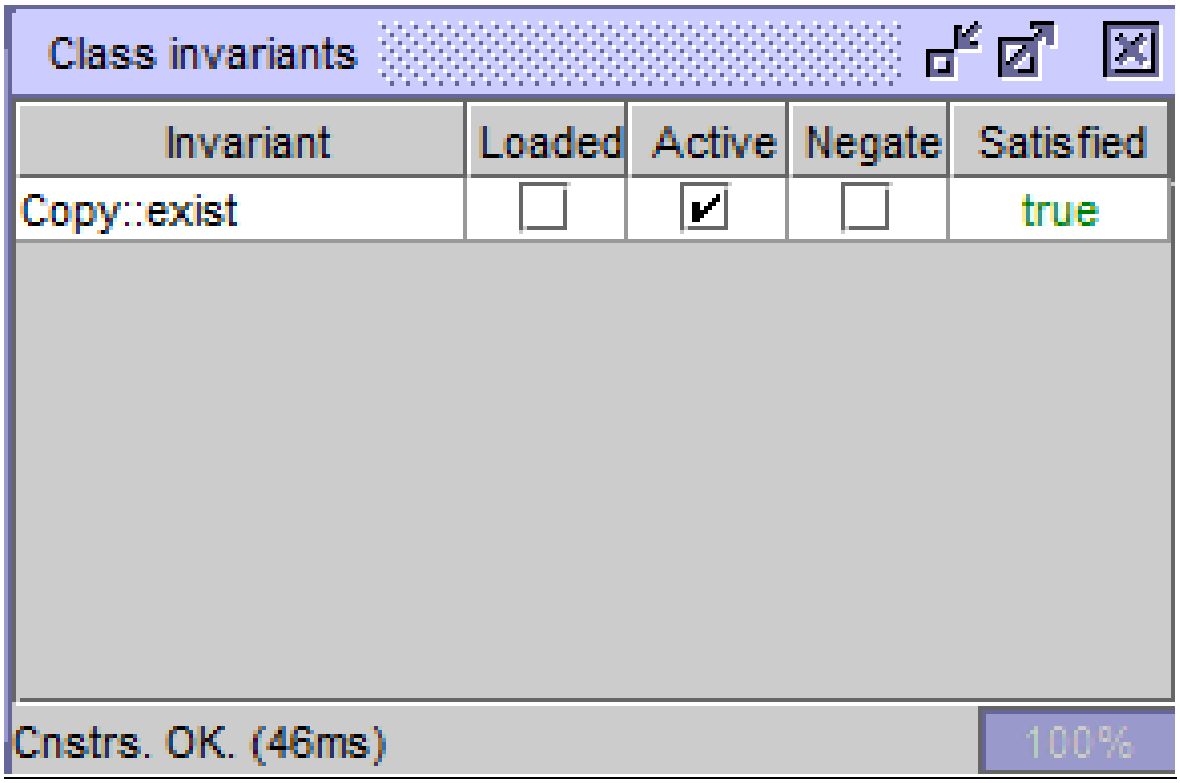




State Machine for Class Book



Class Invariant:



