

4DN4 Lab 2 Report

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Description

We developed code that consists of both the client side and the server side of a grade retrieval application. The client side would be opened in Command Prompt or Terminal using ***"python GradeRetrievalApp.py -r client"*** and the server side would be opened similarly using ***"python GradeRetrievalApp.py -r server"***. The server should be opened first, so that it's able to listen for the connection requests and then the client code can be opened to establish the connection. The client can enter commands to retrieve the class averages for various assignments, but to access their own grades they'll need to login with an ID and password which will be authenticated by the server.

Implementation:

Server:

The server is supposed to have a database of grades. This was achieved using a CSV file that contained all the student IDs passwords and grades, and importing it using the pandas library. The CSV file was read and stored in self.db in the constructor method of the class. During the execution of the constructor, all rows of the database are printed as required by the assignment spec.

After setting up and printing the database the server stays in a "listening" state and waits for connection requests from clients. When the connection is established the server waits for commands to be sent from the client. We used 0.0.0.0 as the HOSTNAME which serves as an INADDR_ANY allowing it to bind to all local network interface addresses. The server port that it would listen on was set to port 50000, the receiver buffer size was set to 1024, and the message encoding was set to utf-8. The server socket address was instantiated using a tuple with the hostname and port.

We created a socket using the AF_INET family and SOCK_STREAM to set up an IPv4 TCP connection. We used the setsockopt function to set a socket layer and allowed for the socket to be reused without any timeouts. We then bind the socket to the socket address using the bind() function and set the socket to a listening state using the listen() function. The server will output a message saying "Listening on port 50000".

Once a connection is established with a client the server will output a statement notifying that a connection was made. The bytes received from the client will then be decoded using the MSG_ENCODING. The server will then print the decoded message as a string. The decoded string is compared with a list of expected commands, if the string matches one of the commands the respective value is returned. When "GG" command is received, the server prompts for a username and password. The server then uses the ID/pass hash to find the corresponding grades in the database and stores them in a list variable "output" which is sent to the client. If this results in "output" being empty (e.g len(output)==0), that means the user ID and password combination does not exist, no grades would be returned and an "Incorrect Credentials" error is thrown instead.

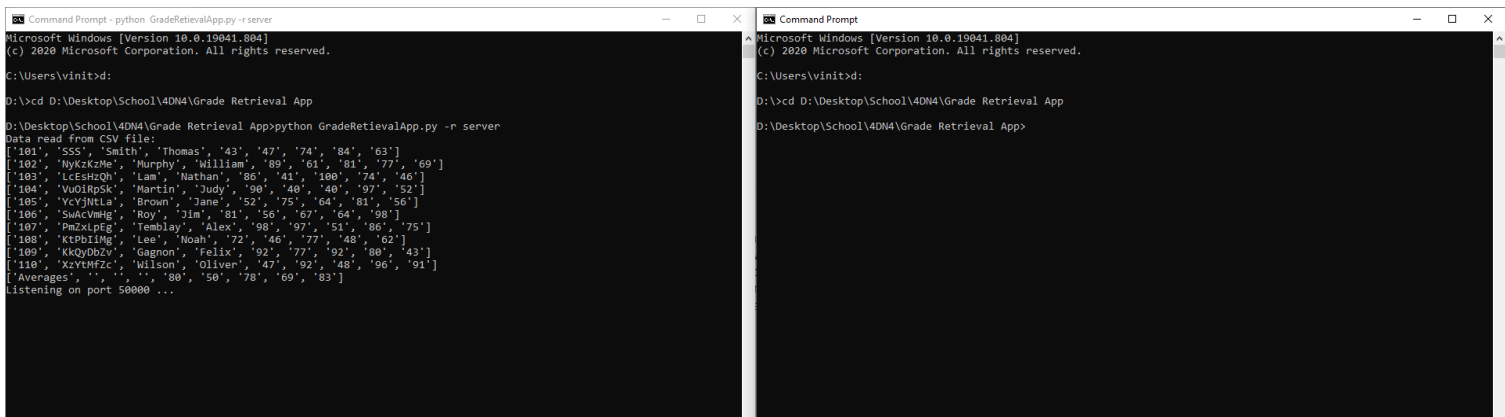
Client:

The client class makes a TCP connection request to the server. We did this by creating an IPv4 TCP socket and then connecting to the server using the connect() function with the address tuple. The client prompts for a command to be entered in the command line. Once the command is entered the client outputs an echo of the command (Command Entered: ..) . The function connection_send is used to send that command string to the server using the sendall() function and encoding the string. When the server responds with the grades/averages we've

commanded, the client will output the retrieved information (Received: ..). If the server responds with a String “Enter Username and Password” we set self.authorizing to True. Doing this enters a specific if statement in our connection_send() function that deals with encrypting and sending the user ID and password. Finally, the client receives, decodes and prints a set of bytes from the server which would be the grades.

