HW2　　B06504016 林家宏

1.

(a)我把 msg 的 buffersize 寫成 1000，timer 的 increment 設為 30，sequence number 則沒有去限制，初始值設為 0。另外我把 ackonwledge number 初始值設為 100，刻意讓他和 sequence number 不同，畢竟在通常情況下兩個是不一樣的。

當 A 端開始傳送第一個封包，會印出 seq ack check 三個 number 以及原始訊息。B 端收到後，如果封包正確，就會回應一個封包，這封包的 seq 就是 A 傳送過來的 ack，ack 則是預期收到的下個 A 傳來的 seq。訊息內容則是 ACK。若傳送失敗，則傳過去訊息內容則是 NAK。

```
EVENT time: 61.522457,  type: 2, fromlayer3  entity: 1        EVENT time: 66.129433,  type: 1, fromlayer5  entity: 0
receiving:                                                     A: sending:
          seq:2, ack:102 check:F0F0EA8                           seq:6, ack:106,
          message:cccccccccccccccccccc                           check:FAFAFA8C
                                                                  message: gggggggggggggggggggg
receive:2,looking for:2
B:sending:                                                     EVENT time: 68.455338,  type: 2, fromlayer3  entity: 1
  seq:102, ack:3 check:FFB4BC55                                receiving:
  message:ACK                                                           seq:1, ack:101 check:141413AF
                                                                        message:bbbbbbbbbbbbbbbbbbbb

EVENT time: 64.931442,  type: 1, fromlayer5  entity: 0        receive:1,looking for:4
A: sending:                                                             TOLAYER3: packet being corrupted
  seq:4, ack:104,                                             B:sending:
  check:505049A                                                 seq:101, ack:2 check:FFB4BC57
  message: eeeeeeeeeeeeeeeeeeee                                 message:ACK

EVENT time: 65.681038,  type: 2, fromlayer3  entity: 0
receive acknum: 102, looking for: 101                         EVENT time: 70.821678,  type: 2, fromlayer3  entity: 1
                                                              receiving:
EVENT time: 65.725098,  type: 2, fromlayer3  entity: 1                 seq:2, ack:102 check:F0F0EA8
receiving:                                                              message:cccccccccccccccccccc
          seq:3, ack:103 check:A0A09A1
          message:dddddddddddddddddddd                        receive:2,looking for:4
                                                              B:sending:
receive:3,looking for:3                                         seq:102, ack:3 check:FFB4BC55
B:sending:                                                      message:ACK
  seq:103, ack:4 check:FFB4BC53
  message:ACK
                                                              EVENT time: 72.605598,  type: 2, fromlayer3  entity: 1
          TOLAYER3: packet being corrupted                    receiving:
                                                                        seq:3, ack:999999 check:A0A09A1
EVENT time: 65.999512,  type: 1, fromlayer5  entity: 0                  message:dddddddddddddddddddd
A: sending:
  seq:5, ack:105,                                             B:sending:
  check:FFFFFF93                                                seq:103, ack:4 check:FFB4BE46
  message: ffffffffffffffffffff                                message:NAK

EVENT time: 66.129433,  type: 1, fromlayer5  entity: 0        EVENT time: 75.484344,  type: 2, fromlayer3  entity: 0
A: sending:                                                   receive acknum: 103, looking for: 101
  seq:6, ack:106,
```

```
EVENT time: 75.484344,  type: 2, fromlayer3  entity: 0        EVENT time: 81.734283,  type: 2, fromlayer3  entity: 0
receive acknum: 103, looking for: 101                         receive acknum: 101, looking for: 101
                                                              corrupted!