Testing Constraints on the Command Prompt

```
use> !tim.borrow(TheTimes)
<input>:1:0: Type mismatch for operation borrow(c : Copy) in argument 1. Expected type `Copy', found `Journal'.
use> _
```

```
use> !Will.JournalBorrow(TheTimes)
[Error] 2 preconditions in operation call `Staff::JournalBorrow(self:Will, j:TheTimes)' do not hold:
  status1: (j.onShelf = true)
    j : Journal = TheTimes
    j.onShelf : Boolean = false
    true : Boolean = true
    (j.onShelf = true) : Boolean = false

  cond1: self.journalBorrowed->excludes(j)
    self : Staff = Will
    self.journalBorrowed : Journal = TheTimes
    self.journalBorrowed : Set(Journal) = Set{TheTimes}
    j : Journal = TheTimes
    self.journalBorrowed->excludes(j) : Boolean = false

  call stack at the time of evaluation:
    1. Staff::JournalBorrow(self:Will, j:TheTimes) [caller: Will.JournalBorrow(TheTimes)@<input>:1:0]

+-----------------------------------------------------------------+
| Evaluation is paused. You may inspect, but not modify the state. |
+-----------------------------------------------------------------+

Currently only commands starting with `?', `:', `help' or `info' are allowed.
`c' continues the evaluation (i.e. unwinds the stack).

> _
```

```
use> !Will.CopyBorrow(c4)
[Error] 2 preconditions in operation call `Staff::CopyBorrow(self:Will, c:c4)' do not hold:
  status1: (c.status = 'onShelf')
    c : Copy = c4
    c.status : String = 'onLoan'
    'onShelf' : String = 'onShelf'
    (c.status = 'onShelf') : Boolean = false

  cond1: self.copyBorrowed->excludes(c)
    self : Staff = Will
    self.copyBorrowed : Set(Copy) = Set{c4,c6}
    c : Copy = c4
    self.copyBorrowed->excludes(c) : Boolean = false

  call stack at the time of evaluation:
    1. Staff::CopyBorrow(self:Will, c:c4) [caller: Will.CopyBorrow(c4)@<input>:1:0]

+-----------------------------------------------------------------+
| Evaluation is paused. You may inspect, but not modify the state. |
+-----------------------------------------------------------------+

Currently only commands starting with `?', `:', `help' or `info' are allowed.
`c' continues the evaluation (i.e. unwinds the stack).

> _
```

```
use> !joe.borrow(c7)
[Error] 1 precondition in operation call `Member::borrow(self:joe, c:c7)' does not hold:
  Resereved: if (c.ReservedBy <> 'NA') then (c.ReservedBy = self.name) else (c.ReservedBy = 'NA') endif
    c : Copy = c7
    c.ReservedBy : String = 'tim'
    'NA' : String = 'NA'
    (c.ReservedBy <> 'NA') : Boolean = true
    c : Copy = c7
    c.ReservedBy : String = 'tim'
    self : Member = joe
    self.name : OclVoid = Undefined
    (c.ReservedBy = self.name) : Boolean = false
    if (c.ReservedBy <> 'NA') then (c.ReservedBy = self.name) else (c.ReservedBy = 'NA') endif : Boolean = false

  call stack at the time of evaluation:
    1. Member::borrow(self:joe, c:c7) [caller: joe.borrow(c7)@<input>:1:0]

+-----------------------------------------------------------------+
| Evaluation is paused. You may inspect, but not modify the state. |
+-----------------------------------------------------------------+

Currently only commands starting with `?', `:', `help' or `info' are allowed.
`c' continues the evaluation (i.e. unwinds the stack).

>
```

```
use> !openter tim Reserve(c7)
precondition `status' is false
Error: precondition false in operation call `Member::Reserve(self:tim, c:c7)'.
use> !opexit
Error: No current operation
use> !tim.CancelReserve(c7)
use> !tim.CancelReserve(c7)
[Error] 1 precondition in operation call `Member::CancelReserve(self:tim, c:c7)' does not hold:
  status: (c.status = 'Reserved')
    c : Copy = c7
    c.status : String = 'onShelf'
    'Reserved' : String = 'Reserved'
    (c.status = 'Reserved') : Boolean = false

  call stack at the time of evaluation:
    1. Member::CancelReserve(self:tim, c:c7) [caller: tim.CancelReserve(c7)@<input>:1:0]

+-----------------------------------------------------------------+
| Evaluation is paused. You may inspect, but not modify the state. |
+-----------------------------------------------------------------+

Currently only commands starting with `?', `:', `help' or `info' are allowed.
`c' continues the evaluation (i.e. unwinds the stack).

>
```

```
use> !openenter tim Reserve(c7)
precondition `status' is true
use> opexit
Error: Unknown command `opexit'. Try `help'.
use> !opexit