Screenshot Based Demonstration

Two command prompt windows are opened. Used “***python GradeRetrievalApp.py -r server***” to open the server in one window.



```
Command Prompt - python GradeRetrievalApp.py -r server
Microsoft Windows [Version 10.0.19041.804]
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C:\Users\vinit>

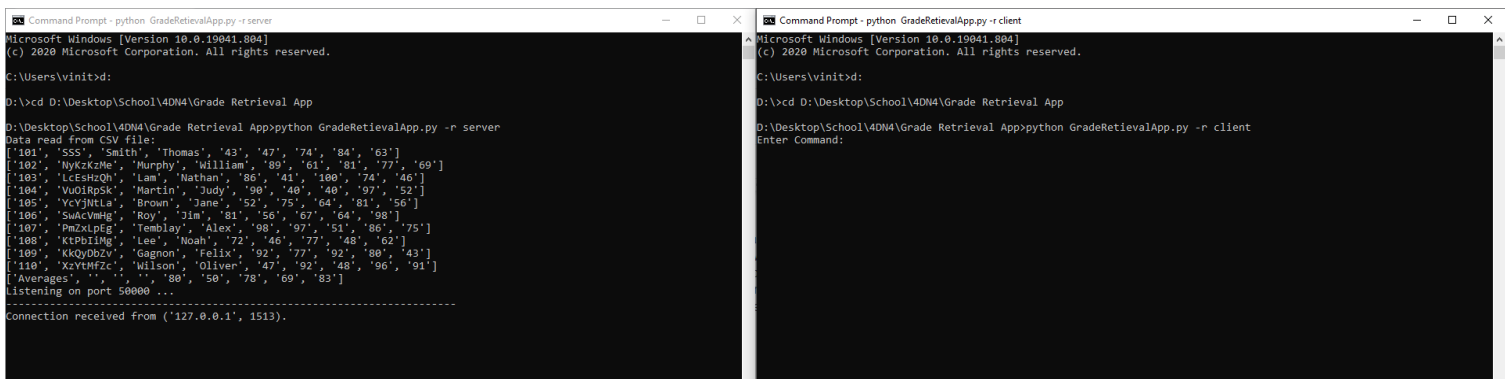
D:\>cd D:\Desktop\School\4DN4\Grade Retrieval App
D:\Desktop\School\4DN4\Grade Retrieval App>python GradeRetrievalApp.py -r server
Data read from CSV file:
[['101', 'SSS', 'Smith', 'Thomas', '43', '47', '74', '84', '63'],
 ['102', 'NyKzKzMe', 'Murphy', 'William', '89', '61', '81', '77', '69'],
 ['103', 'LcEsHzQh', 'Lam', 'Nathan', '86', '41', '100', '74', '46'],
 ['104', 'VuoiRpSk', 'Martin', 'Judy', '90', '40', '40', '97', '52'],
 ['105', 'YcVjHtLa', 'Brown', 'Jane', '52', '75', '64', '81', '56'],
 ['106', 'SwAcVMHg', 'Roy', 'Jim', '81', '50', '67', '64', '98'],
 ['107', 'PmZxLpEg', 'Temblay', 'Alex', '98', '97', '51', '86', '75'],
 ['108', 'KtPbIIng', 'Lee', 'Noah', '72', '46', '77', '48', '62'],
 ['109', 'KkQyDbZv', 'Gagnon', 'Felix', '92', '77', '92', '80', '43'],
 ['110', 'XzYtMfZc', 'Wilson', 'Oliver', '47', '92', '48', '96', '91'],
 ['Averages', '', '', '80', '50', '78', '69', '83']]
Listening on port 50000 ...

Command Prompt
Microsoft Windows [Version 10.0.19041.804]
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C:\Users\vinit>

D:\>cd D:\Desktop\School\4DN4\Grade Retrieval App
D:\Desktop\School\4DN4\Grade Retrieval App>
```