EVENT time: 75.627434,  type: 1, fromlayer5  entity: 0
          TOLAYER3: packet being corrupted                    EVENT time: 86.553566,  type: 2, fromlayer3  entity: 0
A: sending:                                                   receive acknum: 102, looking for: 101
  seq:7, ack:107,
  check:F5F5F585                                              EVENT time: 89.224945,  type: 1, fromlayer5  entity: 0
  message: hhhhhhhhhhhhhhhhhhhh                               A: sending:
                                                                seq:8, ack:108,
EVENT time: 78.443565,  type: 2, fromlayer3  entity: 1          check:F0F0F07E
receiving:                                                      message: iiiiiiiiiiiiiiiiiiii
          seq:4, ack:104 check:505049A
          message:eeeeeeeeeeeeeeeeeeee                        EVENT time: 89.402451,  type: 0, timerinterrupt  entity: 0
                                                              sending:
receive:4,looking for:4                                                 seq:1, ack:101 check:141413AF
B:sending:                                                              message:bbbbbbbbbbbbbbbbbbbb
  seq:104, ack:5 check:FFB4BC51
  message:ACK                                                 sending:
                                                                        seq:2, ack:102 check:F0F0EA8
                                                                        message:cccccccccccccccccccc
EVENT time: 79.749954,  type: 2, fromlayer3  entity: 1
receiving:                                                    sending:
          seq:5, ack:105 check:FFFFFF93                                 seq:3, ack:103 check:A0A09A1
          message:ffffffffffffffffffff                                  message:dddddddddddddddddddd

receive:5,looking for:5                                       sending:
B:sending:                                                              seq:4, ack:104 check:505049A
  seq:105, ack:6 check:FFB4BC4F                                         message:eeeeeeeeeeeeeeeeeeee
  message:ACK
                                                                        TOLAYER3: packet being lost
EVENT time: 80.970238,  type: 2, fromlayer3  entity: 1        sending:
receiving:                                                              seq:5, ack:105 check:FFFFFF93
          seq:6, ack:106 check:FAFAFA8C                                 message:ffffffffffffffffffff
          message:gggggggggggggggggggg
                                                              sending:
receive:6,looking for:6                                                 seq:6, ack:106 check:FAFAFA8C
B:sending:                                                              message:gggggggggggggggggggg
  seq:106, ack:7 check:FFB4BC4D
  message:ACK                                                 sending:
                                                                        seq:7, ack:107 check:F5F5F585
```

```
sending:                                          receive:1,looking for:7
      seq:7, ack:107 check:F5F5F585              B:sending:
      message:hhhhhhhhhhhhhhhhhhhh                 seq:101, ack:2 check:FFB4BC57
                                                   message:ACK
sending:
      seq:8, ack:108 check:F0F0F07E
      message:iiiiiiiiiiiiiiiiiiii               EVENT time: 103.545685,  type: 2, fromlayer3  entity: 0
                                                 receive acknum: 105, looking for: 101
In starttimer:increment:30.000000

                                                 EVENT time: 104.209259,  type: 1, fromlayer5  entity: 0
EVENT time: 89.881020,  type: 2, fromlayer3  entity: 1
receiving:                                       EVENT time: 104.607986,  type: 2, fromlayer3  entity: 1
      seq:7, ack:107 check:F5F5F585              receiving:
      message:Zhhhhhhhhhhhhhhhhhhh                      seq:2, ack:102 check:F0F0EA8
                                                        message:cccccccccccccccccccc
B:sending:
  seq:106, ack:7 check:FFB4BE40                  receive:2,looking for:7
  message:NAK                                    B:sending:
                                                   seq:102, ack:3 check:FFB4BC55
                                                   message:ACK
EVENT time: 95.893173,  type: 2, fromlayer3  entity: 1
receiving:
      seq:8, ack:108 check:F0F0F07E              EVENT time: 105.352020,  type: 2, fromlayer3  entity: 0
      message:iiiiiiiiiiiiiiiiiiii               receive acknum: 106, looking for: 101

receive:8,looking for:7
B:sending:                                       EVENT time: 109.335983,  type: 1, fromlayer5  entity: 0
  seq:106, ack:7 check:FFB4BE40
  message:NAK                                    EVENT time: 109.994843,  type: 2, fromlayer3  entity: 1
                                                 receiving:
                                                        seq:3, ack:103 check:A0A09A1
EVENT time: 95.949646,  type: 2, fromlayer3  entity: 0       message:dddddddddddddddddddd
receive acknum: 103, looking for: 101
                                                 receive:3,looking for:7
EVENT time: 101.567314,  type: 2, fromlayer3  entity: 0       TOLAYER3: packet being lost
receive acknum: 104, looking for: 101            B:sending:
                                                   seq:103, ack:4 check:FFB4BC53
EVENT time: 102.125610,  type: 2, fromlayer3  entity: 1  message:ACK
receiving:
        seq:1, ack:101 check:141413AF
        message:bbbbbbbbbbbbbbbbbbbb
