Comp 9331 Ass Report

StudentID: z5184142 StudentName:JiachenLi Language use:Python3.7

1. A brief discussion of how you have implemented the STP protocol. Provide a list of features that you have successfully implemented. In case you have not been able to get certain features of STP working, you should also mention that in your report.

To the STP protocol, I have constructed a class, which is called STP. This class contains eight elements and it is shown in the table below.

Syn_bit	Synchronous Sequence Number
Ack_bit	Reply for Syn/Fin Number
Fin_bit	Fin Number
Seq_number	Packet Sequence Number
Ack_number	Packet Ack Number
payload	For Carrying Data
lengthofdata	Length of Carrying Data
checksum	Md5 for checksum

The function of the program is shown in the table below.

ThreeHandShakeFunction	Contains
CloseConnectionFunction	Contains
SendFile	Contains
ReceiveFile	Contains
PLDFunction	Contains (but the delay function has some bugs, when it goes to delay, all threads will stop until it sends the packet, so the timer will not retransmit if delay time is longer than TimeoutInterval.)
Timeoutdetect	Contains
FastRetransmit	Contains

2. A detailed diagram of your STP header and a quick explanation of all fields (similar to the diagrams that we have used in the lectures to understand TCP/UDP headers).

STP header:

Syn_bit	Synchronous Number
Ack_bit	Reply for Syn/Fin Number
Fin_bit	Fin Number
Seq_number	Packet Sequence Number
Ack_number	Packet Ack Number
payload	For Carrying Data
lengthofdata	Length of Carrying Data
checksum	Md5 for checksum

3. Discuss any design trade-offs considered and made. Describe possible improvements and extensions

The timer is not designed well, especially when the packet is going to be delay transmitted. The timer will stop instead of continue calculating the Timeout Interval. Also, the timer may clash if the receiver is dealing with the self.timer_list, which makes me to make the sleep time of timer becomes longer. The corrupted packet that I modified, is just replace the payload with b'#', which may not satisfy the requirements.

4. Indicate any segments of code that you have borrowed from the Web or other books.
https://github.com/jin-zhe/reliable-UDP/blob/master/Sender.java

5.

(a)

Test Case: pDrop = 0.1, MWS = 500 bytes, MSS = 100 bytes, seed = 100, gamma = 4

Sender:

```
snd      0.0     S       0       0       0
rcv      0.0     SA      0       0       1
snd      0.0     A       1       0       1
snd      0.0     D       1       100     1
snd      0.0     D       101     100     1
drop     0.0     D       201     100     1
snd      0.0     D       301     100     1
snd      0.0     D       401     100     1
rcv      0.0     A       1       0       101
rcv      0.0     A       1       0       201
rcv\DA   0.0     A       1       0       201
rcv\DA   0.0     A       1       0       201
snd      0.0     D       501     100     1
snd      0.0     D       601     100     1
rcv\DA   0.0     A       1       0       201
snd/RXT  0.0     D       201     100     1
rcv\DA   0.0     A       1       0       201
rcv      0.0     A       1       0       701
snd      0.0     D       701     100     1
snd      0.0     D       801     100     1
snd      0.0     D       901     100     1
rcv      0.0     A       1       0       801
snd      0.0     D       1001    100     1
rcv      0.0     A       1       0       901
snd      0.0     D       1101    100     1
rcv      0.0     A       1       0       1001
snd      0.0     D       1201    100     1
rcv      0.0     A       1       0       1101
snd      0.0     D       1301    100     1
snd      0.0     D       1401    100     1
rcv      0.0     A       1       0       1201
snd      0.0     D       1501    100     1
snd      0.0     D       1601    100     1
rcv      0.0     A       1       0       1301
snd      0.0     D       1701    100     1
rcv      0.0     A       1       0       1401
snd      0.0     D       1801    100     1
rcv      0.01    A       1       0       1501
snd      0.01    D       1901    100     1
rcv      0.01    A       1       0       1601
drop     0.01    D       2001    100     1
rcv      0.01    A       1       0       1701
rcv      0.01    A       1       0       1801
rcv      0.01    A       1       0       1901
rcv      0.01    A       1       0       2001
snd      0.01    D       2101    100     1
snd      0.01    D       2201    100     1
snd      0.01    D       2301    100     1
snd      0.01    D       2401    100     1
rcv\DA   0.01    A       1       0       2001
rcv\DA   0.01    A       1       0       2001
rcv\DA   0.01    A       1       0       2001
snd/RXT  0.01    D       2001    100     1
rcv\DA   0.01    A       1       0       2001
rcv      0.01    A       1       0       2501
snd      0.01    D       2501    100     1
snd      0.01    D       2601    100     1
drop     0.01    D       2701    100     1
drop     0.01    D       2801    100     1
snd      0.01    D       2901    100     1
rcv      0.01    A       1       0       2601
rcv      0.01    A       1       0       2701
rcv\DA   0.01    A       1       0       2701
snd      0.01    D       3001    28      1
rcv\DA   0.01    A       1       0       2701
snd/RXT  0.06    D       2701    100     1
rcv      0.06    A       1       0       2801
snd/RXT  0.07    D       2801    100     1
rcv      0.07    A       1       0       3029
snd      0.07    F       3029    0       1
rcv      0.07    A       1       0       3030
rcv      0.07    F       1       0       3030
snd      0.07    A       3030    0       2
============================================================
Size of the file (in Bytes) 3028
Segments transmitted (including drop & RXT) 39
Number of Segments handled by PLD 35
Number of Segments dropped 4
Number of Segments Corrupted 0
Number of Segments Re-ordered 0
Number of Segments Duplicated 0
Number of Segments Delayed 0
Number of Retransmissions due to TIMEOUT 2
Number of FAST RETRANSMISSION 2
Number of DUP ACKS received 10
============================================================
```