Then in the second window, the client is opened using “***python GradeRetrievalApp.py -r client***”. After opening the client, the client connects to the server and the server outputs a “Connection received from...” message. The client also prompts us to enter command.



```
Command Prompt - python GradeRetrievalApp.py -r server
Microsoft Windows [Version 10.0.19041.804]
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C:\Users\vinit>

D:\>cd D:\Desktop\School\4DN4\Grade Retrieval App
D:\Desktop\School\4DN4\Grade Retrieval App>python GradeRetrievalApp.py -r server
Data read from CSV file:
[['101', 'SSS', 'Smith', 'Thomas', '43', '47', '74', '84', '63'],
 ['102', 'NyKzKzMe', 'Murphy', 'William', '89', '61', '81', '77', '69'],
 ['103', 'LcEsHzQh', 'Lam', 'Nathan', '86', '41', '100', '74', '46'],
 ['104', 'VuoiRpSk', 'Martin', 'Judy', '90', '40', '40', '97', '52'],
 ['105', 'YcVjHtLa', 'Brown', 'Jane', '52', '75', '64', '81', '56'],
 ['106', 'SwAcVMHg', 'Roy', 'Jim', '81', '50', '67', '64', '98'],
 ['107', 'PmZxLpEg', 'Temblay', 'Alex', '98', '97', '51', '86', '75'],
 ['108', 'KtPbIIng', 'Lee', 'Noah', '72', '46', '77', '48', '62'],
 ['109', 'KkQyDbZv', 'Gagnon', 'Felix', '92', '77', '92', '80', '43'],
 ['110', 'XzYtMfZc', 'Wilson', 'Oliver', '47', '92', '48', '96', '91'],
 ['Averages', '', '', '80', '50', '78', '69', '83']]
Listening on port 50000 ...

Connection received from ('127.0.0.1', 1513).

Command Prompt - python GradeRetrievalApp.py -r client
Microsoft Windows [Version 10.0.19041.804]
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C:\Users\vinit>

D:\>cd D:\Desktop\School\4DN4\Grade Retrieval App
D:\Desktop\School\4DN4\Grade Retrieval App>python GradeRetrievalApp.py -r client
Enter Command:
```

We enter the “GMA” command to get the midterm class average. The client echoes the command entered and then outputs a message saying “Fetching Midterm Average”. The server outputs a message saying it has received the GMA command from the client, then sends 80 to the client and outputs “Sent: b'80’”. The client outputs confirming that it received the 80.

```
Command Prompt - python GradeRetrievalApp.py -r server
Microsoft Windows [Version 10.0.19041.884]
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C:\Users\vinit>

D:\>cd D:\Desktop\School\4DN4\Grade Retrieval App
D:\Desktop\School\4DN4\Grade Retrieval App>python GradeRetrievalApp.py -r server
Data read from CSV file:
[['101', 'SSS', 'Smith', 'Thomas', '43', '47', '74', '84', '63'],
 ['102', 'NyKzKzMe', 'Murphy', 'William', '89', '61', '81', '77', '69'],
 ['103', 'LcEsHzQh', 'Lam', 'Nathan', '86', '41', '100', '74', '46'],
 ['104', 'VuOIRpSk', 'Martin', 'Judy', '90', '40', '40', '97', '52'],
 ['105', 'VcyJmLlA', 'Brown', 'Jane', '52', '75', '64', '81', '56'],
 ['106', 'SwAcVnHg', 'Roy', 'Jim', '81', '56', '67', '64', '98'],
 ['107', 'PmZxLPeG', 'Temblay', 'Alex', '98', '97', '51', '86', '75'],
 ['108', 'ktPbIlMg', 'Lee', 'Noah', '72', '46', '77', '48', '62'],
 ['109', 'KkQyObZv', 'Gagnon', 'Felix', '92', '77', '92', '80', '43'],
 ['110', 'XzvYmHzc', 'Wilson', 'Olliver', '47', '92', '48', '96', '91'],
 ['Averages', '', '', '80', '50', '78', '60', '83']]
Listening on port 50000 ...

Connection received from ('127.0.0.1', 1513).

Received: GMA Command from Client
Sent: b'80'
```

```
Command Prompt - python GradeRetrievalApp.py -r client
Microsoft Windows [Version 10.0.19041.884]
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C:\Users\vinit>

D:\>cd D:\Desktop\School\4DN4\Grade Retrieval App
D:\Desktop\School\4DN4\Grade Retrieval App>python GradeRetrievalApp.py -r client
Enter Command: GMA
Command Entered: GMA
Fetching Midterm Average
Received: 80
Enter Command:
```