```

```
EVENT time: 110.478432,  type: 1, fromlayer5  entity: 0            TOLAYER3: packet being corrupted
                                                 sending:
EVENT time: 111.699081,  type: 2, fromlayer3  entity: 1       seq:6, ack:106 check:FAFAFA8C
receiving:                                              message:gggggggggggggggggggg
        seq:4, ack:104 check:505049A
        message:eeeeeeeeeeeeeeeeeeee             sending:
                                                        seq:7, ack:107 check:F5F5F585
receive:4,looking for:7                                 message:hhhhhhhhhhhhhhhhhhhh
        TOLAYER3: packet being corrupted
B:sending:                                                         TOLAYER3: packet being corrupted
  seq:104, ack:5 check:FFB4BC51                  sending:
  message:ACK                                            seq:8, ack:108 check:F0F0F07E
                                                        message:iiiiiiiiiiiiiiiiiiii

EVENT time: 112.048866,  type: 2, fromlayer3  entity: 0  In starttimer:increment:30.000000
receive acknum: 106, looking for: 101
                                                 EVENT time: 119.656944,  type: 2, fromlayer3  entity: 1
EVENT time: 116.620056,  type: 1, fromlayer5  entity: 0  receiving:
                                                        seq:6, ack:106 check:FAFAFA8C
EVENT time: 119.402451,  type: 0, timerinterrupt   entity: 0      message:gggggggggggggggggggg
sending:
        seq:1, ack:101 check:141413AF            receive:6,looking for:7
        message:bbbbbbbbbbbbbbbbbbbb             B:sending:
                                                   seq:106, ack:7 check:FFB4BC4D
        TOLAYER3: packet being lost                 message:ACK
sending:
        seq:2, ack:102 check:F0F0EA8
        message:cccccccccccccccccccc             EVENT time: 119.835999,  type: 2, fromlayer3  entity: 0
                                                 receive acknum: 106, looking for: 101
sending:
        seq:3, ack:103 check:A0A09A1             EVENT time: 123.635284,  type: 2, fromlayer3  entity: 0
        message:dddddddddddddddddddd             receive acknum: 101, looking for: 101
                                                 ACK!
sending:                                         In starttimer:increment:30.000000
        seq:4, ack:104 check:505049A
        message:eeeeeeeeeeeeeeeeeeee             EVENT time: 124.049408,  type: 2, fromlayer3  entity: 1
                                                 receiving:
sending:                                                seq:7, ack:107 check:F5F5F585
        seq:5, ack:105 check:FFFFFF93                   message:hhhhhhhhhhhhhhhhhhhh
        message:ffffffffffffffffffff
                                                 receive:7,looking for:7
                                                 B:sending:
```

```
B:sending:
   seq:107, ack:8 check:FFB4BC4B
   message:ACK


EVENT time: 129.714432,  type: 2, fromlayer3  entity: 1
receiving:
            seq:8, ack:108 check:F0F0F07E
            message:iiiiiiiiiiiiiiiiiiii

receive:8,looking for:8
B:sending:
   seq:108, ack:9 check:FFB4BC49
   message:ACK


EVENT time: 129.894562,  type: 2, fromlayer3  entity: 0
receive acknum: 102, looking for: 102
ACK!
In starttimer:increment:30.000000

EVENT time: 130.992584,  type: 2, fromlayer3  entity: 0
receive acknum: 104, looking for: 103

EVENT time: 134.004776,  type: 1, fromlayer5  entity: 0

EVENT time: 134.142731,  type: 2, fromlayer3  entity: 1
receiving:
            seq:1, ack:101 check:141413AF
            message:bbbbbbbbbbbbbbbbbbbb

receive:1,looking for:9
B:sending:
   seq:101, ack:2 check:FFB4BC57
   message:ACK


EVENT time: 134.905350,  type: 2, fromlayer3  entity: 0
receive acknum: 106, looking for: 103

EVENT time: 135.316177,  type: 2, fromlayer3  entity: 1
receiving:
            seq:3, ack:103 check:A0A09A1
```

```
EVENT time: 135.316177,  type: 2, fromlayer3  entity: 1
receiving:
            seq:3, ack:103 check:A0A09A1
            message:dddddddddddddddddddd

receive:3,looking for:9
            TOLAYER3: packet being corrupted
B:sending:
   seq:103, ack:4 check:FFB4BC53
   message:ACK


EVENT time: 140.593170,  type: 2, fromlayer3  entity: 0
receive acknum: 107, looking for: 103

EVENT time: 141.154648,  type: 2, fromlayer3  entity: 1
receiving:
            seq:4, ack:104 check:505049A
            message:eeeeeeeeeeeeeeeeeeee

receive:4,looking for:9
B:sending:
   seq:104, ack:5 check:FFB4BC51
   message:ACK


EVENT time: 143.689972,  type: 2, fromlayer3  entity: 1
receiving:
            seq:5, ack:105 check:FFFFFF93
            message:ffffffffffffffffffff

receive:5,looking for:9
B:sending:
   seq:105, ack:6 check:FFB4BC4F
   message:ACK


EVENT time: 146.864853,  type: 2, fromlayer3  entity: 0
receive acknum: 108, looking for: 103

EVENT time: 150.186615,  type: 2, fromlayer3  entity: 0
receive acknum: 101, looking for: 103
```

```
EVENT time: 153.012421,  type: 2, fromlayer3  entity: 1
receiving:
            seq:6, ack:106 check:FAFAFA8C
            message:Zgggggggggggggggggggg

B:sending:
   seq:108, ack:9 check:FFB4BE3C
   message:NAK


EVENT time: 153.424133,  type: 1, fromlayer5  entity: 0

EVENT time: 156.008804,  type: 2, fromlayer3  entity: 1
receiving:
            seq:7, ack:107 check:F5F5F585
            message:hhhhhhhhhhhhhhhhhhhh

receive:7,looking for:9
B:sending:
   seq:107, ack:8 check:FFB4BC4B
   message:ACK


EVENT time: 156.955078,  type: 2, fromlayer3  entity: 0
receive acknum: 103, looking for: 103
corrupted!