Receiver:

```
rcv      0.0     S       0       0       0
snd      0.0     SA      0       0       1
rcv      0.0     A       1       0       1
rcv      0.0     D       1       100     1
snd      0.0     A       1       0       101
rcv      0.0     D       101     100     1
snd      0.0     A       1       0       201
rcv      0.0     D       301     100     1
snd/DA   0.0     A       1       0       201
rcv      0.0     D       401     100     1
snd/DA   0.0     A       1       0       201
rcv      0.0     D       501     100     1
snd/DA   0.0     A       1       0       201
rcv      0.0     D       601     100     1
snd/DA   0.0     A       1       0       201
rcv      0.0     D       201     100     1
snd      0.0     A       1       0       701
rcv      0.0     D       701     100     1
snd      0.0     A       1       0       801
rcv      0.0     D       801     100     1
snd      0.0     A       1       0       901
rcv      0.0     D       901     100     1
snd      0.0     A       1       0       1001
rcv      0.0     D       1001    100     1
snd      0.0     A       1       0       1101
rcv      0.0     D       1101    100     1
snd      0.0     A       1       0       1201
rcv      0.0     D       1201    100     1
snd      0.0     A       1       0       1301
rcv      0.0     D       1301    100     1
snd      0.0     A       1       0       1401
rcv      0.0     D       1401    100     1
snd      0.0     A       1       0       1501
rcv      0.0     D       1501    100     1
snd      0.0     A       1       0       1601
rcv      0.0     D       1601    100     1
snd      0.0     A       1       0       1701
rcv      0.01    D       1701    100     1
snd      0.01    A       1       0       1801
rcv      0.01    D       1801    100     1
snd      0.01    A       1       0       1901
rcv      0.01    D       1901    100     1
snd      0.01    A       1       0       2001
rcv      0.01    D       2101    100     1
snd/DA   0.01    A       1       0       2001
rcv      0.01    D       2201    100     1
snd/DA   0.01    A       1       0       2001
rcv      0.01    D       2301    100     1
snd/DA   0.01    A       1       0       2001
rcv      0.01    D       2401    100     1
snd/DA   0.01    A       1       0       2001
rcv      0.01    D       2001    100     1
snd      0.01    A       1       0       2501
rcv      0.01    D       2501    100     1
snd      0.01    A       1       0       2601
rcv      0.01    D       2601    100     1
snd      0.01    A       1       0       2701
rcv      0.01    D       2901    100     1
snd/DA   0.01    A       1       0       2701
rcv      0.01    D       3001    28      1
snd/DA   0.01    A       1       0       2701
rcv      0.35    D       2701    100     1
snd      0.35    A       1       0       2801
rcv      0.36    D       2801    100     1
snd      0.36    A       1       0       3029
rcv      0.37    F       3029    0       1
snd      0.37    A       1       0       3030
snd      0.37    F       1       0       3030
rcv      0.37    A       3030    0       2
============================================
Amount of data received (bytes) 3028
Total Segments Received 35
Data segments received 31
Data segments with Bit Errors 0
Duplicate data segments received 0
Duplicate ACKs sent 10
============================================
```

