Test Plan

Client

The client has many commands that it can send to the server:

1) quit → closes the connection between the server and the client

2) create → creates a new box

3) open → opens an existing box for the client

4) next → prints the next message in the box to the user

5) put → puts/stores a message in a message box

6) delete → delete a specific box

7) close → closes an open bos

The client tries to connect to the server for three times in case it fails the first two times. Once it connects, it receives messages from the server and based on these messages, it outputs non-protocol messages to the user. The client also has a help method that can help the user navigate all the commands. Most of the command functions were implemented using string manipulation methods that we have implemented ourselves, such as getSubString which return a subString if given the main string, and start and end indices. We also used few other functions from the string.h library such as strcmp and strstr to help us with processing the messages received from the server.

Server

The server has many tasks that have to be dealt with:

1) Listen for connections

2) Open a new thread per connection

3) Store all the shared data in a Mailbox System

4) Make sure that no threads are trying to read/write to shared memory simultaneously

5) Listen for the ctrl-c signal to properly free all memory and shut down the server connection

Listening for client connections was put in the main function because accept() will block until a connection is established. When a connection occurred, a thread will run with an initClient() function that had all the code to properly allow the client to read/write data to the Mailbox System.

Data Structures used for Mailbox System

The Mailbox System is a linked list of Message Box nodes. A Message Box node consists of 4 parts: The name of the message box, whether the message box is open or not, a pointer to the next message box, and also a pointer to a Queue. The queue is a linked list of nodes, where each node holds a character array to hold a message, and each node points to a next node. The queue system is used to store messages from the PUTMG and NXTMG commands in the proper order.

Handling Synchronization and Freeing Memory

Mutex's are used in order to make sure that no two clients were reading or writing information to the Mailbox System at the same time. When the user presses ctrl-c to end the server, the signal is detected and calls an exitServer() function. All threads, mutexes, and the entire Mailbox System gets free()'d properly to ensure no memory leaks are present.

Test Case 1

In this test case we wanted to test for general functionality of creating, opening, putting, and getting a message from a message box.

Client

```
./DUMBclient ilab2.cs.rutgers.edu 19005
Success. You are connected.
Please choose a command from the command list below:
1. quit
2. create
3. delete
4. open
5. close
6. next
7. put
create
Okay, enter the name of the box
create:> messagebox1
Successfully created
open
Okay, open which message box?
open:> messagebox1
Successfully opened
put
Okay, enter the message you want to put in the box.
put:> hello, there!
Success. Message was put in the message box
next
hello, there!
next
Error. No messages left in this message box
close
Okay, close which message box?
messagebox1
Successfully closed
quit
Connection closed
```

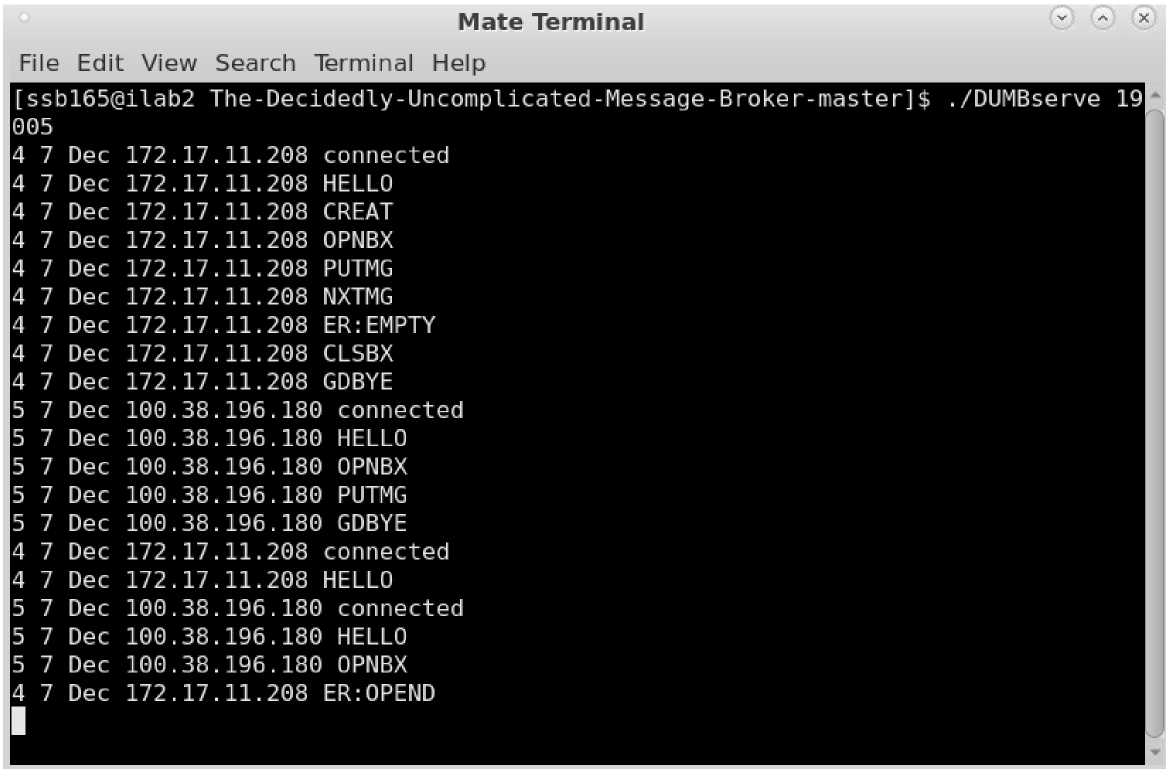
Server

```
4 7 Dec 172.17.11.208 connected
4 7 Dec 172.17.11.208 HELLO
4 7 Dec 172.17.11.208 CREAT
4 7 Dec 172.17.11.208 OPNBX
```

```
4 7 Dec 172.17.11.208 PUTMG
4 7 Dec 172.17.11.208 NXTMG
4 7 Dec 172.17.11.208 ER:EMPTY
4 7 Dec 172.17.11.208 CLSBX
4 7 Dec 172.17.11.208 GDBYE
```