EVENT time: 158.450867,  type: 1, fromlayer5  entity: 0

EVENT time: 159.894562,  type: 0, timerinterrupt   entity: 0
sending:
            seq:3, ack:103 check:A0A09A1
            message:dddddddddddddddddddd

sending:
            seq:4, ack:104 check:505049A
            message:eeeeeeeeeeeeeeeeeeee

            TOLAYER3: packet being lost
sending:
            seq:5, ack:105 check:FFFFFF93
```

```
sending:
            seq:5, ack:105 check:FFFFFF93
            message:ffffffffffffffffffff

            TOLAYER3: packet being corrupted
sending:
            seq:6, ack:106 check:FAFAFA8C
            message:gggggggggggggggggggg

sending:
            seq:7, ack:107 check:F5F5F585
            message:hhhhhhhhhhhhhhhhhhhh

sending:
            seq:8, ack:108 check:F0F0F07E
            message:iiiiiiiiiiiiiiiiiiii

sending:
            seq:9, ack:109 check:EBEBEB77
            message:jjjjjjjjjjjjjjjjjjjj

sending:
            seq:10, ack:110 check:E6E6E670
            message:kkkkkkkkkkkkkkkkkkkk

In starttimer:increment:30.000000

EVENT time: 160.673294,  type: 2, fromlayer3  entity: 0
receive acknum: 104, looking for: 103

EVENT time: 164.264465,  type: 2, fromlayer3  entity: 1
receiving:
            seq:8, ack:108 check:F0F0F07E
            message:Ziiiiiiiiiiiiiiiiiii

B:sending:
   seq:108, ack:9 check:FFB4BE3C
   message:NAK

            TOLAYER3: packet being lost
```

```
        TOLAYER3: packet being lost

EVENT time: 165.544968,  type: 2, fromlayer3  entity: 0
receive acknum: 105, looking for: 103

EVENT time: 168.802902,  type: 2, fromlayer3  entity: 1
receiving:
        seq:9, ack:109 check:EBEBEB77
        message:jjjjjjjjjjjjjjjjjjjj

receive:9,looking for:9
B:sending:
  seq:109, ack:10 check:FFB4BC47
  message:ACK

EVENT time: 172.084198,  type: 2, fromlayer3  entity: 0
receive acknum: 108, looking for: 103

EVENT time: 172.409653,  type: 1, fromlayer5  entity: 0

EVENT time: 174.484360,  type: 2, fromlayer3  entity: 1
receiving:
        seq:10, ack:110 check:E6E6E670
        message:kkkkkkkkkkkkkkkkkkkk

receive:10,looking for:10
B:sending:
  seq:110, ack:11 check:FFB4BC45
  message:ACK

EVENT time: 176.916962,  type: 2, fromlayer3  entity: 0
receive acknum: 107, looking for: 103

EVENT time: 176.972656,  type: 2, fromlayer3  entity: 1
receiving:
        seq:3, ack:103 check:A0A09A1
        message:dddddddddddddddddddd

receive:3,looking for:11
```

```
        seq:3, ack:103 check:A0A09A1
        message:dddddddddddddddddddd

receive:3,looking for:11
        TOLAYER3: packet being corrupted
B:sending:
  seq:103, ack:4 check:FFB4BC53
  message:ACK

EVENT time: 184.732635,  type: 2, fromlayer3  entity: 1
receiving:
        seq:4, ack:104 check:505049A
        message:eeeeeeeeeeeeeeeeeeee

receive:4,looking for:11
B:sending:
  seq:104, ack:5 check:FFB4BC51
  message:ACK

EVENT time: 185.498383,  type: 2, fromlayer3  entity: 0
