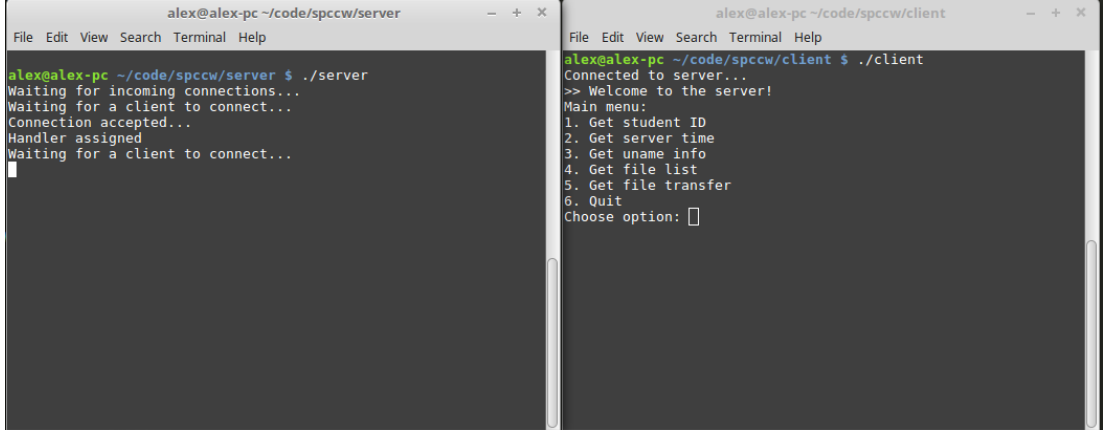
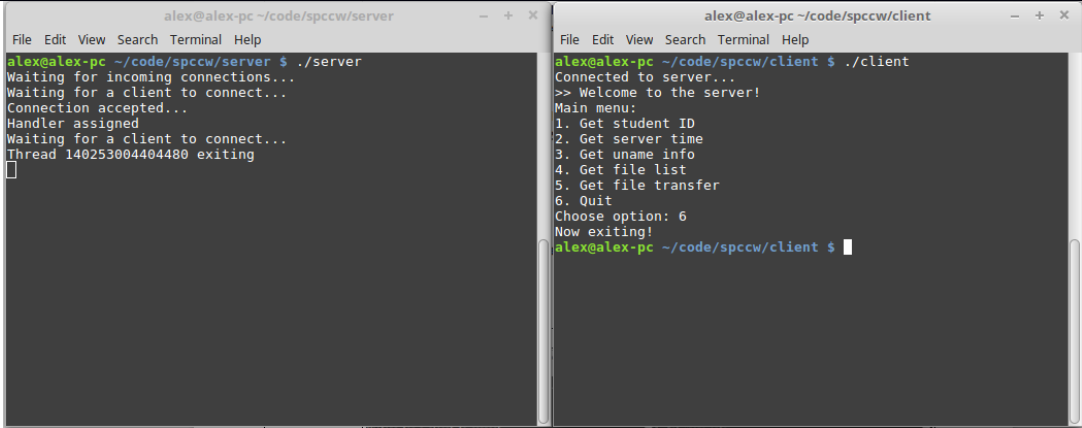
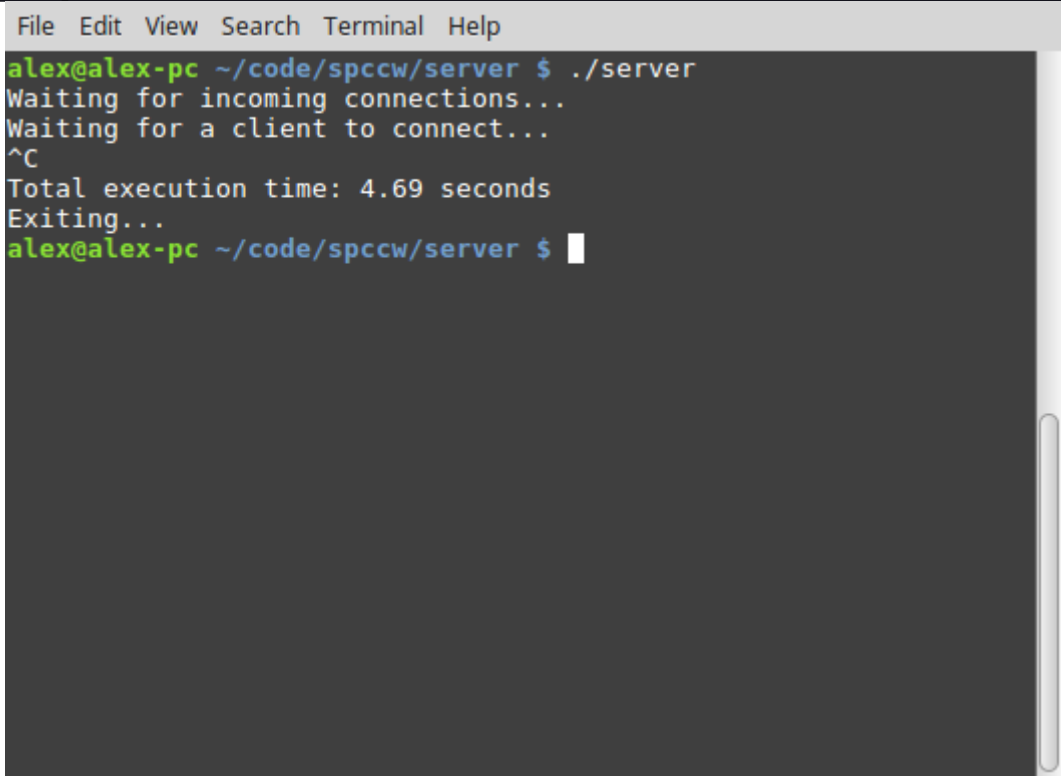
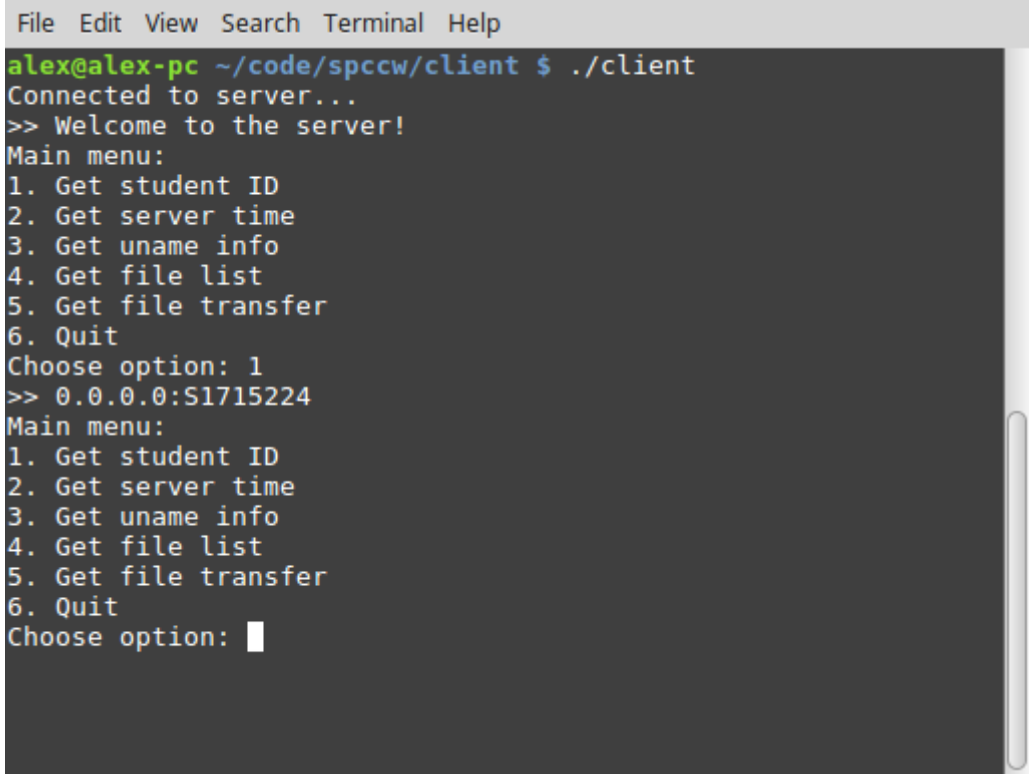


