

```
Packet 0 corrupted
duplicate packet 0
timeout occurred, retransmitting sequence: 1
Received: [Seq: 2 Checksum: 83b2330607fe8f817ce6d24249dea373 Contents: message 2]
duplicate packet 1
Received: [Seq: 3 Checksum: 037805d3ad7b10c5b8425427b516b5ce Contents: message 3]
Packet 4 lost
timeout occurred, retransmitting sequence: 0
duplicate packet 0
timeout occurred, retransmitting sequence: 1
Packet 5 corrupted
Out of order, expected number 4, received number 5
duplicate packet 1
timeout occurred, retransmitting sequence: 2
duplicate packet 2
timeout occurred, retransmitting sequence: 3
duplicate packet 3
timeout occurred, retransmitting sequence: 4
Out of order, expected number 4, received number 6
Reordering Packet 4
Out of order, expected number 4, received number 7
Out of order, expected number 4, received number 8
timeout occurred, retransmitting sequence: 0
Packet 0 lost
timeout occurred, retransmitting sequence: 1
duplicate packet 1
timeout occurred, retransmitting sequence: 2
Out of order, expected number 4, received number 9
Packet 2 corrupted
duplicate packet 2
timeout occurred, retransmitting sequence: 3
duplicate packet 3
timeout occurred, retransmitting sequence: 4
Received: [Seq: 4 Checksum: 6b911f2d7c10477a2780d59b3c9bf093 Contents: message 4]
timeout occurred, retransmitting sequence: 5
Received: [Seq: 5 Checksum: 80449eca73fcd9946d2c4739dace443a Contents: message 5]
timeout occurred, retransmitting sequence: 6
Received: [Seq: 6 Checksum: ef6e487fc4b01a5df44ee20c3cc0402c Contents: message 6]
timeout occurred, retransmitting sequence: 7
Received: [Seq: 7 Checksum: e6b5eecf439d99b2da73b6cc50ffe0fa Contents: message 7]
timeout occurred, retransmitting sequence: 8
Reordering Packet 8
ACK: 0
```

In this example, you can see that packet 0 was corrupted and also lost but managed to recover and send an ACK in the end.

```
Packet 1 lost
timeout occurred, retransmitting sequence: 0
Out of order, expected number 1, received number 2
duplicate packet 0
timeout occurred, retransmitting sequence: 1
Received: [Seq: 1 Checksum: 1db65a6a0a818fd39655b95e33ada11d Contents: message 1]
Out of order, expected number 2, received number 3
Out of order, expected number 2, received number 4
timeout occurred, retransmitting sequence: 0
duplicate packet 0
timeout occurred, retransmitting sequence: 1
Reordering Packet 5
duplicate packet 1
timeout occurred, retransmitting sequence: 2
Received: [Seq: 2 Checksum: 83b2330607fe8f817ce6d24249dea373 Contents: message 2]
timeout occurred, retransmitting sequence: 3
Received: [Seq: 3 Checksum: 037805d3ad7b10c5b8425427b516b5ce Contents: message 3]
timeout occurred, retransmitting sequence: 4
Packet 6 corrupted
Out of order, expected number 4, received number 6
Reordering Packet 4
Out of order, expected number 4, received number 7
Out of order, expected number 4, received number 8
timeout occurred, retransmitting sequence: 0
duplicate packet 0
timeout occurred, retransmitting sequence: 1
duplicate packet 1
timeout occurred, retransmitting sequence: 2
Packet 9 lost
duplicate packet 2
timeout occurred, retransmitting sequence: 3
Reordering Packet 3
timeout occurred, retransmitting sequence: 4
Received: [Seq: 4 Checksum: 6b911f2d7c10477a2780d59b3c9bf093 Contents: message 4]
timeout occurred, retransmitting sequence: 5
Received: [Seq: 5 Checksum: 80449eca73fcd9946d2c4739dace443a Contents: message 5]
timeout occurred, retransmitting sequence: 6
Received: [Seq: 6 Checksum: ef6e487fc4b01a5df44ee20c3cc0402c Contents: message 6]
timeout occurred, retransmitting sequence: 7
Packet 7 lost
timeout occurred, retransmitting sequence: 8
Out of order, expected number 7, received number 8
ACK: 0
ACK: 1
```

Here is another sample run. Here you can see that packet 1 was lost but managed to recover and send an ACK by the end

```
Out of order, expected number 2, received number 4
timeout occurred, retransmitting sequence: 0
duplicate packet 0
timeout occurred, retransmitting sequence: 1
Out of order, expected number 2, received number 5
duplicate packet 1
timeout occurred, retransmitting sequence: 2
Received: [Seq: 2 Checksum: 83b2330607fe8f817ce6d24249dea373 Contents: message 2]
timeout occurred, retransmitting sequence: 3
Packet 3 lost
timeout occurred, retransmitting sequence: 4
Out of order, expected number 3, received number 6
Out of order, expected number 3, received number 4
Out of order, expected number 3, received number 7
Out of order, expected number 3, received number 8
timeout occurred, retransmitting sequence: 0
duplicate packet 0
timeout occurred, retransmitting sequence: 1
duplicate packet 1
timeout occurred, retransmitting sequence: 2
Packet 9 lost
duplicate packet 2
timeout occurred, retransmitting sequence: 3
Packet 3 lost
timeout occurred, retransmitting sequence: 4
Out of order, expected number 3, received number 4
timeout occurred, retransmitting sequence: 5
Out of order, expected number 3, received number 5
timeout occurred, retransmitting sequence: 6
Out of order, expected number 3, received number 6
timeout occurred, retransmitting sequence: 7
Out of order, expected number 3, received number 7
timeout occurred, retransmitting sequence: 8
Out of order, expected number 3, received number 8
ACK: 0
ACK: 1
ACK: 2
```

