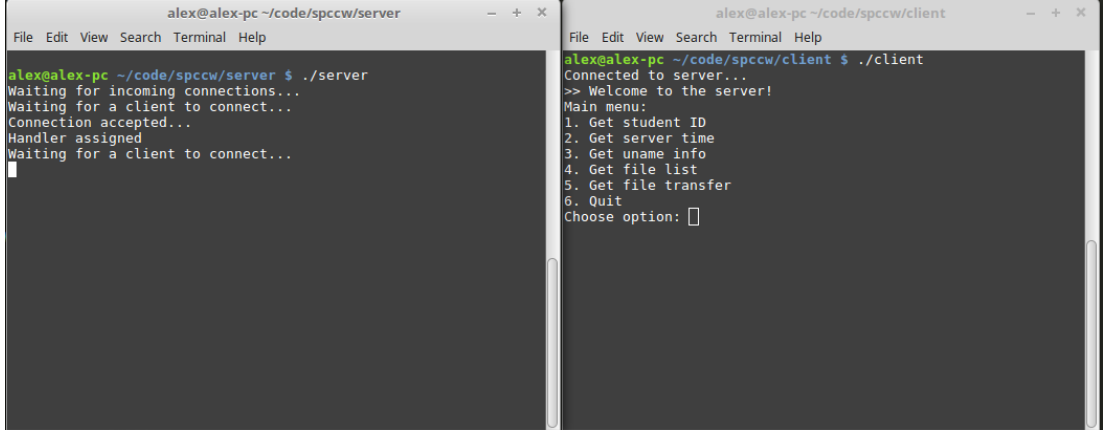
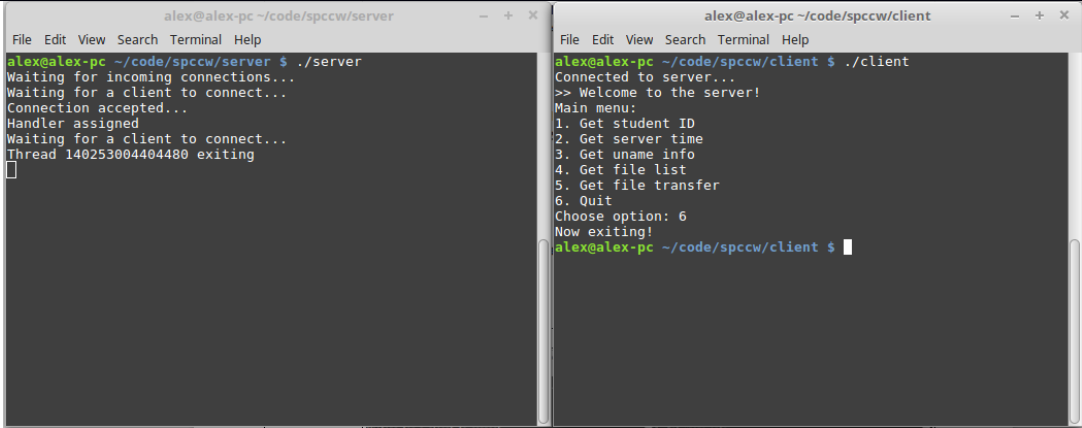
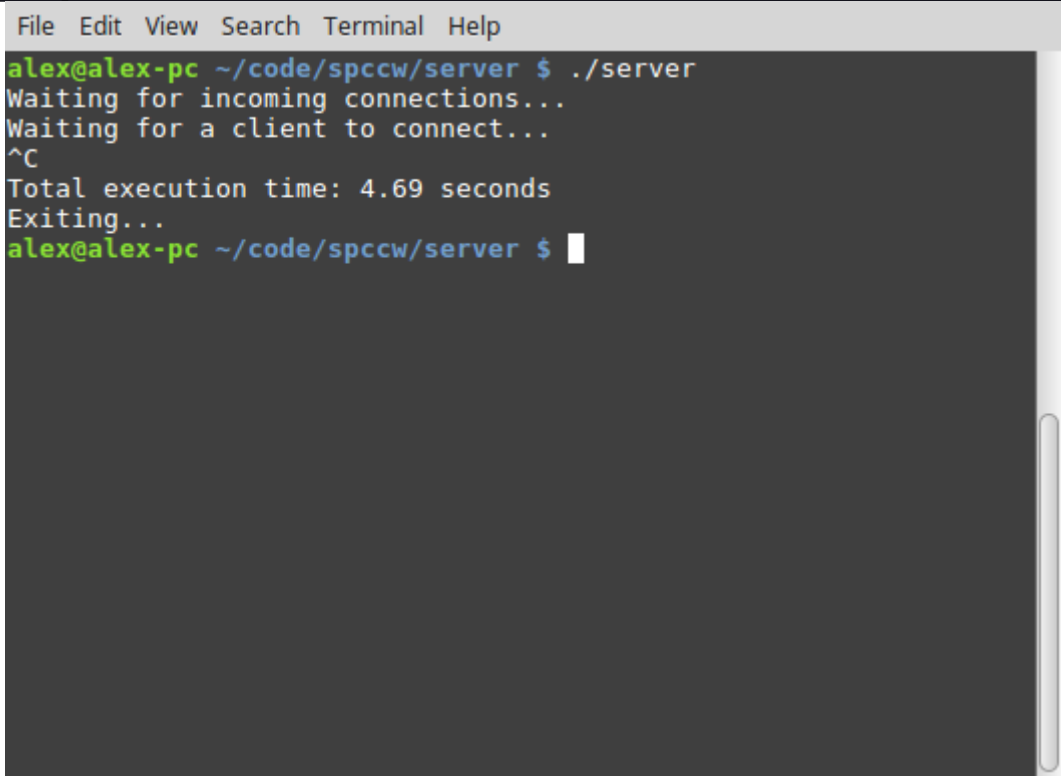
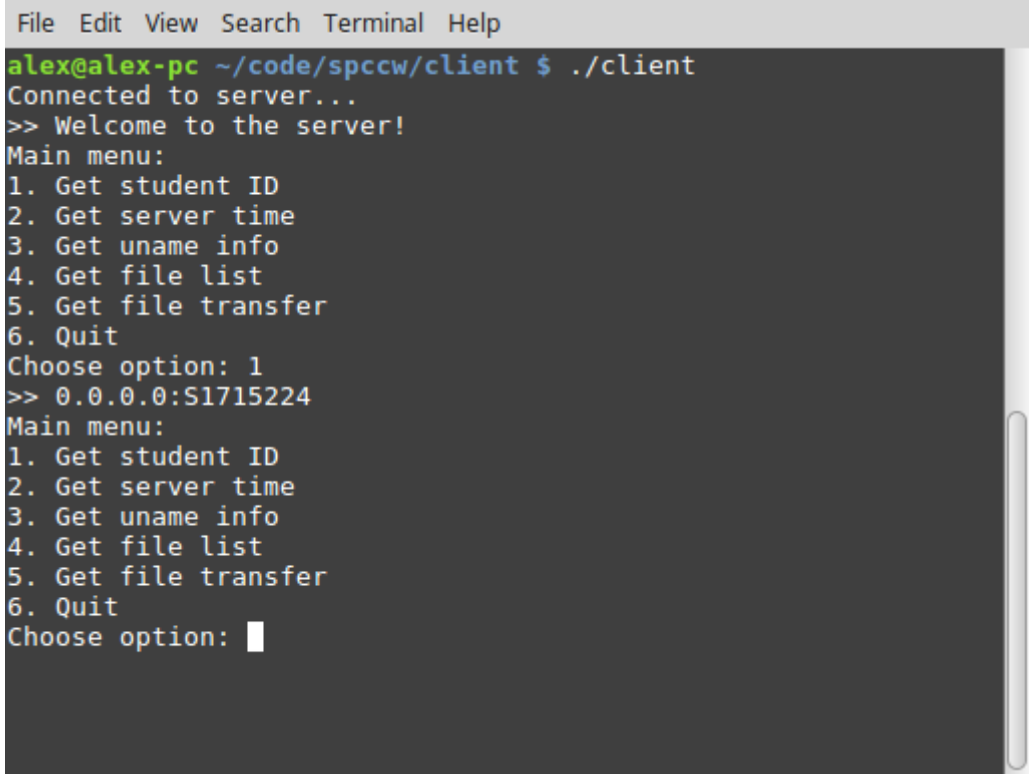