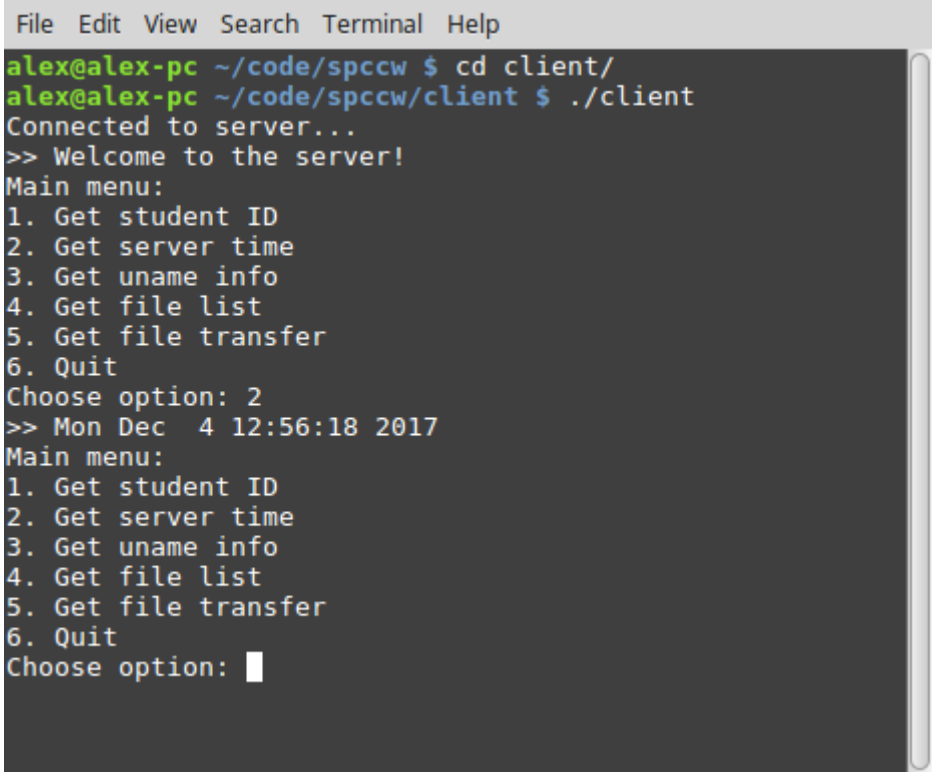
<b>System</b>	Client/Server (C coursework)
<b>Author</b>	Alex McBride
<b>Student ID</b>	S1715224
<b>Student Email</b>	AMCBRI206@caledonian.ac.uk
<b>Date</b>	04/12/2017
<b>Before</b>	It's required to run both server and client in different terminal windows, so you can see the results side-by-side.