receive acknum: 109, looking for: 103

EVENT time: 189.894562,  type: 0, timerinterrupt   entity: 0
sending:
        seq:3, ack:103 check:A0A09A1
        message:dddddddddddddddddddd

sending:
        seq:4, ack:104 check:505049A
        message:eeeeeeeeeeeeeeeeeeee

sending:
        seq:5, ack:105 check:FFFFFF93
        message:ffffffffffffffffffff
        TOLAYER3: packet being lost
sending:
        seq:6, ack:106 check:FAFAFA8C
        message:gggggggggggggggggggg

sending:
```

```
sending:
        seq:7, ack:107 check:F5F5F585
        message:hhhhhhhhhhhhhhhhhhhh

        TOLAYER3: packet being lost
sending:
        seq:8, ack:108 check:F0F0F07E
        message:iiiiiiiiiiiiiiiiiiii

        TOLAYER3: packet being lost
sending:
        seq:9, ack:109 check:EBEBEB77
        message:jjjjjjjjjjjjjjjjjjjj

        TOLAYER3: packet being lost
sending:
        seq:10, ack:110 check:E6E6E670
        message:kkkkkkkkkkkkkkkkkkkk

In starttimer:increment:30.000000

EVENT time: 190.746780,  type: 1, fromlayer5  entity: 0

EVENT time: 192.125015,  type: 2, fromlayer3  entity: 1
receiving:
        seq:6, ack:106 check:FAFAFA8C
        message:Zgggggggggggggggggggg

B:sending:
  seq:110, ack:11 check:FFB4BE38
  message:NAK

EVENT time: 194.543381,  type: 2, fromlayer3  entity: 1
receiving:
        seq:7, ack:107 check:F5F5F585
        message:hhhhhhhhhhhhhhhhhhhh

receive:7,looking for:11
B:sending:
  seq:107, ack:8 check:FFB4BC4B
  message:ACK
```

```
EVENT time: 194.547058,  type: 1, fromlayer5  entity: 0

EVENT time: 195.423813,  type: 2, fromlayer3  entity: 0
receive acknum: 110, looking for: 103

EVENT time: 196.653519,  type: 1, fromlayer5  entity: 0

EVENT time: 197.558228,  type: 2, fromlayer3  entity: 1
 Simulator terminated at time 197.558228
 after sending 20 msgs from layer5
```

(b)

當 A 端開始傳送封包，如果封包損壞，B 端會回應 NAK，A 端收到後會知道這個封包錯，便會重新傳送從這個錯誤封包起的所有可傳送封包。若封包遺失，代表 B 端不會收到封包，所以 A 端會一直收不到 ACK，超過了容許時間後，A 端會重新傳送這個封包起的所有可傳送封包。若 B 端傳送的封包損壞，則 A 端也會重新傳送。若 B 端傳送的 ACK 封包遺失，但 A 端在時間內有收到之後的

ACK 封包，A 端會判定這 ACK 封包前的所有封包都有被收到，因此不會重傳。

```
the number of messages to simulate: 50
packet loss probability: 0.300000
packet corruption probability: 0.300000
average time between messages from sender's layer5: 10.000000
TRACE: 2

EVENT time: 18.705740,  type: 1, fromlayer5  entity: 0
        TOLAYER3: packet being corrupted
In starttimer:increment:30.000000
A: sending:
   seq:0, ack:100,
   check:191918B6
   message: aaaaaaaaaaaaaaaaaaaa
```

```
A: sending:
   seq:1, ack:101,
   check:141413AF
   message: bbbbbbbbbbbbbbbbbbbb

EVENT time: 37.680447,  type: 1, fromlayer5  entity: 0
        TOLAYER3: packet being corrupted
```

```
sending:
        seq:1, ack:101 check:141413AF
        message:bbbbbbbbbbbbbbbbbbbb

        TOLAYER3: packet being corrupted
sending:
        seq:2, ack:102 check:F0F0EA8
        message:cccccccccccccccccccc

        TOLAYER3: packet being lost