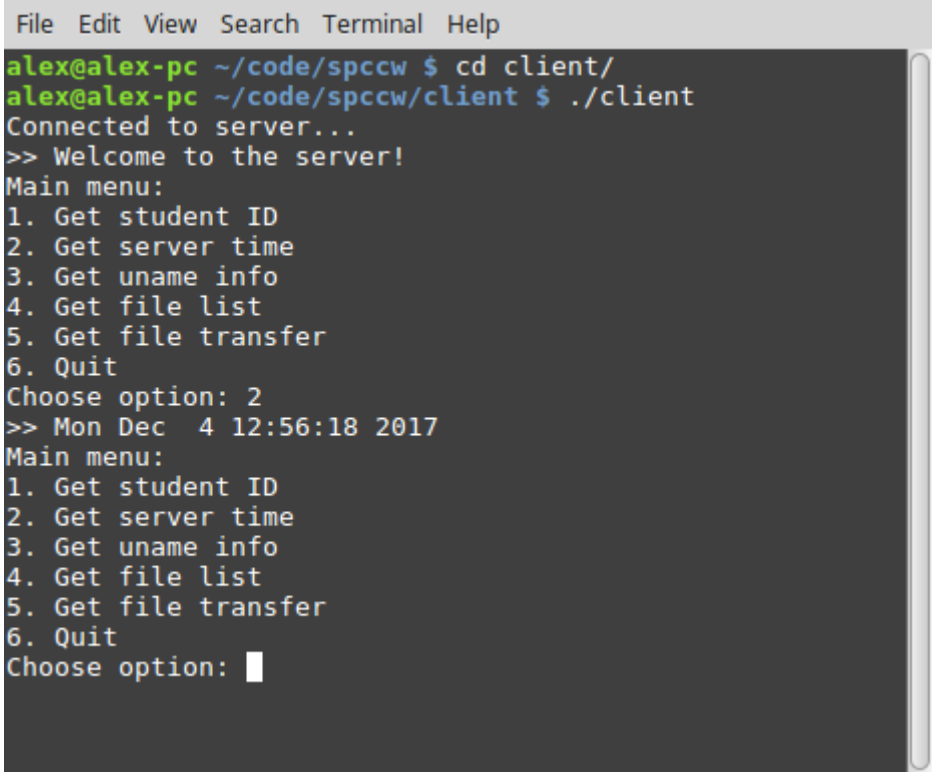
System	Client/Server (C coursework)
Author	Alex McBride
Student ID	S1715224
Student Email	AMCBRI206@caledonian.ac.uk
Date	04/12/2017
Before	It's required to run both server and client in different terminal windows, so you can see the results side-by-side.