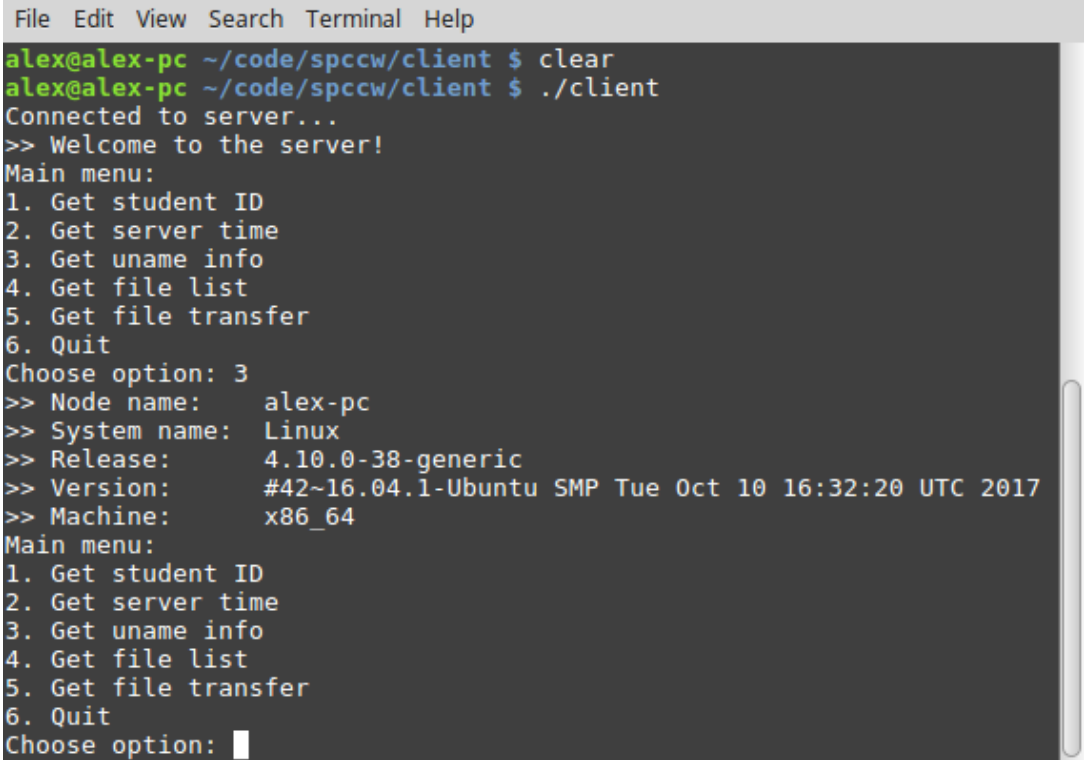
<b>Test</b>	001
<b>Description</b>	Client connects to server
<b>Input</b>	<p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p>
<b>Expected</b>	<p>The server should display the following:</p> <pre>Waiting for incoming connections... Waiting for a client to connect... Connection accepted... Handler assigned</pre> <p>The client should display:</p> <pre>Connected to server... &gt;&gt; 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>
<b>Actual</b>	As expected
<b>Screen</b>	