Test Case 2

In this test case, we wanted to test multi-connections within our server system. We repeated Test Case 1 on 2 clients, one run on linux, the other run on Windows. We creating a messagebox1 and opened messagebox1 on Linux. The Windows client then tried to open messagebox1, but got an ER:OPEND, because the Linux client already opened it first and did not close it. The screenshot of the server demonstrates these connections by looking at what the server outputted on the next page.



```
[ssb165@ilab2 The-Decidedly-Uncomplicated-Message-Broker-master]$ ./DUMBserve 19
005
4 7 Dec 172.17.11.208 connected
4 7 Dec 172.17.11.208 HELLO
4 7 Dec 172.17.11.208 CREAT
4 7 Dec 172.17.11.208 OPNBX
4 7 Dec 172.17.11.208 PUTMG
4 7 Dec 172.17.11.208 NXTMG
4 7 Dec 172.17.11.208 ER:EMPTY
4 7 Dec 172.17.11.208 CLSBX
4 7 Dec 172.17.11.208 GDBYE
5 7 Dec 100.38.196.180 connected
5 7 Dec 100.38.196.180 HELLO
5 7 Dec 100.38.196.180 OPNBX
5 7 Dec 100.38.196.180 PUTMG
5 7 Dec 100.38.196.180 GDBYE
4 7 Dec 172.17.11.208 connected
4 7 Dec 172.17.11.208 HELLO
5 7 Dec 100.38.196.180 connected
5 7 Dec 100.38.196.180 HELLO
5 7 Dec 100.38.196.180 OPNBX
4 7 Dec 172.17.11.208 ER:OPEND
```

Test Case 3

With this test case we wanted to test the limit for putting a really really long message into a message box.