In this example, you can see that packet 2 did not arrive on time and arrived after packet 5, but the packets eventually were put in the correct order and ACKed

```
Out of order, expected number 4, received number 9
ACK: 3
timeout occurred, retransmitting sequence: 4
Packet 4 lost
timeout occurred, retransmitting sequence: 5
Packet 5 corrupted
Out of order, expected number 4, received number 5
timeout occurred, retransmitting sequence: 6
Out of order, expected number 4, received number 6
timeout occurred, retransmitting sequence: 7
Packet 7 corrupted
Out of order, expected number 4, received number 7
timeout occurred, retransmitting sequence: 8
Reordering Packet 8
timeout occurred, retransmitting sequence: 9
Reordering Packet 9
timeout occurred, retransmitting sequence: 4
Received: [Seq: 4 Checksum: 6b911f2d7c10477a2780d59b3c9bf093 Contents: message 4]
timeout occurred, retransmitting sequence: 5
Received: [Seq: 5 Checksum: 80449eca73fcd9946d2c4739dace443a Contents: message 5]
timeout occurred, retransmitting sequence: 6
Received: [Seq: 6 Checksum: ef6e487fc4b01a5df44ee20c3cc0402c Contents: message 6]
timeout occurred, retransmitting sequence: 7
Reordering Packet 7
timeout occurred, retransmitting sequence: 8
Packet 8 corrupted
Out of order, expected number 7, received number 8
timeout occurred, retransmitting sequence: 9
Out of order, expected number 7, received number 9
ACK: 4
ACK: 5
ACK: 6
timeout occurred, retransmitting sequence: 7
Received: [Seq: 7 Checksum: e6b5eecf439d99b2da73b6cc50ffe0fa Contents: message 7]
timeout occurred, retransmitting sequence: 8
Packet 8 corrupted
Received: [Seq: 8 Checksum: ff23b8e665ba03b9c75c5e79b6f8118a Contents: message 8]
timeout occurred, retransmitting sequence: 9
Received: [Seq: 9 Checksum: fd79b1e4d33308046f13baec75cc02c3 Contents: message 9]
ACK: 7
ACK: 8
ACK: 9
```

Here is a final image showing that all of the packets ACKs were received in the end

```

C:\Users\clark\OneDrive\Documents\Backup\Documents\Networks\hw03\database_hw3>dir
Volume in drive C is Windows
Volume Serial Number is 6C9A-CA09

Directory of C:\Users\clark\OneDrive\Documents\Backup\Documents\Networks\hw03\database_hw3

03/21/2025  04:54 PM    <DIR>          .
03/18/2025  04:17 PM    <DIR>          ..
03/21/2025  04:29 PM             3,164 client.py
03/21/2025  04:43 PM        108,019 Documentation.pdf
03/21/2025  03:02 PM              0 file.txt
03/21/2025  03:24 PM             7,909 main.py
03/21/2025  04:36 PM             474 README.md
03/21/2025  04:31 PM            2,162 requirements.txt
03/21/2025  04:27 PM            2,640 server.py
03/21/2025  03:35 PM    <DIR>          __pycache__
              7 File(s)         124,368 bytes
              3 Dir(s)    364,277,964,800 bytes free

C:\Users\clark\OneDrive\Documents\Backup\Documents\Networks\hw03\database_hw3>python server.py
Server started on port 6969

```

This is an image of before the final transfer runs. You can see that in the current directory there is the file named “file.txt” that is ready to be transferred, but there is no file that is the received file yet. The program has started on the server side and is listening

```

C:\Users\clark\OneDrive\Documents\Backup\Documents\Networks\hw03\database_hw3>python client.py

C:\Users\clark\OneDrive\Documents\Backup\Documents\Networks\hw03\database_hw3>dir
Volume in drive C is Windows
Volume Serial Number is 6C9A-CA09

Directory of C:\Users\clark\OneDrive\Documents\Backup\Documents\Networks\hw03\database_hw3

03/21/2025  04:57 PM    <DIR>          .
03/18/2025  04:17 PM    <DIR>          ..
03/21/2025  04:29 PM             3,164 client.py
03/21/2025  04:43 PM        108,019 Documentation.pdf
03/21/2025  03:02 PM              0 file.txt
03/21/2025  03:24 PM             7,909 main.py
03/21/2025  04:55 PM             555 README.md
03/21/2025  04:57 PM              0 received_file.txt
03/21/2025  04:31 PM            2,162 requirements.txt
03/21/2025  04:27 PM            2,640 server.py
03/21/2025  03:35 PM    <DIR>          __pycache__
              8 File(s)         124,449 bytes
              3 Dir(s)    364,272,762,880 bytes free

C:\Users\clark\OneDrive\Documents\Backup\Documents\Networks\hw03\database_hw3>|

```

In this final image, I started the client, which initiated the transfer. In the listed files below, you can now see that there is a file named `received_file.txt`, which was sent from this terminal to the other one.