```

```
EVENT time: 58.599510,  type: 2, fromlayer3  entity: 1
receiving:
        seq:1, ack:101 check:141413AF
        message:bbbbbbbbbbbbbbbbbbbb

receive:1,looking for:4
        TOLAYER3: packet being corrupted
B:sending:
   seq:101, ack:2 check:FFB4BC57
   message:ACK
```

```
EVENT time: 78.705742,  type: 0, timerinterrupt    entity: 0
sending:
        seq:0, ack:100 check:191918B6
        message:aaaaaaaaaaaaaaaaaaaa

        TOLAYER3: packet being lost
sending:
        seq:1, ack:101 check:141413AF
        message:bbbbbbbbbbbbbbbbbbbb

        TOLAYER3: packet being lost
sending:
        seq:2, ack:102 check:F0F0EA8
        message:cccccccccccccccccccc

        TOLAYER3: packet being corrupted
sending:
        seq:3, ack:103 check:A0A09A1
        message:dddddddddddddddddddd

        TOLAYER3: packet being corrupted
sending:
        seq:4, ack:104 check:505049A
        message:eeeeeeeeeeeeeeeeeeee
sending:
        seq:5, ack:105 check:FFFFFF93
        message:ffffffffffffffffffff
```

```
EVENT time: 83.979843,  type: 2, fromlayer3  entity: 1
receiving:
        seq:0, ack:100 check:191918B6
        message:aaaaaaaaaaaaaaaaaaaa

receive:0,looking for:5
        TOLAYER3: packet being corrupted
B:sending:
   seq:100, ack:1 check:FFB4BC59
   message:ACK
```

```
EVENT time: 85.384987,  type: 1, fromlayer5  entity: 0
        TOLAYER3: packet being corrupted
A: sending:
   seq:6, ack:106,
   check:FAFAFA8C
   message: gggggggggggggggggggg

EVENT time: 90.229782,  type: 2, fromlayer3  entity: 1
receiving:
        seq:3, ack:103 check:A0A09A1
        message:Zdddddddddddddddddddd

B:sending:
   seq:104, ack:5 check:FFB4BE44
   message:NAK

        TOLAYER3: packet being lost
```

```
EVENT time: 90.229782,  type: 2, fromlayer3  entity: 1
receiving:
        seq:3, ack:103 check:A0A09A1
        message:Zdddddddddddddddddddd

B:sending:
   seq:104, ack:5 check:FFB4BE44
   message:NAK

        TOLAYER3: packet being lost
```

```
EVENT time: 147.387817,  type: 0, timerinterrupt    entity: 0
                    TOLAYER3: packet being corrupted
sending:
        seq:1, ack:101 check:141413AF
        message:bbbbbbbbbbbbbbbbbbbb

            TOLAYER3: packet being corrupted
sending:
        seq:2, ack:102 check:F0F0EA8
        message:cccccccccccccccccccc

sending:
        seq:3, ack:103 check:A0A09A1
        message:dddddddddddddddddddd

            TOLAYER3: packet being corrupted
sending:
        seq:4, ack:104 check:505049A
        message:eeeeeeeeeeeeeeeeeeee

            TOLAYER3: packet being corrupted
sending:
        seq:5, ack:105 check:FFFFFF93
        message:ffffffffffffffffffff

            TOLAYER3: packet being lost
sending:
        seq:6, ack:106 check:FAFAFA8C
        message:gggggggggggggggggggg

            TOLAYER3: packet being lost
sending:
        seq:7, ack:107 check:F5F5F585
        message:hhhhhhhhhhhhhhhhhhhh