postcondition `status2' is false
  c : Copy = c7
  c.status : String = 'onShelf'
  'Reserved' : String = 'Reserved'
  (c.status = 'Reserved') : Boolean = false
Error: postcondition false in operation call `Member::Reserve(self:tim, c:c7)'.
use> !openenter tim Reserve(c7)
precondition `status' is true
use> !c7.status := 'Reserved'
use> !c7.ReservedBy := tim.name
use> !opexit
postcondition `status2' is true
```

```
use> !tim.borrow(c7)
use> !tim.borrow(c7)
[Error] 2 preconditions in operation call `Member::borrow(self:tim, c:c7)' do not hold:
  status: (c.status <> 'onLoan')
    c : Copy = c7
    c.status : String = 'onLoan'
    'onLoan' : String = 'onLoan'
    (c.status <> 'onLoan') : Boolean = false

  cond1: self.borrowed->excludes(c)
    self : Member = tim
    self.borrowed : Set(Copy) = Set{c7}
    c : Copy = c7
    self.borrowed->excludes(c) : Boolean = false

  call stack at the time of evaluation:
    1. Member::borrow(self:tim, c:c7) [caller: tim.borrow(c7)@<input>:1:0]

+-----------------------------------------------------------------+
| Evaluation is paused. You may inspect, but not modify the state. |
+-----------------------------------------------------------------+

Currently only commands starting with `?', `:', `help' or `info' are allowed.
`c' continues the evaluation (i.e. unwinds the stack).

> c
Error: precondition false in operation call `Member::borrow(self:tim, c:c7)'.
use>
```

```
use> !tim.return(c7)
use> !tim.return(c7)
[Error] 2 preconditions in operation call `Member::return(self:tim, c:c7)' do not hold:
  status: (c.status = 'onLoan')
    c : Copy = c7
    c.status : String = 'onShelf'
    'onLoan' : String = 'onLoan'
    (c.status = 'onLoan') : Boolean = false

  cond1: self.borrowed->includes(c)
    self : Member = tim
    self.borrowed : Set(Copy) = Set{}
    c : Copy = c7
    self.borrowed->includes(c) : Boolean = false

  call stack at the time of evaluation:
    1. Member::return(self:tim, c:c7) [caller: tim.return(c7)@<input>:1:0]

+-----------------------------------------------------------------+
| Evaluation is paused. You may inspect, but not modify the state. |
+-----------------------------------------------------------------+

Currently only commands starting with `?', `:', `help' or `info' are allowed.
`c' continues the evaluation (i.e. unwinds the stack).

>
```

```
use> !Will.JournalReturn(TheTimes)
use> !Will.JournalReturn(TheTimes)
[Error] 2 preconditions in operation call `Staff::JournalReturn(self:Will, j:TheTimes)' do not hold:
  status1: (j.onShelf = false)
    j : Journal = TheTimes
    j.onShelf : Boolean = true
    false : Boolean = false
    (j.onShelf = false) : Boolean = false

  cond1: self.journalBorrowed->includes(j)
    self : Staff = Will
    self.journalBorrowed : OclVoid = Undefined
    self.journalBorrowed : Set(Journal) = Set{}
    j : Journal = TheTimes
    self.journalBorrowed->includes(j) : Boolean = false

  call stack at the time of evaluation:
    1. Staff::JournalReturn(self:Will, j:TheTimes) [caller: Will.JournalReturn(TheTimes)@<input>:1:0]

+-----------------------------------------------------------------+
| Evaluation is paused. You may inspect, but not modify the state. |
+-----------------------------------------------------------------+

Currently only commands starting with `?', `:', `help' or `info' are allowed.
`c' continues the evaluation (i.e. unwinds the stack).

>
```

```
use> !Will.CopyReturn(c4)
use> !Will.CopyReturn(c4)
[Error] 2 preconditions in operation call `Staff::CopyReturn(self:Will, c:c4)' do not hold:
  status: (c.status = 'onLoan')
    c : Copy = c4
    c.status : String = 'onShelf'
    'onLoan' : String = 'onLoan'
    (c.status = 'onLoan') : Boolean = false

  cond1: self.copyBorrowed->includes(c)
    self : Staff = Will
    self.copyBorrowed : Set(Copy) = Set{c6}
    c : Copy = c4
    self.copyBorrowed->includes(c) : Boolean = false

  call stack at the time of evaluation:
    1. Staff::CopyReturn(self:Will, c:c4) [caller: Will.CopyReturn(c4)@<input>:1:0]

+-------------------------------------------------------------------+
| Evaluation is paused. You may inspect, but not modify the state. |
+-------------------------------------------------------------------+

Currently only commands starting with `?', `:', `help' or `info' are allowed.
`c' continues the evaluation (i.e. unwinds the stack).

>
```