<b>Test</b>	002
<b>Description</b>	Client disconnects from server
<b>Input</b>	<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>
<b>Expected</b>	<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... &gt;&gt; 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>
<b>Actual</b>	As expected
<b>Screen</b>	

<b>Test</b>	003
<b>Description</b>	Server closes correctly on interrupt
<b>Input</b>	<p>In first terminal start the server: <code>./server</code></p> <p>Then press Ctrl+C to send SIGINT to the server process.</p>
<b>Expected</b>	<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>
<b>Actual</b>	As expected
<b>Screen</b>	 <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 displayed is:</p> <pre> alex@alex-pc ~/code/spccw/server \$ ./server Waiting for incoming connections... Waiting for a client to connect... ^C Total execution time: 4.69 seconds Exiting... alex@alex-pc ~/code/spccw/server \$ </pre>

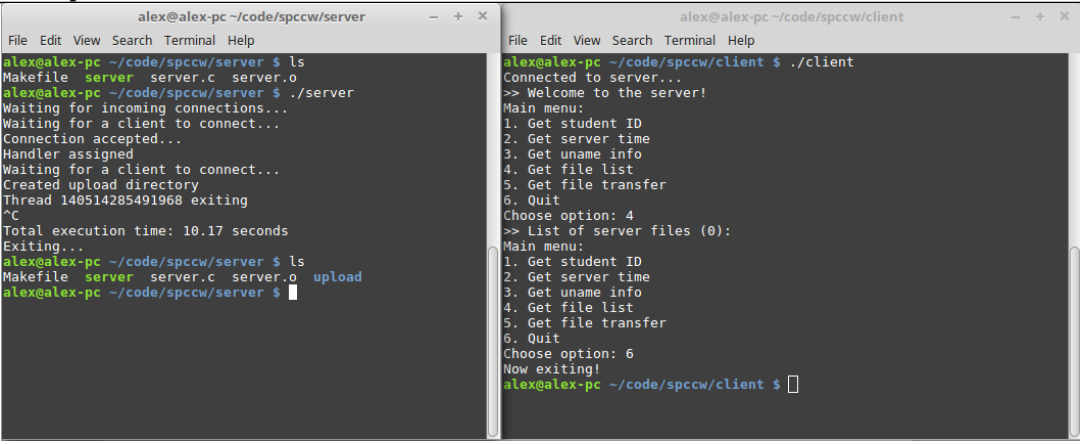
<b>Test</b>	004
<b>Description</b>	Get student ID works correctly
<b>Input</b>	<p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p> <p>Then select option 1 from the client menu</p>
<b>Expected</b>	<p>The client should display the following:</p> <pre> Connected to server... &gt;&gt; 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 &gt;&gt; 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>
<b>Actual</b>	As expected
<b>Screen</b>	 <pre> File Edit View Search Terminal Help alex@alex-pc ~/code/spccw/client \$ ./client Connected to server... &gt;&gt; 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 &gt;&gt; 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>

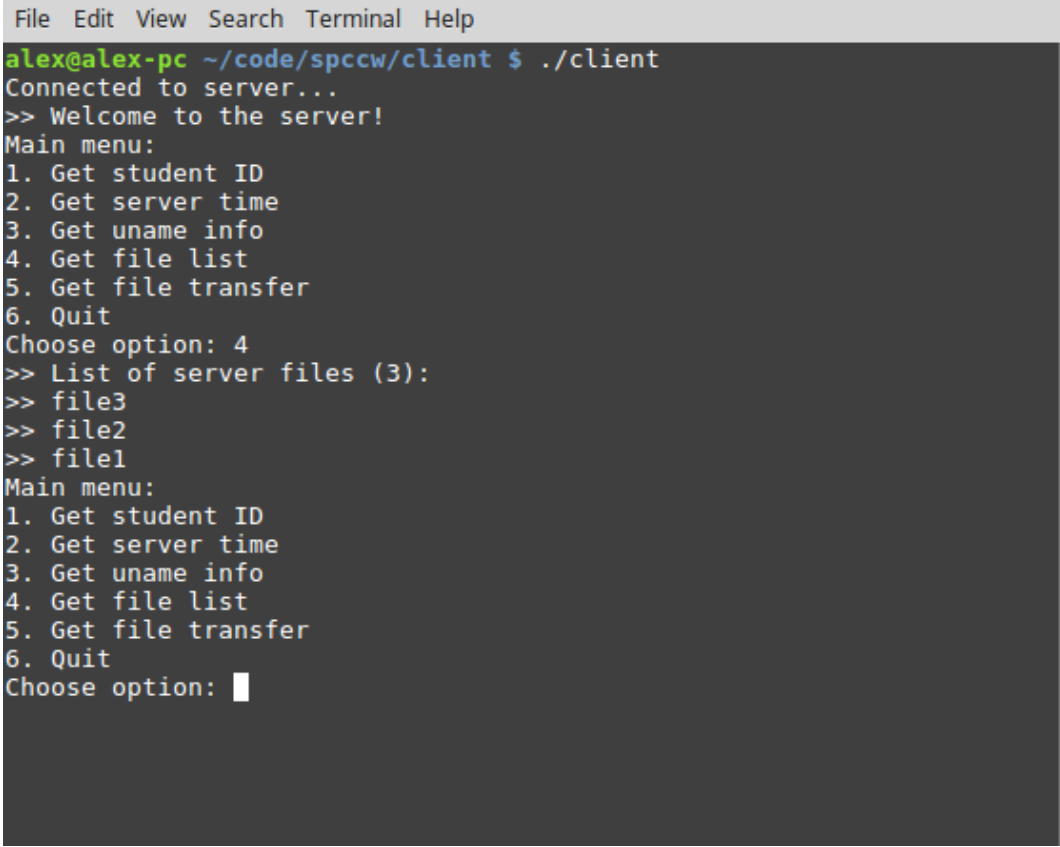
<b>Test</b>	005
<b>Description</b>	Get server time works correctly
<b>Input</b>	<p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p> <p>Then select option 2 from the client menu</p>
<b>Expected</b>	<p>The client should display the following:</p> <pre> Connected to server... &gt;&gt; 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 &gt;&gt; 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>
<b>Actual</b>	As expected
<b>Screen</b>	 <pre> File Edit View Search Terminal Help alex@alex-pc ~/code/spccw \$ cd client/ alex@alex-pc ~/code/spccw/client \$ ./client Connected to server... &gt;&gt; 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 &gt;&gt; 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>