```

```
EVENT time: 65.124435,  type: 2, fromlayer3   entity: 1
receiving:
        seq:4, ack:104 check:505049A
        message:eeeeeeeeeeeeeeeeeeee

receive:4,looking for:4
B:sending:
  seq:104, ack:5 check:FFB4BC51
  message:ACK

        TOLAYER3: packet being lost
```

```
EVENT time: 158.111984,  type: 2, fromlayer3   entity: 1
receiving:
        seq:1, ack:101 check:141413AF
        message:Zbbbbbbbbbbbbbbbbbbb

B:sending:
  seq:108, ack:9 check:FFB4BE3C
  message:NAK

        TOLAYER3: packet being lost
```

```
EVENT time: 332.167389,  type: 0, timerinterrupt    entity: 0
        TOLAYER3: packet being lost
sending:
        seq:3, ack:103 check:A0A09A1
        message:dddddddddddddddddddd

        TOLAYER3: packet being lost
sending:
```

```
EVENT time: 542.167358,  type: 0, timerinterrupt    entity: 0
sending:
        seq:3, ack:103 check:A0A09A1
        message:dddddddddddddddddddd

sending:
        seq:4, ack:104 check:505049A
        message:eeeeeeeeeeeeeeeeeeee

sending:
        seq:5, ack:105 check:FFFFFF93
        message:ffffffffffffffffffff

sending:
        seq:6, ack:106 check:FAFAFA8C
        message:gggggggggggggggggggg

        TOLAYER3: packet being corrupted
sending:
        seq:7, ack:107 check:F5F5F585
        message:hhhhhhhhhhhhhhhhhhhh

sending:
        seq:8, ack:108 check:F0F0F07E
        message:iiiiiiiiiiiiiiiiiiii

sending:
        seq:9, ack:109 check:EBEBEB77
        message:jjjjjjjjjjjjjjjjjjjj

sending:
        seq:10, ack:110 check:E6E6E670
        message:kkkkkkkkkkkkkkkkkkkk
```

2.(a)我使用 timer 記錄了 time 並測量出了 sampleRTT，據此估算 estimatedRTT，
為了方便，我把封包遺失和毀損的機率直接設為 0，並在 terminate 後面將資料

print 出來。我繳交的檔案是把這幾行註解掉的，如果想看輸出把註解刪掉即可。
以下分別提供 alpha 等於 0.125、0.5、0.8 的結果。

```
terminate:
    printf(" Simulator terminated at time %f\n after sending %d msgs from layer5\n",time,nsim);
    /*int k = 0;
    for(k=0;k<packetnum;k++){
        printf("sample : %f ", sampleRTT[k]);
        printf("estimated : %f, ", estimatedRTT[k]);
        printf("time : %f \n", recordtime[k]);
    }*/
}
```

執行結果

Alpha = 0.125

```
EVENT time: 218.426834,  type: 1, fromlayer5  entity: 0
 Simulator terminated at time 218.426834
 after sending 20 msgs from layer5
sample : 10.696709 estimated : 10.696709, time : 29.402449
sample : 12.210154 estimated : 10.885889, time : 41.612602
sample : 21.643246 estimated : 12.230558, time : 63.255848
sample : 8.464062 estimated : 11.759747, time : 71.719910
sample : 6.831436 estimated : 11.143707, time : 78.551346
sample : 15.971741 estimated : 11.747211, time : 94.523087
sample : 8.061279 estimated : 11.286470, time : 102.584366
sample : 1.755676 estimated : 10.095121, time : 104.340042
sample : 10.923172 estimated : 10.198627, time : 115.263214
sample : 6.809921 estimated : 9.775040, time : 122.073135
sample : 15.522003 estimated : 10.493410, time : 137.595139