We enter the 4 Lab Mark commands and the same process as above occurs.

```
Command Prompt - python GradeRetrievalApp.py -r server
Microsoft Windows [Version 10.0.19041.884]
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C:\Users\vinit>

D:\>cd D:\Desktop\School\4DN4\Grade Retrieval App
D:\Desktop\School\4DN4\Grade Retrieval App>python GradeRetrievalApp.py -r server
Data read from CSV file:
[['101', 'SSS', 'Smith', 'Thomas', '43', '47', '74', '84', '63'],
 ['102', 'NyKzKzMe', 'Murphy', 'William', '89', '61', '81', '77', '69'],
 ['103', 'LcEsHzQh', 'Lam', 'Nathan', '86', '41', '100', '74', '46'],
 ['104', 'VuOIRpSk', 'Martin', 'Judy', '90', '40', '40', '97', '52'],
 ['105', 'VcyJmLlA', 'Brown', 'Jane', '52', '75', '64', '81', '56'],
 ['106', 'SwAcVnHg', 'Roy', 'Jim', '81', '56', '67', '64', '98'],
 ['107', 'PmZxLPeG', 'Temblay', 'Alex', '98', '97', '51', '86', '75'],
 ['108', 'ktPbIlMg', 'Lee', 'Noah', '72', '46', '77', '48', '62'],
 ['109', 'KkQyObZv', 'Gagnon', 'Felix', '92', '77', '92', '80', '43'],
 ['110', 'XzvYmHzc', 'Wilson', 'Olliver', '47', '92', '48', '96', '91'],
 ['Averages', '', '', '80', '50', '78', '60', '83']]
Listening on port 50000 ...

Connection received from ('127.0.0.1', 1513).

Received: GMA Command from Client
Sent: b'80'

Received: GL1A Command from Client
Sent: b'50'

Received: GL2A Command from Client
Sent: b'78'

Received: GL3A Command from Client
Sent: b'69'

Received: GL4A Command from Client
Sent: b'83'
```

```
Command Prompt - python GradeRetrievalApp.py -r client
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C:\Users\vinit>

D:\>cd D:\Desktop\School\4DN4\Grade Retrieval App
D:\Desktop\School\4DN4\Grade Retrieval App>python GradeRetrievalApp.py -r client
Enter Command: GMA
Command Entered: GMA
Fetching Midterm Average
Received: 80

Enter Command: GL1A
Command Entered: GL1A
Fetching Lab 1 Average
Received: 50

Enter Command: GL2A
Command Entered: GL2A
Fetching Lab 2 Average
Received: 78

Enter Command: GL3A
Command Entered: GL3A
Fetching Lab 3 Average
Received: 69

Enter Command: GL4A
Command Entered: GL4A
Fetching Lab 4 Average
Received: 83

Enter Command:
```

We enter the GG command to get our grades. Once again the client echoes the entered command. Then the client outputs a message stating that a login is required to fetch grades. The server receives the GG commands and outputs a message confirming that the command was received. The server sends back a prompt to enter Username and Password. The client receives the prompt from the server and then prompts the user to enter their ID.

```
Command Prompt - python GradeRetrievalApp.py -r server
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C:\Users\vinit>cd D:\Desktop\School\4DNA\Grade Retrieval App

D:\Desktop\School\4DNA\Grade Retrieval App>python GradeRetrievalApp.py -r server
Data read from CSV file:
['101','SSS','Smith','Thomas','43','47','74','84','63']
['102','NyKzKzMe','Murphy','William','89','61','81','77','69']
['103','LcShzQh','Lam','Nathan','86','41','100','74','46']
['104','VuOIRpSk','Martin','Judy','90','40','40','97','52']
['105','VcYJNLLa','Brown','Jane','52','75','64','81','56']
['106','SwAcVMHg','Roy','Jim','81','56','67','64','98']
['107','PmZxlpEg','Temblay','Alex','98','97','51','86','75']
['108','KtPbIImg','Lee','Noah','72','46','77','48','62']
['109','KkQyDbZv','Gagnon','Felix','92','77','92','80','43']
['110','XzYtMFZc','Wilson','Oliver','47','92','48','96','91']
['Averages','','','80','50','78','69','83']
Listening on port 50000 ...
-----
Connection received from ('127.0.0.1', 1513).

Received: GMA Command from Client
Sent: b'80'

Received: GL1A Command from Client
Sent: b'50'

Received: GL2A Command from Client
Sent: b'78'

Received: GL3A Command from Client
Sent: b'69'

Received: GL4A Command from Client
Sent: b'83'

Received: GG Command from Client
Sent: b'Enter Username and Password:'

Command Prompt - python GradeRetrievalApp.py -r client
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C:\Users\vinit>cd D:\Desktop\School\4DNA\Grade Retrieval App

D:\Desktop\School\4DNA\Grade Retrieval App>python GradeRetrievalApp.py -r client
Enter Command: GMA
Command Entered: GMA
Fetching Midterm Average
Received: 80

Enter Command: GL1A
Command Entered: GL1A
Fetching Lab 1 Average
Received: 50

Enter Command: GL2A
Command Entered: GL2A
Fetching Lab 2 Average
Received: 78

Enter Command: GL3A
Command Entered: GL3A
Fetching Lab 3 Average
Received: 69

Enter Command: GL4A
Command Entered: GL4A
Fetching Lab 4 Average
Received: 83

Enter Command: GG
Command Entered: GG
Login Required to Fetch Grades
Received: Enter Username and Password:

ID:
```