<b>Test</b>	006
<b>Description</b>	Get uname info works correctly
<b>Input</b>	<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>
<b>Expected</b>	<p>The client should display the following:</p> <pre> Connected to server... &gt;&gt; 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 &gt;&gt; Node name:      alex-pc &gt;&gt; System name:    Linux &gt;&gt; Release:        4.10.0-38-generic &gt;&gt; Version:        #42~16.04.1-Ubuntu SMP Tue Oct 10 16:32:20 UTC 2017 &gt;&gt; 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>
<b>Actual</b>	As expected
<b>Screen</b>	 <pre> File Edit View Search Terminal Help alex@alex-pc ~/code/spccw/client \$ clear alex@alex-pc ~/code/spccw/client \$ ./client Connected to server... &gt;&gt; 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 &gt;&gt; Node name:      alex-pc &gt;&gt; System name:    Linux &gt;&gt; Release:        4.10.0-38-generic &gt;&gt; Version:        #42~16.04.1-Ubuntu SMP Tue Oct 10 16:32:20 UTC 2017 &gt;&gt; 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>

<b>Test</b>	007
<b>Description</b>	Get file list creates upload directory
<b>Input</b>	<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>
<b>Expected</b>	<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... &gt;&gt; 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 &gt;&gt; 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 behavior: it waits for connections, accepts one, prints a thread ID (140514285491968), and exits after 10.17 seconds. The right window, titled 'alex@alex-pc ~/code/spccw/client', shows the execution of './client', which connects to the server, displays a welcome message, and presents a menu with six options. Option 4 ('Get file list') is selected, showing an empty list of files. Option 6 ('Quit') is then selected, and the client prints 'Now exiting!'.</p>

<b>Test</b>	008
<b>Description</b>	Get file list correctly lists files in upload directory
<b>Input</b>	<p>Add some files to the upload directory named file1, file2, and file3: ls &gt; 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>
<b>Expected</b>	<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... &gt;&gt; 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 &gt;&gt; List of server files (3): &gt;&gt; file3 &gt;&gt; file2 &gt;&gt; file1 </pre>
<b>Actual</b>	As expected
<b>Screen</b>	 <pre> File Edit View Search Terminal Help alex@alex-pc ~/code/spccw/client \$ ./client Connected to server... &gt;&gt; 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 &gt;&gt; List of server files (3): &gt;&gt; file3 &gt;&gt; file2 &gt;&gt; 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>

<b>Test</b>	009
<b>Description</b>	Get file transfer works correctly
<b>Input</b>	<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>
<b>Expected</b>	<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... &gt;&gt; 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 &gt;&gt; Transferred 41 of 41 bytes &gt;&gt; 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>
<b>Actual</b>	As expected