Test Case: pDrop = 0.3, MWS = 500 bytes, MSS = 100 bytes, seed = 100, gamma = 4

Discuss: With the drop percentage becomes a litter bit larger, from 0.1 to 0.3. It can be found the Timeout Interval is becoming longer with the packet drop.

Sender:

```
snd         0.0         S           0           0           0
rcv         0.0         SA          0           0           1
snd         0.0         A           1           0           1
drop        0.0         D           1           100         1
snd         0.0         D           101         100         1
snd         0.0         D           201         100         1
snd         0.0         D           301         100         1
drop        0.0         D           401         100         1
rcv         0.0         A           1           0           1
rcv\DA      0.0         A           1           0           1
rcv\DA      0.0         A           1           0           1
drop        1.51        D           1           100         1
drop        1.52        D           101         100         1
snd/RXT     1.53        D           201         100         1
rcv\DA      1.53        A           1           0           1
snd/RXT     1.53        D           1           100         1
rcv         1.53        A           1           0           401
drop        1.53        D           501         100         1
drop        1.53        D           601         100         1
snd         1.53        D           701         100         1
snd         1.53        D           801         100         1
rcv\DA      1.53        A           1           0           401
rcv\DA      1.53        A           1           0           401
drop        2.41        D           401         100         1
snd/RXT     3.94        D           501         100         1
rcv\DA      3.95        A           1           0           401
snd/RXT     3.95        D           401         100         1
rcv         3.95        A           1           0           601
snd         3.95        D           901         100         1
snd         3.95        D           1001        100         1
rcv\DA      3.95        A           1           0           601
rcv\DA      3.95        A           1           0           601
snd/RXT     4.05        D           601         100         1
rcv         4.05        A           1           0           1101
drop        4.05        D           1101        100         1
snd         4.05        D           1201        100         1
drop        4.05        D           1301        100         1
drop        4.05        D           1401        100         1
snd         4.05        D           1501        100         1
rcv\DA      4.05        A           1           0           1101
rcv\DA      4.05        A           1           0           1101
snd/RXT     6.47        D           1101        100         1
rcv         6.47        A           1           0           1301
drop        6.47        D           1601        100         1
snd         6.47        D           1701        100         1
rcv\DA      6.47        A           1           0           1301
snd/RXT     8.16        D           1301        100         1
rcv         8.16        A           1           0           1401
snd         8.16        D           1801        100         1
rcv\DA      8.17        A           1           0           1401
drop        8.18        D           1401        100         1
drop        8.19        D           1501        100         1
drop        10.39       D           1601        100         1
drop        10.4        D           1701        100         1
drop        12.08       D           1801        100         1
snd/RXT     12.09       D           1401        100         1
rcv         12.09       A           1           0           1601
snd         12.09       D           1901        100         1
snd         12.09       D           2001        100         1
rcv\DA      12.09       A           1           0           1601
rcv\DA      12.09       A           1           0           1601
snd/RXT     17.15       D           1601        100         1
rcv         17.15       A           1           0           2101
snd         17.15       D           2101        100         1
drop        17.15       D           2201        100         1
snd         17.15       D           2301        100         1
drop        17.15       D           2401        100         1
drop        17.15       D           2501        100         1
rcv         17.15       A           1           0           2201
rcv\DA      17.15       A           1           0           2201
drop        17.15       D           2601        100         1
snd/RXT     26.28       D           2201        100         1
rcv         26.28       A           1           0           2401
snd         26.28       D           2701        100         1
drop        26.28       D           2801        100         1
rcv\DA      26.28       A           1           0           2401
snd/RXT     33.07       D           2401        100         1
rcv         33.07       A           1           0           2501
drop        33.07       D           2901        100         1
snd/RXT     33.08       D           2501        100         1
rcv         33.08       A           1           0           2601
snd         33.08       D           3001        28          1
rcv\DA      33.08       A           1           0           2601
drop        33.09       D           2601        100         1
snd/RXT     39.5        D           2701        100         1
rcv\DA      39.5        A           1           0           2601
drop        39.51       D           2801        100         1
snd/RXT     46.29       D           2901        100         1
rcv\DA      46.29       A           1           0           2601
snd/RXT     46.29       D           2601        100         1
rcv         46.29       A           1           0           2801
snd/RXT     49.09       D           3001        28          1
rcv\DA      49.09       A           1           0           2801
snd/RXT     55.5        D           2801        100         1
rcv         55.5        A           1           0           3029
snd         55.5        F           3029        0           1
rcv         55.5        A           1           0           3030
rcv         55.5        F           1           0           3030
snd         55.5        A           3030        0           2
=============================================================
Size of the file (in Bytes) 3028
Segments transmitted (including drop & RXT) 62
Number of Segments handled by PLD 58
Number of Segments dropped 24
Number of Segments Corrupted 0
Number of Segments Re-ordered 0
Number of Segments Duplicated 0
Number of Segments Delayed 0
Number of Retransmissions due to TIMEOUT 24
Number of FAST RETRANSMISSION 3
Number of DUP ACKS received 20
=============================================================
```