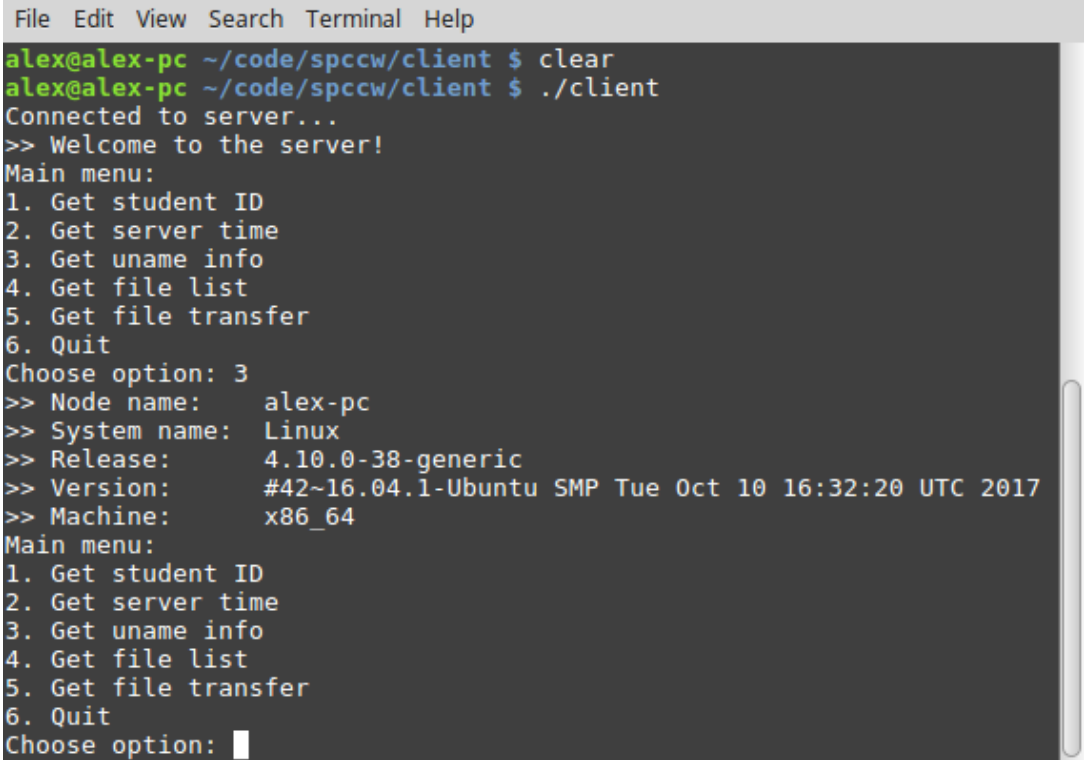
Test	001
Description	Client connects to server
Input	<p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p>
Expected	<p>The server should display the following:</p> <pre>Waiting for incoming connections... Waiting for a client to connect... Connection accepted... Handler assigned</pre> <p>The client should display:</p> <pre>Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option:</pre>
Actual	As expected
Screen	

Test	002
Description	Client disconnects from server
Input	<p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p> <p>Then press 6 in the client to select the menu option to quit.</p>
Expected	<p>The server should display the following (note the actual thread ID will vary):</p> <pre>Waiting for incoming connections... Waiting for a client to connect... Connection accepted... Handler assigned Waiting for a client to connect... Thread 140253004404480 exiting</pre> <p>The client should display:</p> <pre>Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 6 Now exiting!</pre>
Actual	As expected
Screen	

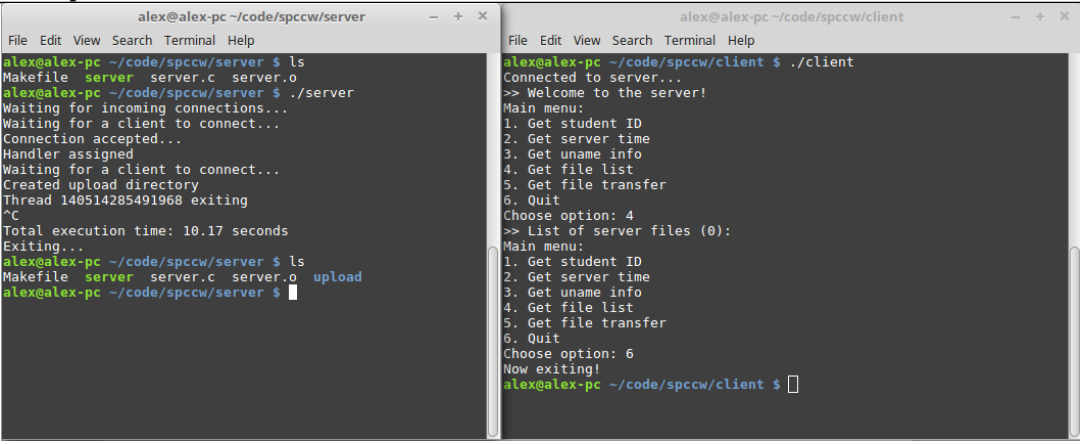
Test	003
Description	Server closes correctly on interrupt
Input	<p>In first terminal start the server: <code>./server</code></p> <p>Then press Ctrl+C to send SIGINT to the server process.</p>
Expected	<p>The server should display the following (note the actual execution time will vary):</p> <pre> Waiting for incoming connections... Waiting for a client to connect... ^C Total execution time: 4.69 seconds Exiting... </pre>
Actual	As expected
Screen	 <p>The screenshot shows a terminal window with a menu bar (File, Edit, View, Search, Terminal, Help). The prompt is <code>alex@alex-pc ~/code/spccw/server</code>. The user has entered <code>./server</code>. The output shows the server waiting for connections, then for a client to connect. After pressing Ctrl+C, it displays the total execution time of 4.69 seconds and exits. The prompt returns to <code>alex@alex-pc ~/code/spccw/server</code>.</p>