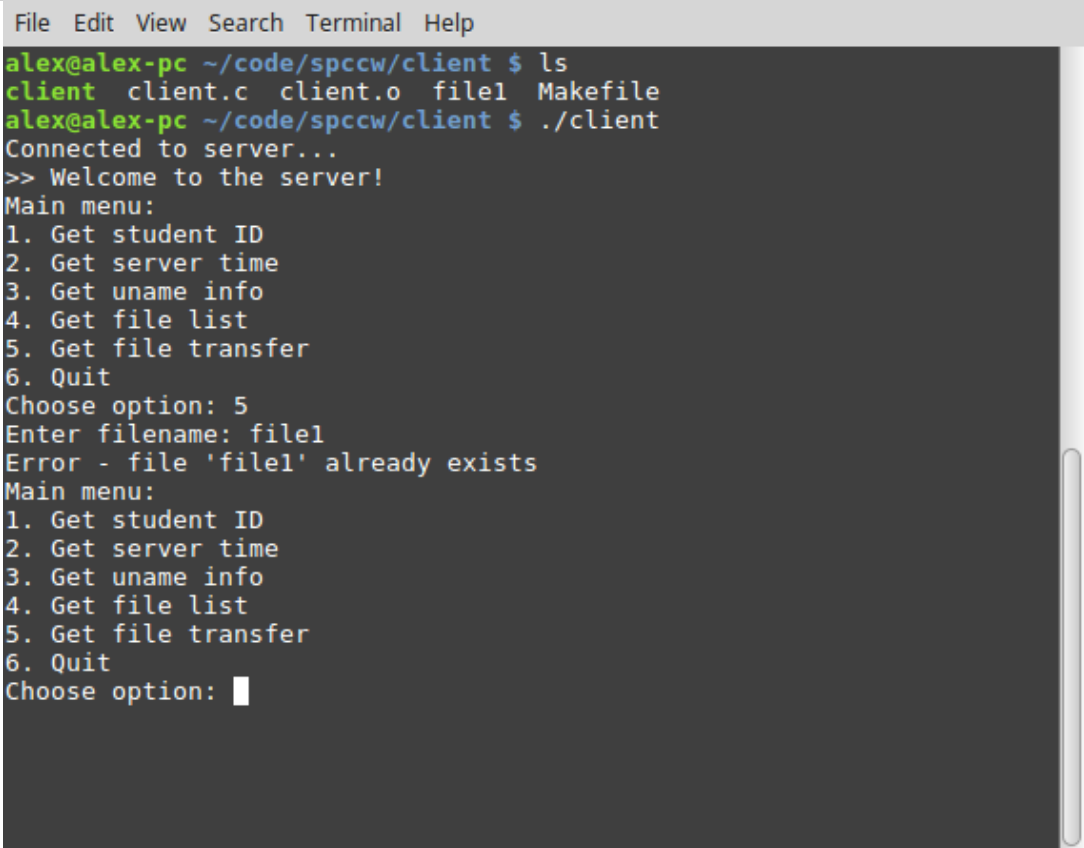
## Screen

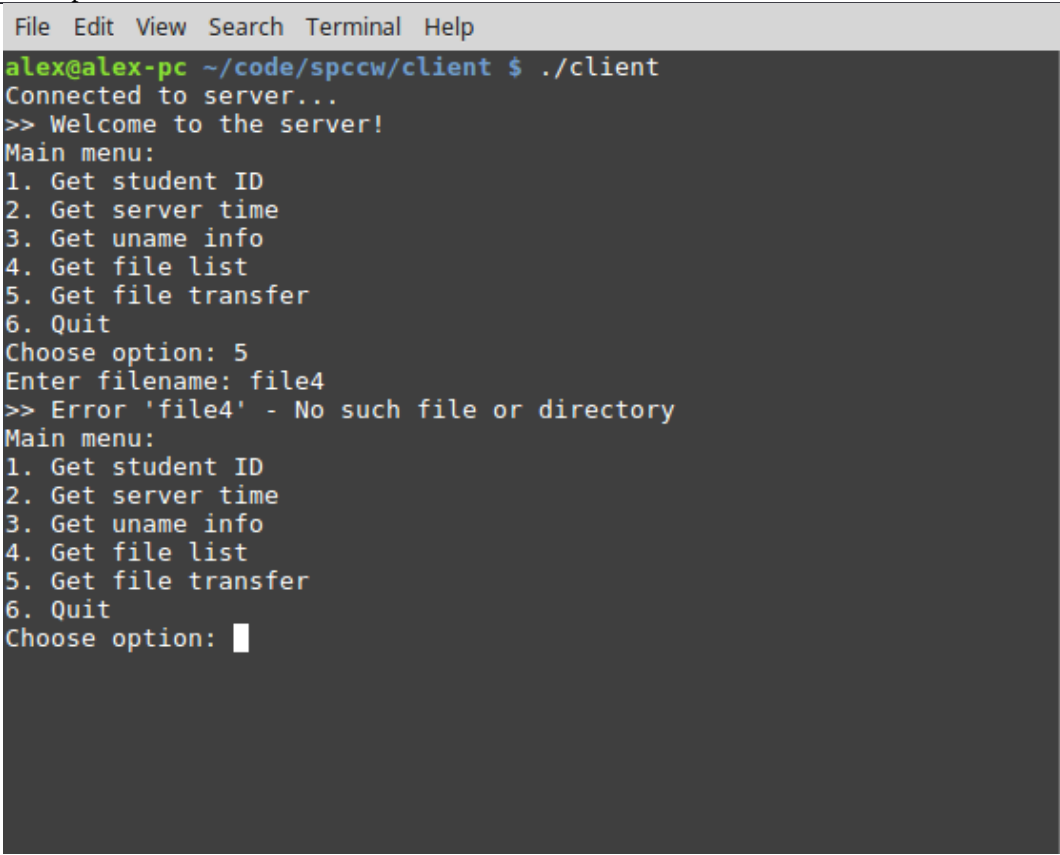
```
alex@alex-pc ~/code/spccw/server
File Edit View Search Terminal Help

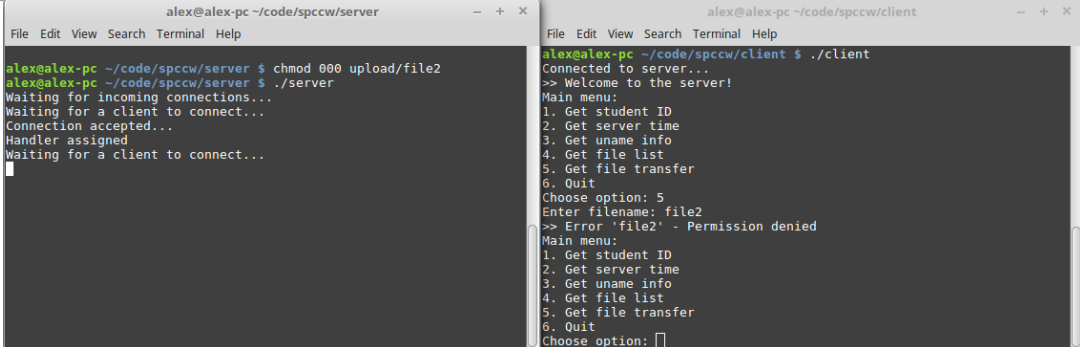
alex@alex-pc ~/code/spccw/server $ ls -l upload
total 12
-rw-rw-r-- 1 alex alex 41 Dec  4 13:21 file1
-rw-rw-r-- 1 alex alex 41 Dec  4 13:21 file2