Receiver:

```
rcv         0.0         S           0           0           0
snd         0.0         SA          0           0           1
rcv         0.0         A           1           0           1
rcv         0.0         D           101         100         1
snd/DA      0.0         A           1           0           1
rcv         0.0         D           201         100         1
snd/DA      0.0         A           1           0           1
rcv         0.0         D           301         100         1
snd/DA      0.0         A           1           0           1
rcv         0.0         D           201         100         1
snd/DA      0.0         A           1           0           1
rcv         1.53        D           1           100         1
snd         1.53        A           1           0           401
rcv         1.53        D           701         100         1
snd/DA      1.53        A           1           0           401
rcv         1.53        D           801         100         1
snd/DA      1.53        A           1           0           401
rcv         3.94        D           501         100         1
snd/DA      3.94        A           1           0           401
rcv         3.95        D           401         100         1
snd         3.95        A           1           0           601
rcv         3.95        D           901         100         1
snd/DA      3.95        A           1           0           601
rcv         3.95        D           1001        100         1
snd/DA      3.95        A           1           0           601
rcv         4.05        D           601         100         1
snd         4.05        A           1           0           1101
rcv         4.05        D           1201        100         1
snd/DA      4.05        A           1           0           1101
rcv         4.05        D           1501        100         1
snd/DA      4.05        A           1           0           1101
rcv         6.47        D           1101        100         1
snd         6.47        A           1           0           1301
rcv         6.47        D           1701        100         1
snd/DA      6.47        A           1           0           1301
rcv         8.16        D           1301        100         1
snd         8.16        A           1           0           1401
rcv         8.16        D           1801        100         1
snd/DA      8.16        A           1           0           1401
rcv         12.09       D           1401        100         1
snd         12.09       A           1           0           1601
rcv         12.09       D           1901        100         1
snd/DA      12.09       A           1           0           1601
rcv         12.09       D           2001        100         1
snd/DA      12.09       A           1           0           1601
rcv         17.15       D           1601        100         1
snd         17.15       A           1           0           2101
rcv         17.15       D           2101        100         1
snd         17.15       A           1           0           2201
rcv         17.15       D           2301        100         1
snd/DA      17.15       A           1           0           2201
rcv         26.28       D           2201        100         1
snd         26.28       A           1           0           2401
rcv         26.28       D           2701        100         1
snd/DA      26.28       A           1           0           2401
rcv         33.07       D           2401        100         1
snd         33.07       A           1           0           2501
rcv         33.08       D           2501        100         1
snd         33.08       A           1           0           2601
rcv         33.08       D           3001        28          1
snd/DA      33.08       A           1           0           2601
rcv         33.08       D           2701        100         1
snd/DA      33.08       A           1           0           2601
rcv         46.29       D           2901        100         1
snd/DA      46.29       A           1           0           2601
rcv         46.29       D           2601        100         1
snd         46.29       A           1           0           2801
rcv         46.29       D           3001        28          1
snd/DA      46.29       A           1           0           2801
rcv         55.5        D           2801        100         1
snd         55.5        A           1           0           3029
rcv         55.5        F           3029        0           1
snd         55.5        A           1           0           3030
snd         55.5        F           1           0           3030
rcv         55.5        A           3030        0           2
=============================================
Amount of data received (bytes) 3028
Total Segments Received 38
Data segments received 34
Data segments with Bit Errors 0
Duplicate data segments received 3
Duplicate ACKs sent 21
=============================================
```