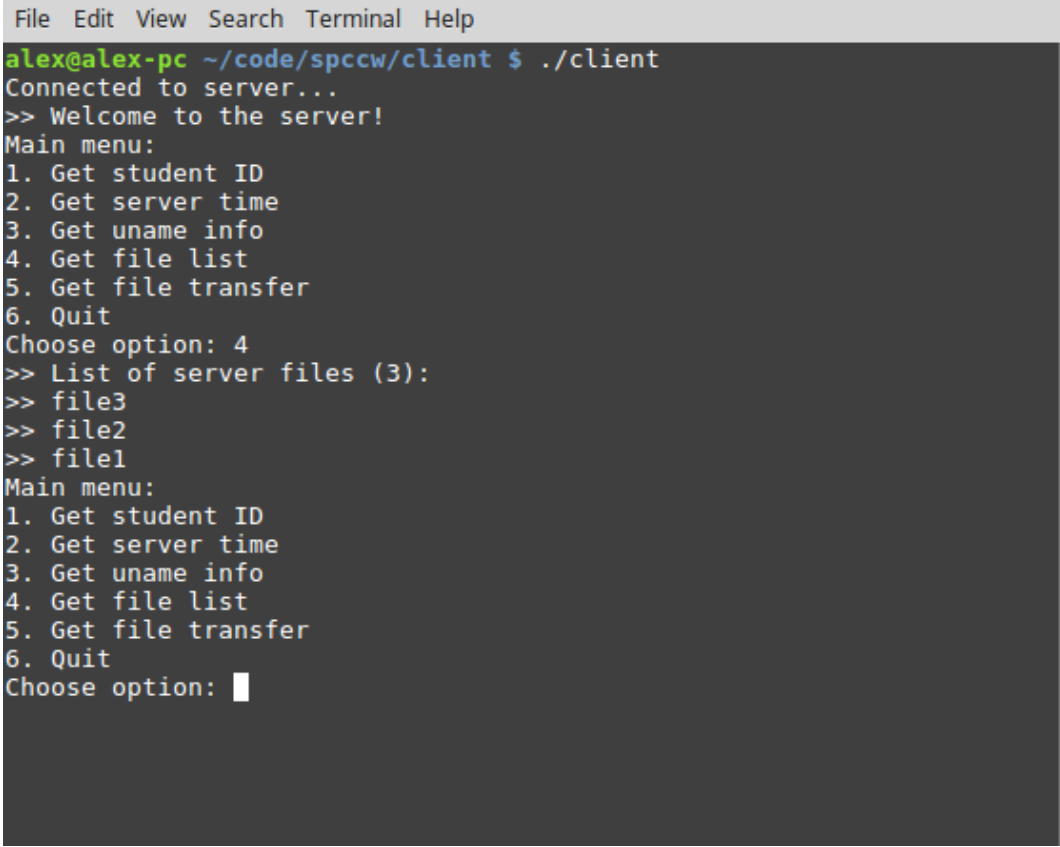
Test	004
Description	Get student ID works correctly
Input	<p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p> <p>Then select option 1 from the client menu</p>
Expected	<p>The client should display the following:</p> <pre> Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 1 >> 0.0.0.0:S1715224 </pre> <p>Before then displaying the menu again. Note the IP address only works on the lab VM, on this test machine it is returned as 0.0.0.0.</p>
Actual	As expected
Screen	 <pre> File Edit View Search Terminal Help alex@alex-pc ~/code/spccw/client \$./client Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 1 >> 0.0.0.0:S1715224 Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: █ </pre>

Test	005
Description	Get server time works correctly
Input	<p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p> <p>Then select option 2 from the client menu</p>
Expected	<p>The client should display the following:</p> <pre> Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 2 >> Mon Dec 4 12:56:18 2017 </pre> <p>Before then displaying the menu again. Note that the current date and time will vary depending on when the test was run.</p>
Actual	As expected
Screen	 <pre> File Edit View Search Terminal Help alex@alex-pc ~/code/spccw \$ cd client/ alex@alex-pc ~/code/spccw/client \$./client Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 2 >> Mon Dec 4 12:56:18 2017 Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: █ </pre>

Test	006
Description	Get uname info works correctly
Input	<p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p> <p>Then select option 3 from the client menu</p>
Expected	<p>The client should display the following:</p> <pre> Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 3 >> Node name: alex-pc >> System name: Linux >> Release: 4.10.0-38-generic >> Version: #42~16.04.1-Ubuntu SMP Tue Oct 10 16:32:20 UTC 2017 >> Machine: x86_64 </pre> <p>Before then displaying the menu again. Note that the actual uname info provided will vary from machine to machine.</p>
Actual	As expected
Screen	 <pre> File Edit View Search Terminal Help alex@alex-pc ~/code/spccw/client \$ clear alex@alex-pc ~/code/spccw/client \$./client Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 3 >> Node name: alex-pc >> System name: Linux >> Release: 4.10.0-38-generic >> Version: #42~16.04.1-Ubuntu SMP Tue Oct 10 16:32:20 UTC 2017 >> Machine: x86_64 Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: </pre>