]We enter the ID 101, the client then prompts for the password.

```
Command Prompt - python GradeRetrievalApp.py -r server
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C:\Users\vinit>cd D:\Desktop\School\4DNA\Grade Retrieval App

D:\Desktop\School\4DNA\Grade Retrieval App>python GradeRetrievalApp.py -r server
Data read from CSV file:
['101','SSS','Smith','Thomas','43','47','74','84','63']
['102','NyKzKzMe','Murphy','William','89','61','81','77','69']
['103','LcShzQh','Lam','Nathan','86','41','100','74','46']
['104','VuOIRpSk','Martin','Judy','90','40','40','97','52']
['105','VcYJNLLa','Brown','Jane','52','75','64','81','56']
['106','SwAcVMHg','Roy','Jim','81','56','67','64','98']
['107','PmZxlpEg','Temblay','Alex','98','97','51','86','75']
['108','KtPbIImg','Lee','Noah','72','46','77','48','62']
['109','KkQyDbZv','Gagnon','Felix','92','77','92','80','43']
['110','XzYtMFZc','Wilson','Oliver','47','92','48','96','91']
['Averages','','','80','50','78','69','83']
Listening on port 50000 ...
-----
Connection received from ('127.0.0.1', 1513).

Received: GMA Command from Client
Sent: b'80'

Received: GL1A Command from Client
Sent: b'50'

Received: GL2A Command from Client
Sent: b'78'

Received: GL3A Command from Client
Sent: b'69'

Received: GL4A Command from Client
Sent: b'83'

Received: GG Command from Client
Sent: b'Enter Username and Password:'

Command Prompt - python GradeRetrievalApp.py -r client
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C:\Users\vinit>cd D:\Desktop\School\4DNA\Grade Retrieval App

D:\Desktop\School\4DNA\Grade Retrieval App>python GradeRetrievalApp.py -r client
Enter Command: GMA
Command Entered: GMA
Fetching Midterm Average
Received: 80

Enter Command: GL1A
Command Entered: GL1A
Fetching Lab 1 Average
Received: 50

Enter Command: GL2A
Command Entered: GL2A
Fetching Lab 2 Average
Received: 78

Enter Command: GL3A
Command Entered: GL3A
Fetching Lab 3 Average
Received: 69

Enter Command: GL4A
Command Entered: GL4A
Fetching Lab 4 Average
Received: 83

Enter Command: GG
Command Entered: GG
Login Required to Fetch Grades
Received: Enter Username and Password:

ID: 101
Password:
```