(b): not test yet. Because there are some problems in delay, which will cause extremely long time to wait.

(c): MWS=500bytes MSS=50 gamma=4 pDrop=0.1 pDuplicate=0.1 pCorrupt=0.1 pOrder=0.1 maxOrder=4 pDelay=0 maxDelay=0 seed=300

The file is successful transmitted, it took almost two and half minute to transfer. The pDrop is the most critical contributing in the overall transfer time. Because the pDrop will make the Timeout Interval becomes longer.

Sender:

```
snd       0.0     S       0       0       0
rcv       0.0     SA      0       0       1
snd       0.0     A       1       0       1
snd/corr          0.01    D       1       100     1
snd       0.01    D       101     100     1
snd       0.01    D       201     100     1
snd       0.01    D       301     100     1
snd       0.01    D       401     100     1
rcv       0.01    A       1       0       1
rcv\DA    0.01    A       1       0       1
rcv\DA    0.01    A       1       0       1
rcv\DA    0.01    A       1       0       1
snd       0.01    D       1       100     1
snd/dup   0.01    D       1       100     1
rcv\DA    0.01    A       1       0       1
rcv       0.01    A       1       0       501
rcv\DA    0.01    A       1       0       501
snd       0.01    D       501     100     1
snd/corr          0.01    D       601     100     1
snd       0.01    D       701     100     1
snd       0.01    D       801     100     1
snd       0.01    D       901     100     1
rcv       0.01    A       1       0       601
snd       0.01    D       1001    100     1
snd     154.58  D       1604301 100     1
snd     154.58  D       1604401 100     1
snd     154.58  D       1604501 100     1
snd     154.58  D       1604601 100     1
snd     154.58  D       1604701 100     1
rcv\DA  154.58  A       1       0       1604301
rcv     154.58  A       1       0       1604401
snd     154.58  D       1604801 100     1
rcv     154.58  A       1       0       1604501
rcv     154.58  A       1       0       1604601
snd     154.58  D       1604901 100     1
snd     154.58  D       1605001 100     1
rcv     154.58  A       1       0       1604701
rcv     154.58  A       1       0       1604801
snd/corr        154.58  D       1605101 100     1
snd     154.58  D       1605201 100     1
rcv     154.58  A       1       0       1604901
rcv     154.58  A       1       0       1605001
snd     154.58  D       1605301 100     1
snd     154.58  D       1605401 100     1
rcv     154.59  A       1       0       1605101
snd     154.59  D       1605501 85      1
rcv\DA  154.59  A       1       0       1605101
rcv\DA  154.59  A       1       0       1605101
rcv\DA  154.59  A       1       0       1605101
snd/RXT 154.59  D       1605101 100     1
rcv\DA  154.59  A       1       0       1605101
rcv\DA  154.59  A       1       0       1605101
rcv     154.59  A       1       0       1605586
snd     154.59  F       1605586 0       1
rcv     154.61  A       1       0       1605587
rcv     154.61  F       1       0       1605587
snd     154.61  A       1605587 0       2
============================================================
Size of the file (in Bytes) 1605585
Segments transmitted (including drop & RXT) 16627
Number of Segments handled by PLD 20079
Number of Segments dropped 2060
Number of Segments Corrupted 1671
Number of Segments Re-ordered 2
Number of Segments Duplicated 1784
Number of Segments Delayed 0
Number of Retransmissions due to TIMEOUT 1621
Number of FAST RETRANSMISSION 2402
Number of DUP ACKS received 10917
============================================================
```