Test	007
Description	Get file list creates upload directory
Input	<p>Check that the upload directory does not exist for the server: <code>ls</code></p> <p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p> <p>Then select option 4 from the client menu.</p> <p>Exit from the client by pressing 6 and the server by pressing CTRL+C.</p> <p>Enter ls to check that the upload directoy has been created.</p>
Expected	<p>The upload directory should now exist in the server directory: <code>ls</code></p> <p>The server should display the following:</p> <pre>alex@alex-pc ~/code/spccw/server \$ ls Makefile server server.c server.o alex@alex-pc ~/code/spccw/server \$./server Waiting for incoming connections... Waiting for a client to connect... Connection accepted... Handler assigned Waiting for a client to connect... Created upload directory Thread 140514285491968 exiting ^C Total execution time: 10.17 seconds Exiting... alex@alex-pc ~/code/spccw/server \$ ls Makefile server server.c server.o upload alex@alex-pc ~/code/spccw/server \$</pre> <p>The client should display:</p> <pre>Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 4 >> List of server files (0): Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 6</pre>

	<p>Now exiting!</p> <p>Note: the thread ID and execution times will vary depending on the test.</p>
Actual	As expected
Screen	 <p>The screenshot displays two terminal windows side-by-side. The left window, titled 'alex@alex-pc ~/code/spccw/server', shows the compilation of 'server.c' into 'server.o', the execution of './server', and the server's runtime logs. It indicates that it is waiting for connections, a client has connected, and it is now waiting for a client to connect again. It also shows the creation of an upload directory and the thread ID 140514285491968 exiting. The total execution time is 10.17 seconds. The right window, titled 'alex@alex-pc ~/code/spccw/client', shows the execution of './client', which connects to the server and displays a main menu with options: 1. Get student ID, 2. Get server time, 3. Get uname info, 4. Get file list, 5. Get file transfer, 6. Quit. The user selects option 4, and the client displays the list of server files (0). The user then selects option 6, and the client displays 'Now exiting!'.</p> <pre>alex@alex-pc ~/code/spccw/server File Edit View Search Terminal Help alex@alex-pc ~/code/spccw/server \$ ls Makefile server server.c server.o alex@alex-pc ~/code/spccw/server \$./server Waiting for incoming connections... Waiting for a client to connect... Connection accepted... Handler assigned Waiting for a client to connect... Created upload directory Thread 140514285491968 exiting ^C Total execution time: 10.17 seconds Exiting... alex@alex-pc ~/code/spccw/server \$ ls Makefile server server.c server.o upload alex@alex-pc ~/code/spccw/server \$ alex@alex-pc ~/code/spccw/client File Edit View Search Terminal Help alex@alex-pc ~/code/spccw/client \$./client Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 4 >> List of server files (0): Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 6 Now exiting! alex@alex-pc ~/code/spccw/client \$</pre>

Test	008
Description	Get file list correctly lists files in upload directory
Input	<p>Add some files to the upload directory named file1, file2, and file3: ls > upload/file1</p> <p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p> <p>Then select option 4 from the client menu.</p>
Expected	<p>The upload directory should now exist in the server directory: ls</p> <p>The client should display the following:</p> <pre> Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 4 >> List of server files (3): >> file3 >> file2 >> file1 </pre>
Actual	As expected
Screen	 <pre> File Edit View Search Terminal Help alex@alex-pc ~/code/spccw/client \$./client Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 4 >> List of server files (3): >> file3 >> file2 >> file1 Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: █ </pre>

Test	009
Description	Get file transfer works correctly
Input	<p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal get a list of current files to make sure directory does not contain file1, then start the client: <code>./client</code></p> <p>Then select option 5 from the client menu and enter 'file1' and press enter.</p> <p>Exit the menu (option 6) and run ls again to check that 'file1' has been transferred.</p>
Expected	<p>The server should display the following:</p> <pre>Waiting for incoming connections... Waiting for a client to connect... Connection accepted... Handler assigned Waiting for a client to connect... Thread 139786179524352 exiting</pre> <p>Before then displaying the menu again. Note that the actual uname info provided will vary from machine to machine.</p> <p>The client should display:</p> <pre>alex@alex-pc ~/code/spccw/client \$ ls client client.c client.o Makefile alex@alex-pc ~/code/spccw/client \$./client Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 5 Enter filename: file1 >> Transferred 41 of 41 bytes >> File transfer of 'file1' complete! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 6 Now exiting! alex@alex-pc ~/code/spccw/client \$ ls client client.c client.o file1 Makefile alex@alex-pc ~/code/spccw/client \$</pre> <p>Note: the exact contents of the server and client directories may vary.</p>
Actual	As expected