sample : 7.150314 estimated : 10.075523, time : 144.745453
sample : 7.861938 estimated : 9.798825, time : 152.607391
sample : 13.160980 estimated : 10.219094, time : 165.768372
sample : 13.605072 estimated : 10.642342, time : 179.373444
sample : 17.022415 estimated : 11.439851, time : 196.395859
sample : 9.556534 estimated : 11.204436, time : 205.952393
```

Alpha = 0.5

```
EVENT time: 218.426834,  type: 1, fromlayer5  entity: 0
 Simulator terminated at time 218.426834
 after sending 20 msgs from layer5
sample : 10.696709 estimated : 10.696709, time : 29.402449
sample : 12.210154 estimated : 11.453431, time : 41.612602
sample : 21.643246 estimated : 16.548338, time : 63.255848
sample : 8.464062 estimated : 12.506200, time : 71.719910
sample : 6.831436 estimated : 9.668818, time : 78.551346
sample : 15.971741 estimated : 12.820279, time : 94.523087
sample : 8.061279 estimated : 10.440779, time : 102.584366
sample : 1.755676 estimated : 6.098228, time : 104.340042
sample : 10.923172 estimated : 8.510700, time : 115.263214
sample : 6.809921 estimated : 7.660311, time : 122.073135
sample : 15.522003 estimated : 11.591157, time : 137.595139
sample : 7.150314 estimated : 9.370735, time : 144.745453
sample : 7.861938 estimated : 8.616337, time : 152.607391
sample : 13.160980 estimated : 10.888659, time : 165.768372
sample : 13.605072 estimated : 12.246865, time : 179.373444
sample : 17.022415 estimated : 14.634640, time : 196.395859
sample : 9.556534 estimated : 12.095587, time : 205.952393
```
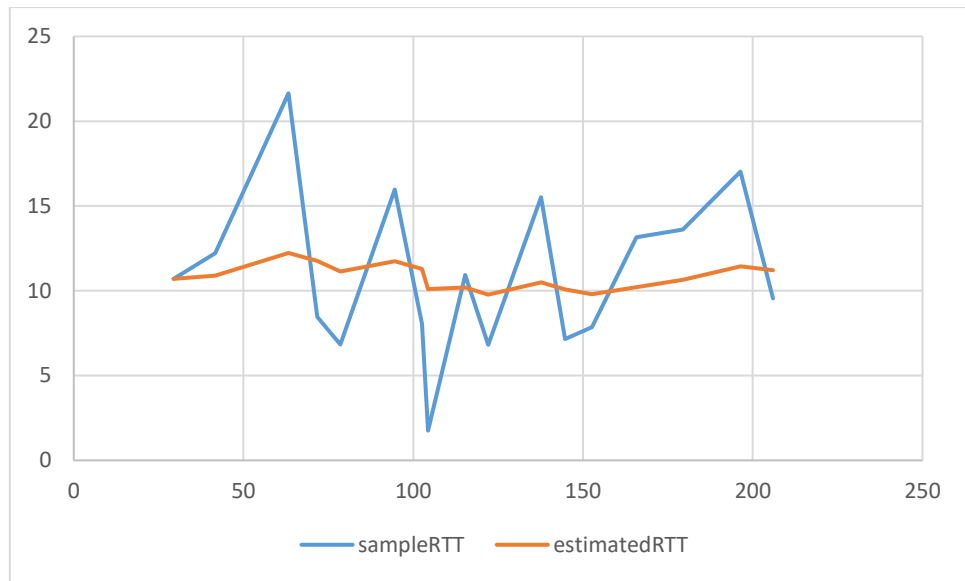
Alpha = 0.8

```
EVENT time: 240.088226,  type: 2, fromlayer3  entity: 1
 Simulator terminated at time 240.088226
 after sending 20 msgs from layer5
sample : 12.567282 estimated : 12.567282, time : 31.273022
sample : 13.852062 estimated : 13.595106, time : 45.125084
sample : 23.340164 estimated : 21.391153, time : 68.465248
sample : 9.346382 estimated : 11.755336, time : 77.811630
sample : 6.831436 estimated : 7.816216, time : 84.643066
sample : 18.162239 estimated : 16.093035, time : 102.805305
sample : 9.439461 estimated : 10.770175, time : 112.244766
sample : 1.755676 estimated : 3.558576, time : 114.000443
sample : 12.135139 estimated : 10.419827, time : 126.135582
sample : 7.455360 estimated : 8.048253, time : 133.590942
sample : 17.351501 estimated : 15.490852, time : 150.942444
sample : 7.377441 estimated : 9.000124, time : 158.319885
sample : 7.861938 estimated : 8.089576, time : 166.181824
sample : 14.571014 estimated : 13.274727, time : 180.752838
sample : 15.321747 estimated : 14.912343, time : 196.074585
sample : 18.761520 estimated : 17.991684, time : 214.836105
sample : 10.557190 estimated : 12.044088, time : 225.393295
```
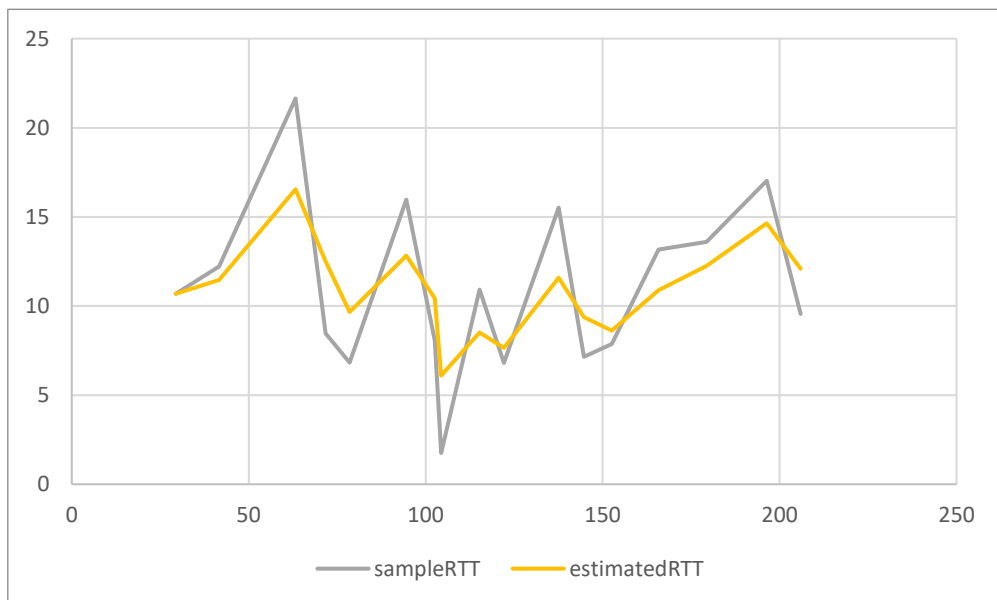
2(b)將上題得到的數據使用 excel 作圖，很明顯 alpha 值愈小，estimatedRTT 愈穩定，alpha 值增加時，estimatedRTT 會愈來愈趨近 sampleRTT。下面的圖片應該可以很清楚的說明此項結果。

Alpha = 0.125

Alpha = 0.5

Alpha = 0.8