Receiver:

```
rcv       0.0     S       0       0       0
snd       0.0     SA      0       0       1
rcv       0.0     A       1       0       1
rcv/corr          0.01    D       1       100     1
snd       0.01    A       1       0       1
rcv       0.01    D       101     100     1
snd/DA    0.01    A       1       0       1
rcv       0.01    D       201     100     1
snd/DA    0.01    A       1       0       1
rcv       0.01    D       301     100     1
snd/DA    0.01    A       1       0       1
rcv       0.01    D       401     100     1
snd/DA    0.01    A       1       0       1
rcv       0.01    D       1       100     1
snd       0.01    A       1       0       501
rcv       0.01    D       1       100     1
snd/DA    0.01    A       1       0       501
rcv       0.01    D       501     100     1
snd       0.01    A       1       0       601
rcv/corr          0.01    D       601     100     1
snd       0.01    A       1       0       601
rcv       0.01    D       701     100     1
snd/DA    0.01    A       1       0       601
rcv       0.01    D       801     100     1
snd/DA    0.01    A       1       0       601
rcv       0.01    D       901     100     1
snd/DA    0.01    A       1       0       601
rcv       0.01    D       1001    100     1
snd/DA    0.01    A       1       0       601
rcv/corr          0.01    D       601     100     1
snd       0.01    A       1       0       601
rcv       0.01    D       601     100     1
snd       0.01    A       1       0       1101
rcv       0.01    D       1101    100     1
snd       0.01    A       1       0       1201
rcv       0.01    D       1201    100     1
snd/DA  154.58  A       1       0       1603801
rcv     154.58  D       1603801 100     1
snd     154.58  A       1       0       1604301
rcv     154.58  D       1603801 100     1
snd/DA  154.58  A       1       0       1604301
rcv     154.58  D       1604301 100     1
snd     154.58  A       1       0       1604401
rcv     154.58  D       1604401 100     1
snd     154.58  A       1       0       1604501
rcv     154.58  D       1604501 100     1
snd     154.58  A       1       0       1604601
rcv     154.58  D       1604601 100     1
snd     154.58  A       1       0       1604701
rcv     154.58  D       1604701 100     1
snd     154.58  A       1       0       1604801
rcv     154.58  D       1604801 100     1
snd     154.58  A       1       0       1604901
rcv     154.58  D       1604901 100     1
snd     154.58  A       1       0       1605001
rcv     154.58  D       1605001 100     1
snd     154.58  A       1       0       1605101
rcv/corr        154.58  D       1605101 100     1
snd     154.58  A       1       0       1605101
rcv     154.59  D       1605201 100     1
snd/DA  154.59  A       1       0       1605101
rcv     154.59  D       1605301 100     1
snd/DA  154.59  A       1       0       1605101
rcv     154.59  D       1605401 100     1
snd/DA  154.59  A       1       0       1605101
rcv     154.59  D       1605501 85      1
snd/DA  154.59  A       1       0       1605101
rcv     154.59  D       1605101 100     1
snd     154.59  A       1       0       1605586
rcv     154.61  F       1605586 0       1
snd     154.61  A       1       0       1605587
snd     154.61  F       1       0       1605587
rcv     154.61  A       1605587 0       2
================================================
Amount of data received (bytes) 1605585
Total Segments Received 19807
Data segments received 19803
Data segments with Bit Errors 1636
Duplicate data segments received 2111
Duplicate ACKs sent 10004
================================================
```