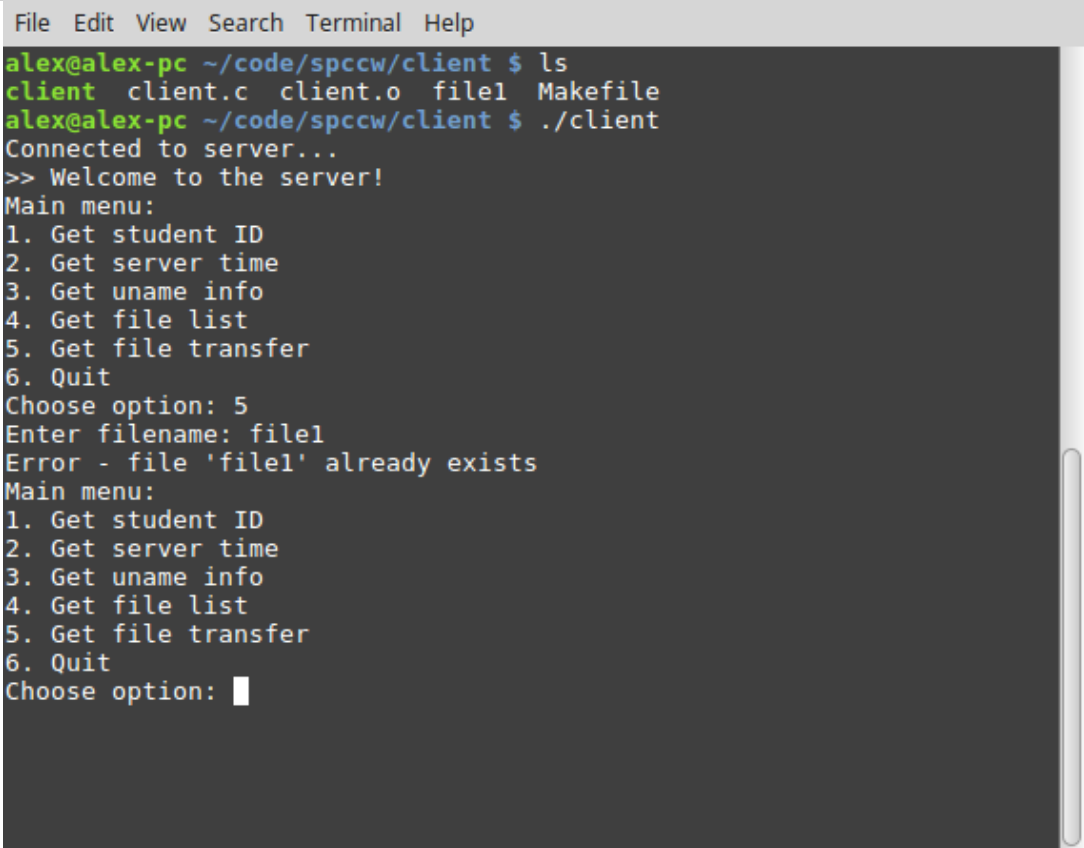
Screen

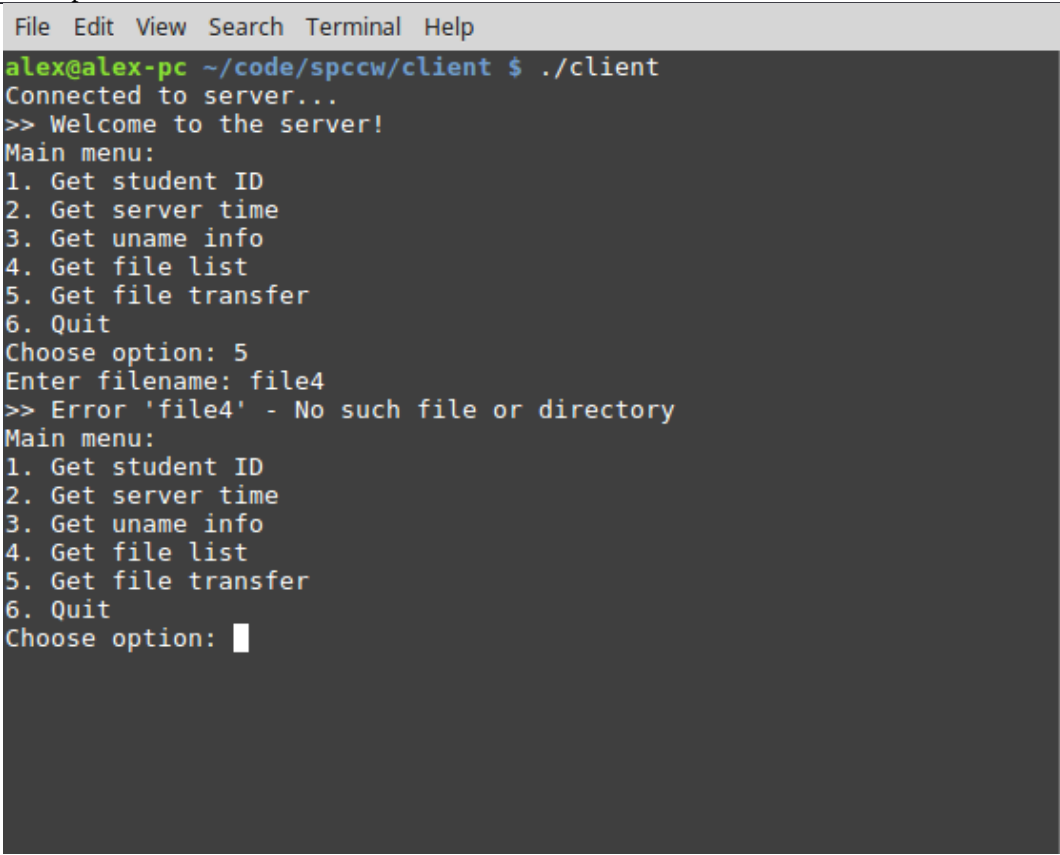
```
alex@alex-pc ~/code/spccw/server
File Edit View Search Terminal Help

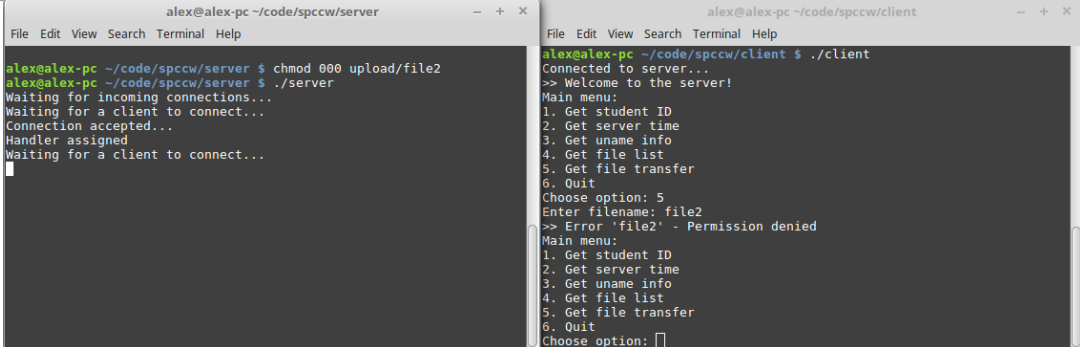
alex@alex-pc ~/code/spccw/server $ ls -l upload
total 12
-rw-rw-r-- 1 alex alex 41 Dec  4 13:21 file1
-rw-rw-r-- 1 alex alex 41 Dec  4 13:21 file2
-rw-rw-r-- 1 alex alex 41 Dec  4 13:21 file3
alex@alex-pc ~/code/spccw/server $ ./server
Waiting for incoming connections...
Waiting for a client to connect...
Connection accepted...
Handler assigned
Waiting for a client to connect...
Thread 139855339710208 exiting
^

alex@alex-pc ~/code/spccw/client
File Edit View Search Terminal Help

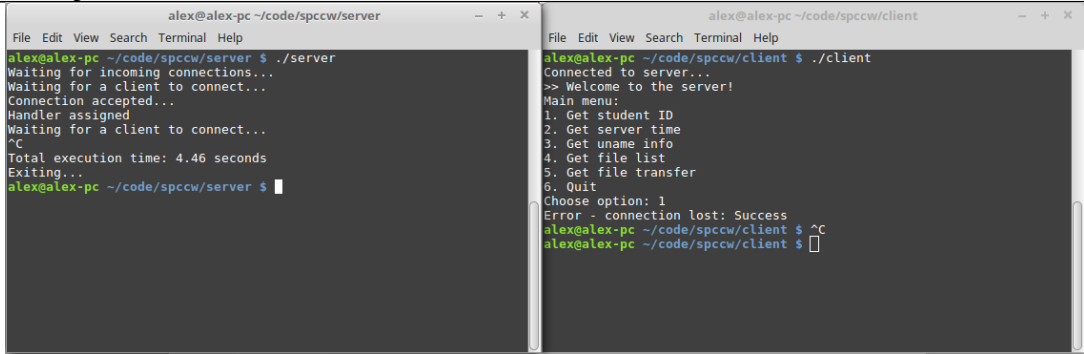
alex@alex-pc ~/code/spccw/client $ ./client
Connected to server...
>> Welcome to the server!
Main menu:
1. Get student ID
2. Get server time
3. Get uname info
4. Get file list
5. Get file transfer
6. Quit
Choose option: 5
Enter filename: file1
>> Transferred 41 of 41 bytes
>> File transfer of 'file1' complete!
Main menu:
1. Get student ID
2. Get server time
3. Get uname info
4. Get file list
5. Get file transfer
6. Quit
Choose option: 6
Now exiting!
alex@alex-pc ~/code/spccw/client $ ls -l
total 64
-rwxrwxr-x 1 alex alex 27184 Dec  4 12:06 client