-rw-rw-r-- 1 alex alex 41 Dec  4 13:21 file3
alex@alex-pc ~/code/spccw/server $ ./server
Waiting for incoming connections...
Waiting for a client to connect...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

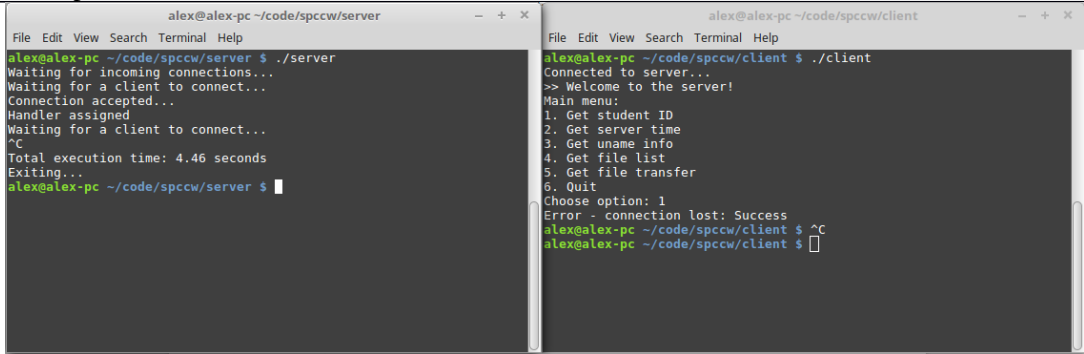
alex@alex-pc ~/code/spccw/client
File Edit View Search Terminal Help

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 $
```