Report on the Library Specification

Introduction:

The report on an extension of the Library Specification that was discussed within class time. I will look at how the library model functions in accordance with how people would interact with the staff of the library and how the staff would interact with the system internally. I would also look at the limitations of the library specification and see if I get the expect results from building and testing the model.

We look at the different part. There is Journals and books in the library system. Each book has several copies associated with the book. Each journal does not have multiply copies themselves. The type of people who are interacting with the system are Members of the Library, who are ordinary people who have successfully applied for membership of the Library, and the staff of the library, the workers of the library.

The library system has its own way of loaning out the books and journals. Members are only able to borrow six books at any time, and only books. Members are not allowed to borrow journals. The staff can borrow the books and journals if they wish. Within a combination of both, Staff can borrow up to 12 at any given time. After both members and staff have passed their limitations, they cannot borrow any more copies.

We will build a system to ensure that the above requirements are met, and test them in accordance with possible questions such as

“Can Members of the Library and Staff members borrow Journals in this sytem?”

We wish to not allow such events to happen within the system as outlined in the specification given.

Method:

We built the model in the language use and soil in uml. By building the objects, I would have a way of testing the capabilities of the system. To ensure the system followed the specifications, I built the appropriate constraints to ensure the system flowed in the expect way. After building all the classes and constraints, I built the associations to ensure there is a connection between each object that interacted with each other.

Once the building of the framework is completed, I build object using a soil file. This was the quickest way to test each object simultaneously. I would want to make sure that every connection, function and behaviours are appropriate before I try to test the faults of the system (if there was any). If I found a huge fault, I would immediately implement a constraint to prevent it from happening further down the line. I then check if this impacts any other part of the system that I wish it would not.

After each testing, I document the results so I knew what the behaviours are acting out as. If there was a flawed pattern, I would find it using the method of building and testing. The objects which I were testing would dynamically change depend on what I interact with. I would also look at the

sequence diagram to see what exactly was happening within the programme. Some of the findings was screenshotted in this report above. Using the uml command line, I tested multiple objects and took screenshots of our findings and pasted them in this document. I also saved the testing as a text file to look back upon.

The class file associated with this work as well as the object file was laid out as visually pleasing for other users. The object file would be the file that dynamically change based upon our input. Once one object satisfied our requirements, I move onto the next object to test.

Evaluation of Findings:

Summary of the findings example:

We will take the bible as an example. There are two copies available in this library. I will call them c1 and c2. There are two members, tim and joe. There is one staff, who is called Will. There is one journal which is known as the times. Will can borrow both both the bible (c1) and the times. So he does. tim comes along and requests to borrow a copy of the bible. He cannot borrow c1 since Will has already borrowed it. However there is c2, which he can borrow. The bible status remains to be available until c2 is taken from the shelf. After that, the status becomes unavailable.

Joe comes along and request a copy of the bible. However, He cannot take c2 nor reserve it at the moment since it is unavailable. However, when Will returns the bible, Joe can reserve it for himself to ensure no one else can take it. If he wants to release it back to open use, he can cancel the reservation so someone else can have the copy for themselves. These are the limitations of the system and the summary of the results.

Initially, the objects would be all over the place with each person be able to borrow an book that is already loaned, as well as reborrow the book that they already borrowed. To prevent this, the constraints implemented ensured that each journal and book can be only borrowed by one person at any time. Books available but only if they have a copy on the shelf ready to be borrowed.

The same rules applied to both staff and members. If a copy is already out, it cannot be borrowed. This is done by checking each copy availability. For example, the system has three words that it is switched from: “onShelf”, “Reserved” and “Loaned”. By comparing to these values, I can compare on whether each person can borrow the book. Once it is fully completed and fully tested, I continue to test to get to the result as the example explained briefly above. I went to ensure the system behaved as the specification requested.

Conclusion:

The system was finally tested and deemed completed after all the implementations of both the use, soil and the diagrams documentation. After the testing has been completed, I went back to the panel which had all the ideas and made sure all the instructions have been followed. After that has been completed, I went back over the data to ensure the results are what I had expected. The first couple were not up to standard, but after fixing them, the results eventually came back to what was

expected. The system could go on to be designed for more book genres and people specification (such as newspapers and Managers) but the system designed was enough to do the satisfied work.