-rw-rw-r-- 1 alex alex 7405 Dec  4 12:06 client.c
-rw-rw-r-- 1 alex alex 18320 Dec  4 12:06 client.o
-rw-rw-r-- 1 alex alex  41 Dec  4 13:39 file1
-rw-rw-r-- 1 alex alex  410 Dec  4 11:44 Makefile
alex@alex-pc ~/code/spccw/client $
```

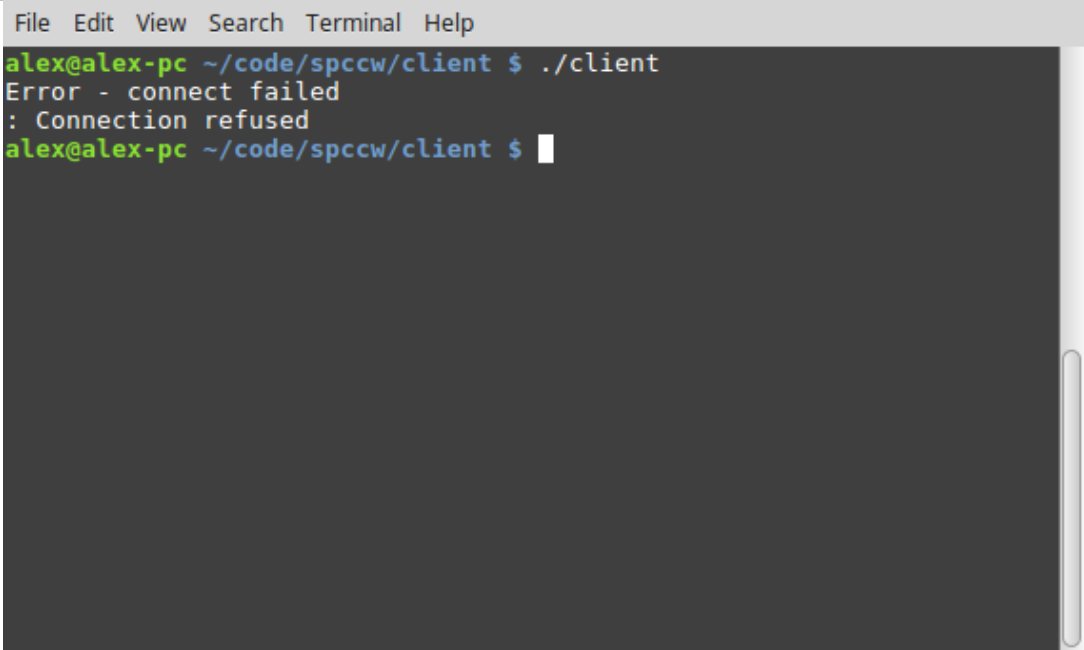
Test	010
Description	Get file transfer shows file already exists error to transfer file that is already present in client directory
Input	<p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal, run 'ls' to check that the file 'file1' exists, then start the client: <code>./client</code></p> <p>Then select option 5 from the client menu, enter 'file1' and press enter.</p>
Expected	<p>The client should display the following:</p> <pre> Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 5 Enter filename: file1 Error - file 'file1' already exists Before then displaying the menu again. </pre>
Actual	As expected
Screen	 <pre> File Edit View Search Terminal Help alex@alex-pc ~/code/spccw/client \$ ls client client.c client.o file1 Makefile alex@alex-pc ~/code/spccw/client \$./client Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 5 Enter filename: file1 Error - file 'file1' already exists Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: █ </pre>