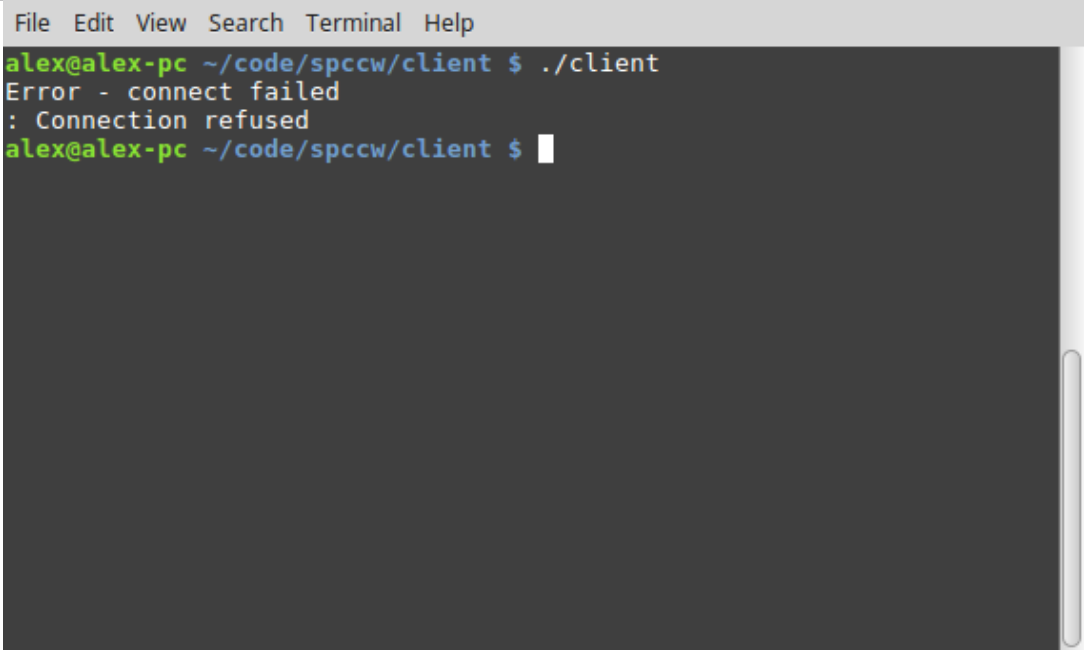
<b>Test</b>	010
<b>Description</b>	Get file transfer shows file already exists error to transfer file that is already present in client directory
<b>Input</b>	<p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal, run 'ls' to check that the file 'file1' exists, then start the client: <code>./client</code></p> <p>Then select option 5 from the client menu, enter 'file1' and press enter.</p>
<b>Expected</b>	<p>The client should display the following:</p> <pre> Connected to server... &gt;&gt; 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>
<b>Actual</b>	As expected
<b>Screen</b>	 <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... &gt;&gt; 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>

<b>Test</b>	011
<b>Description</b>	Get file transfer shows file not found error when asked to transfer file not in upload directory
<b>Input</b>	<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>
<b>Expected</b>	<p>The client should display the following:</p> <pre> Connected to server... &gt;&gt; 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 &gt;&gt; Error 'file4' - No such file or directory  Before then displaying the menu again. </pre>
<b>Actual</b>	As expected
<b>Screen</b>	 <pre> File Edit View Search Terminal Help alex@alex-pc ~/code/spccw/client \$ ./client Connected to server... &gt;&gt; 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 &gt;&gt; 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>

<b>Test</b>	012
<b>Description</b>	Get file transfer shows permission error when asked to transfer file not in upload directory
<b>Input</b>	<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>
<b>Expected</b>	<p>The client should display the following:</p> <pre> Connected to server... &gt;&gt; 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 &gt;&gt; Error 'file2' - Permission denied </pre>
<b>Actual</b>	As expected
<b>Screen</b>	 <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> and the running of <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 to the server, 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 message: '&gt;&gt; Error 'file2' - Permission denied'. Below the error message, the main menu is repeated, and the prompt 'Choose option:' is shown with a cursor.</p>

<b>Test</b>	013
<b>Description</b>	Client deals with losing server connection gracefully
<b>Input</b>	<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>
<b>Expected</b>	<p>The client should display the following:</p> <pre> Connected to server... &gt;&gt; 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>
<b>Actual</b>	As expected
<b>Screen</b>	 <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 then a Ctrl+C signal (^C). It reports 'Total execution time: 4.46 seconds' and 'Exiting...'. The right window, titled 'alex@alex-pc ~/code/spccw/client', shows the execution of the client program. It starts with 'alex@alex-pc ~/code/spccw/client \$ ./client', followed by 'Connected to server...', '&gt;&gt; Welcome to the server!', and a 'Main menu:' with six options. Option 1 is chosen, leading to 'Error - connection lost: Success'. A Ctrl+C signal (^C) is then entered, and the prompt returns.</p>



<b>Test</b>	014
<b>Description</b>	Client deals gracefully with not being able to connect to server
<b>Input</b>	In the second terminal start the client, without the server being active: <code>./client</code>
<b>Expected</b>	The client should display the following:  Error - connect failed : Connection refused
<b>Actual</b>	As expected
<b>Screen</b>	 <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/client</code>. The user enters <code>./client</code>, and the output is:</p> <pre>alex@alex-pc ~/code/spccw/client \$ ./client Error - connect failed : Connection refused alex@alex-pc ~/code/spccw/client \$</pre>