Client

```
open
Okay, open which message box?
open:> messagebox1
Successfully opened
```

```
put
Okay, enter the message you want to put in the box.
put:>
kmplikhhpirbqnkxuiyjcqfpriddyertovsaxvlrfacmtvisrjjmphrvgwgnlyfwifjtuzhzcwperpcfrosfvobgrugdauxirlhdirbgxdcxvlvfhsqgzaaylmnqfcofbzaddyxohjiznujwyconvqsig
jqcdvwvgqrtcppllmefqrkzwrfvstqjftatvltldxoagukmsrqrcvekoapipiihacsvbidtdlbjqojzihnnaxtxiejujkxinnzuvxcloxztxilcvregtmjnvastckjycuveeiugxnbstsdsbechlmzjojrprt
eedrrnnanzpltstdjxreuoqfjbbauwmxulfkpjgptkwpuxbkjdmmrymanrkjwqlvnrlvlbpgelgdhyuiyzscimupyvenclhqajchkzrpyosghostabvjmyppgrlxpnkmlasiedngkoopoodlk
nuzzvotwyrpkabsyuygjaxivmjulkuubihjvqgjuecdwlquunkvieahpaoquakczsopoocooqrneacvuubtcdsvjbogwbbzqnezjqjfihryzkeqvkbhxoaoorjxhwzahkasldskqgmhqjgvpa
qpmfycmsajazizbbhcbidjlzpjmuiszmurqnowywpwacxclhigsjdvccdynuzyjncrhvqlyjhtedaiewgybkmiyjtonprtuvnafagwpbdsjqsstvqisyxjqrlyscvinnfohtavqdocijsovabvtgzt
urppygyplqojcfdywmbakxmgytpwdfoiydpctnnrwerksmnqfc
Your message was trimmed
Success. Message was put in the message box
next
hey, world
next
kmplikhhpirbqnkxuiyjcqfpriddyertovsaxvlrfacmtvisrjjmphrvgwgnlyfwifjtuzhzcwperpcfrosfvobgrugdauxirlhdirbgxdcxvlvfhsqgzaaylmnqfcofbzaddyxohjiznujwyconvqsig
jqcdvwvgqrtcppllmefqrkzwrfvstqjftatvltldxoagukmsrqrcvekoapipiihacsvbidtdlbjqojzihnnaxtxiejujkxinnzuvxc
```

Here we see that the user inputted an 800 character long string, however the client notifies the user that their message has been trimmed and saved. When the user asks for the message back, they get 255 characters. This is because the limit of a message is 256 bytes including the null terminator, 255 bytes free to set by the user.

Test Case 4

This test case was created to make sure that 2 clients cannot try to open/delete/close each other's message boxes. The client output is pasted below for client 1. Note that client 2 has messagebox2 open and messagebox3 does not exist.

Client

```
open
Okay, open which message box?
open:> messagebox1
Successfully opened
close
Okay, close which message box?
messagebox2
Error. This box is not currently open
close
Okay, close which message box?
messagebox3
Error. This box is not currently open
delete
Okay, enter the name of the box
messagebox1
Error. This box is currently open
delete
Okay, enter the name of the box
messagebox3
Error. Box doesn't exist
close
Okay, close which message box?
messagebox2
Error. This box is not currently open
close
Okay, close which message box?
messagebox1
Successfully closed
delete
Okay, enter the name of the box
messagebox1
Successfully deleted
delete
Okay, enter the name of the box
messagebox2
Error. This box is currently open
```

Test Case 5

This test case was created to make sure that the program doesn't allow for creating boxes with names less than 5 characters or more than 25 characters. The client output is below.

```
./DUMBclient 127.0.0.1 8989
Success. You are connected.
Please choose a command from the command list below:
1. quit
2. create
3. delete
4. open
5. close
6. next
7. put
create
Okay, enter the name of the box
create:> m
Error. The name must be 5 to 25 characters long and start with an alphabetic character
create
Okay, enter the name of the box
create:> myboxmyboxmyboxmyboxmyboxx
Error. The name must be 5 to 25 characters long and start with an alphabetic character
create
Okay, enter the name of the box
create:> mybox
Successfully created
```

Test Case 6

This test case was created to make sure that the user cannot open a new box before they close the current open box. The client output is below.

```
Okay, enter the name of the box
create:> mybox1
Successfully created
create
Okay, enter the name of the box
create:> mybox2
Successfully created
open
Okay, open which message box?
open:> mybox1
Successfully opened
open
Okay, open which message box?
open:> mybox2
Error. You have a box opened
close
Okay, close which message box?
```

```
mybox1
Successfully closed
open
Okay, open which message box?
open:> mybox2
Successfully opened
```

Test Case 7

This test case was created to make sure that the user cannot delete an opened box or a box that has messages(not empty). The client output is below.

```
create
Okay, enter the name of the box
create:> mybox
Successfully created
open
Okay, open which message box?
open:> mybox
Successfully opened
put
Okay, enter the message you want to put in the box.
put:> hi
Success. Message was put in the message box
put
Okay, enter the message you want to put in the box.
put:> hello!
Success. Message was put in the message box
delete
Okay, enter the name of the box
mybox
Error. This box is currently open
close
Okay, close which message box?
mybox
Successfully closed
delete
Okay, enter the name of the box
mybox
Error. This box is not empty
next
Error. Either the message box not open or doesn't exist
open
Okay, open which message box?
open:> mybox
Successfully opened
next
hi
next
hello!
next
Error. No messages left in this message box
```

```
close
Okay, close which message box?
mybox
Successfully closed
delete
Okay, enter the name of the box
mybox
Successfully deleted
```