Test	011
Description	Get file transfer shows file not found error when asked to transfer file not in upload directory
Input	<p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p> <p>Then select option 5 from the client menu, enter 'file4' and press enter.</p>
Expected	<p>The client should display the following:</p> <pre> Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 5 Enter filename: file4 >> Error 'file4' - No such file or directory Before then displaying the menu again.</pre>
Actual	As expected
Screen	 <pre> File Edit View Search Terminal Help alex@alex-pc ~/code/spccw/client \$./client Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 5 Enter filename: file4 >> Error 'file4' - No such file or directory Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: █</pre>

Test	012
Description	Get file transfer shows permission error when asked to transfer file not in upload directory
Input	<p>Set permission on 'file3' in the upload directory to prevent reading: <code>chmod 000 upload/file2</code></p> <p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p> <p>Then select option 5 from the client menu, enter 'file1' and press enter.</p>
Expected	<p>The client should display the following:</p> <pre> Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 5 Enter filename: file2 >> Error 'file2' - Permission denied </pre>
Actual	As expected
Screen	 <p>The image displays two terminal windows side-by-side. The left window, titled 'alex@alex-pc ~/code/spccw/server', shows the execution of <code>chmod 000 upload/file2</code> followed by <code>./server</code>. The server output indicates it is waiting for connections, a client has connected, and it is now waiting for a client to connect. The right window, titled 'alex@alex-pc ~/code/spccw/client', shows the execution of <code>./client</code>. The client output shows a successful connection, a welcome message, and a main menu with six options. Option 5, 'Get file transfer', is selected. The user enters 'file2' as the filename, and the client displays the error: '>> Error 'file2' - Permission denied'. Below the error, the main menu is repeated, and the prompt 'Choose option:' is shown with a cursor.</p>

Test	013
Description	Get file transfer shows suitable error if client local directory not writable
Input	<p>Set permission on the 'client' directory to prevent writing: <code>chmod 555 client</code></p> <p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p> <p>Then select option 5 from the client menu, enter 'file3' and press enter.</p> <p>After test is complete set client folder back to <code>chmod 775 client</code>.</p>
Expected	<p>The client should display the following:</p> <pre> Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 5 Enter filename: file3 Error - failed to open local file: Permission denied </pre>
Actual	As expected
Screen	 <p>The screenshot displays two terminal windows side-by-side. The left window, titled 'alex@alex-pc ~/code/spccw/server', shows the server's execution: setting permissions on the client directory, starting the server, and waiting for a connection. The right window, titled 'alex@alex-pc ~/code/spccw/client', shows the client's execution: starting the client, connecting to the server, displaying a main menu, selecting option 5, entering 'file3', and receiving an 'Error - failed to open local file: Permission denied' message.</p>

Test	014
Description	Client deals with losing server connection gracefully
Input	<p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p> <p>Kill the server with CTRL+C and then select option 1 from client menu.</p>
Expected	<p>The client should display the following:</p> <pre> Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 1 Error - connection lost: Success </pre>
Actual	As expected
Screen	 <p>The screenshot displays two terminal windows side-by-side. The left window, titled 'alex@alex-pc ~/code/spccw/server', shows the execution of the server program. It starts with 'alex@alex-pc ~/code/spccw/server \$./server', followed by 'Waiting for incoming connections...', 'Waiting for a client to connect...', 'Connection accepted...', 'Handler assigned', 'Waiting for a client to connect...', and finally 'Total execution time: 4.46 seconds' and 'Exiting...' after a Ctrl+C signal. The right window, titled 'alex@alex-pc ~/code/spccw/client', shows the client program execution. It starts with 'alex@alex-pc ~/code/spccw/client \$./client', followed by 'Connected to server...', '>> Welcome to the server!', and a 'Main menu:' with options 1 through 6. Option 1 is chosen, leading to 'Error - connection lost: Success' and 'alex@alex-pc ~/code/spccw/client \$ ^C'.</p>

Test	015
Description	Client deals gracefully with not being able to connect to server
Input	In the second terminal start the client, without the server being active: <code>./client</code>
Expected	The client should display the following: Error - connect failed : Connection refused
Actual	As expected
Screen	 <pre> File Edit View Search Terminal Help alex@alex-pc ~/code/spccw/client \$./client Error - connect failed : Connection refused alex@alex-pc ~/code/spccw/client \$ </pre>