We enter the wrong password. The client sends the ID/pass hash to the server and outputs a message saying “ID/Pass hash sent to server”. The server receives the hash and sees that it is an incorrect login. The server outputs a message saying “ID/password Failure. Aborting Fetch.” and then sends an “Incorrect Credentials” message to the client. The client receives the error message and outputs what it received. The client prompts to Enter Command again without outputting any grades.

```

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C:\Users\vinit>D:
D:\>cd D:\Desktop\School\4DM4\Grade Retrieval App
D:\Desktop\School\4DM4\Grade Retrieval App>python GradeRetrievalApp.py -r server
Data read from CSV file:
['101', 'SSS', 'Smith', 'Thomas', '43', '47', '74', '84', '63']
['102', 'NyKzKzMe', 'Murphy', 'William', '89', '61', '81', '77', '69']
['103', 'LcESH2QH', 'Lam', 'Nathan', '86', '41', '100', '74', '46']
['104', 'WuDRpsk', 'Martin', 'Judy', '90', '40', '40', '97', '52']
['105', 'VcYJNtLa', 'Brown', 'Jane', '52', '75', '64', '81', '56']
['106', 'SwAcVMHg', 'Roy', 'Jim', '81', '56', '67', '64', '98']
['107', 'PmZxLPeg', 'Temblay', 'Alex', '98', '97', '51', '86', '75']
['108', 'KtP0iIng', 'Lee', 'Noah', '72', '46', '77', '48', '62']
['109', 'KkQyD0Zv', 'Gagnon', 'Felix', '92', '77', '92', '80', '43']
['110', 'XzYtMFZc', 'Wilson', 'Oliver', '47', '92', '48', '96', '91']
['Averages', '', '', '80', '50', '78', '69', '83']
Listening on port 50000 ...
Connection received from ('127.0.0.1', 1666).
Received: GMA Command from Client
Sent: b'80'
Received: GL1A Command from Client
Sent: b'50'
Received: GL2A Command from Client
Sent: b'78'
Received: GL3A Command from Client
Sent: b'69'
Received: GL4A Command from Client
Sent: b'83'
Received: GG Command from Client
Sent: b'Enter Username and Password:'
ID/pass hash recieved from server
b'ID/Password Failure. Aborting Fetch.'
Sent: b'Incorrect Credentials'

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C:\Users\vinit>D:
D:\>cd D:\Desktop\School\4DM4\Grade Retrieval App
D:\Desktop\School\4DM4\Grade Retrieval App>python GradeRetrievalApp.py -r client
Enter Command: GMA
Command Entered: GMA
Fetching Midterm Average
Received: 80
Enter Command: GL1A
Command Entered: GL1A
Fetching Lab 1 Average
Received: 50
Enter Command: GL2A
Command Entered: GL2A
Fetching Lab 2 Average
Received: 78
Enter Command: GL3A
Command Entered: GL3A
Fetching Lab 3 Average
Received: 69
Enter Command: GL4A
Command Entered: GL4A
Fetching Lab 4 Average
Received: 83
Enter Command: GG
Command Entered: GG
Login Required to Fetch Grades
Received: Enter Username and Password:
ID: 101
Password:
ID/pass hash sent to server
Received: Incorrect Credentials
Enter Command:
  
```

Finally we try using the GG command again and this time enter the correct credentials. The client and server act similarly to the previous situation except this time the server recognizes the ID/Pass hash as valid, outputs “Correct Password, Record Found” and sends the grades to the client. The client receives the grades and outputs what it received.

```

Listening on port 50000 ...
Connection received from ('127.0.0.1', 1666).
Received: GMA Command from Client
Sent: b'80'
Received: GL1A Command from Client
Sent: b'50'
Received: GL2A Command from Client
Sent: b'78'
Received: GL3A Command from Client
Sent: b'69'
Received: GL4A Command from Client
Sent: b'83'
Received: GG Command from Client
Sent: b'Enter Username and Password:'
ID/pass hash recieved from server
b'ID/Password Failure. Aborting Fetch.'
Sent: b'Incorrect Credentials'
Received: GG Command from Client
Sent: b'Enter Username and Password:'
ID/pass hash recieved from server
b'Correct Password, Record Found'
Sent: b'43,47,74,84,63'

Fetching Lab 4 Average
Received: 78
Enter Command: GL3A
Command Entered: GL3A
Fetching Lab 3 Average
Received: 69
Enter Command: GL4A
Command Entered: GL4A
Fetching Lab 4 Average
Received: 83
Enter Command: GG
Command Entered: GG
Login Required to Fetch Grades
Received: Enter Username and Password:
ID: 101
Password:
ID/pass hash sent to server
Received: Incorrect Credentials
Enter Command: GG
Command Entered: GG
Login Required to Fetch Grades
Received: Enter Username and Password:
ID: 101
Password:
ID/pass hash sent to server
Received: 43,47,74,84,63
Enter Command:
  
```