Comp 2322 Computer Networking

Lab 6: TCP

Due time: 11:59pm, April 15, 2024, Monday

Total marks: 10 points

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Q2.

The IP address of gaia.cs.umass.edu is 128.119.245.12 and TCP port number is 80.

```
No.     Time               Source                Destination           Protocol Length Info
    199 21:44:25.867722    192.168.1.102         128.119.245.12        HTTP     104    POST /ethereal-labs/lab3-1-reply.htm HTTP/1.1
(text/plain)
Frame 199: 104 bytes on wire (832 bits), 104 bytes captured (832 bits)
Ethernet II, Src: ActiontecEle_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysGroup_da:af:73 (00:06:25:da:af:73)
Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.119.245.12
Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 164041, Ack: 1, Len: 50
[122 Reassembled TCP Segments (164090 bytes): #4(565), #5(1460), #7(1460), #8(1460), #10(1460), #11(1460), #13(1147), #18(1460),
#19(1460), #20(1460), #21(1460), #22(1460), #23(892), #30(1460), #31(1460), #32(1460), #33(1460), #34(1460), ]
Hypertext Transfer Protocol
    POST /ethereal-labs/lab3-1-reply.htm HTTP/1.1\r\n
    Host: gaia.cs.umass.edu\r\n
    User-Agent: Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US; rv:1.0.2) Gecko/20030208 Netscape/7.02\r\n
    Accept: text/xml,application/xml,application/xhtml+xml,text/html;q=0.9,text/plain;q=0.8,video/x-mng,image/png,image/jpeg,image/
gif;q=0.2,text/css,*/*;q=0.1\r\n
    Accept-Language: en-us, en;q=0.50\r\n
    Accept-Encoding: gzip, deflate, compress;q=0.9\r\n
    Accept-Charset: ISO-8859-1, utf-8;q=0.66, *;q=0.66\r\n
    Keep-Alive: 300\r\n
    Connection: keep-alive\r\n
    Referer: http://gaia.cs.umass.edu/ethereal-labs/lab3-1.htm\r\n
    Content-Type: multipart/form-data; boundary=---------------------------265001916915724\r\n
    Content-Length: 163411\r\n
    \r\n
    [Full request URI: http://gaia.cs.umass.edu/ethereal-labs/lab3-1-reply.htm]
    [HTTP request 1/1]
    [Response in frame: 203]
    File Data: 163411 bytes
MIME Multipart Media Encapsulation, Type: multipart/form-data, Boundary: "---------------------------265001916915724"
```

Q4.

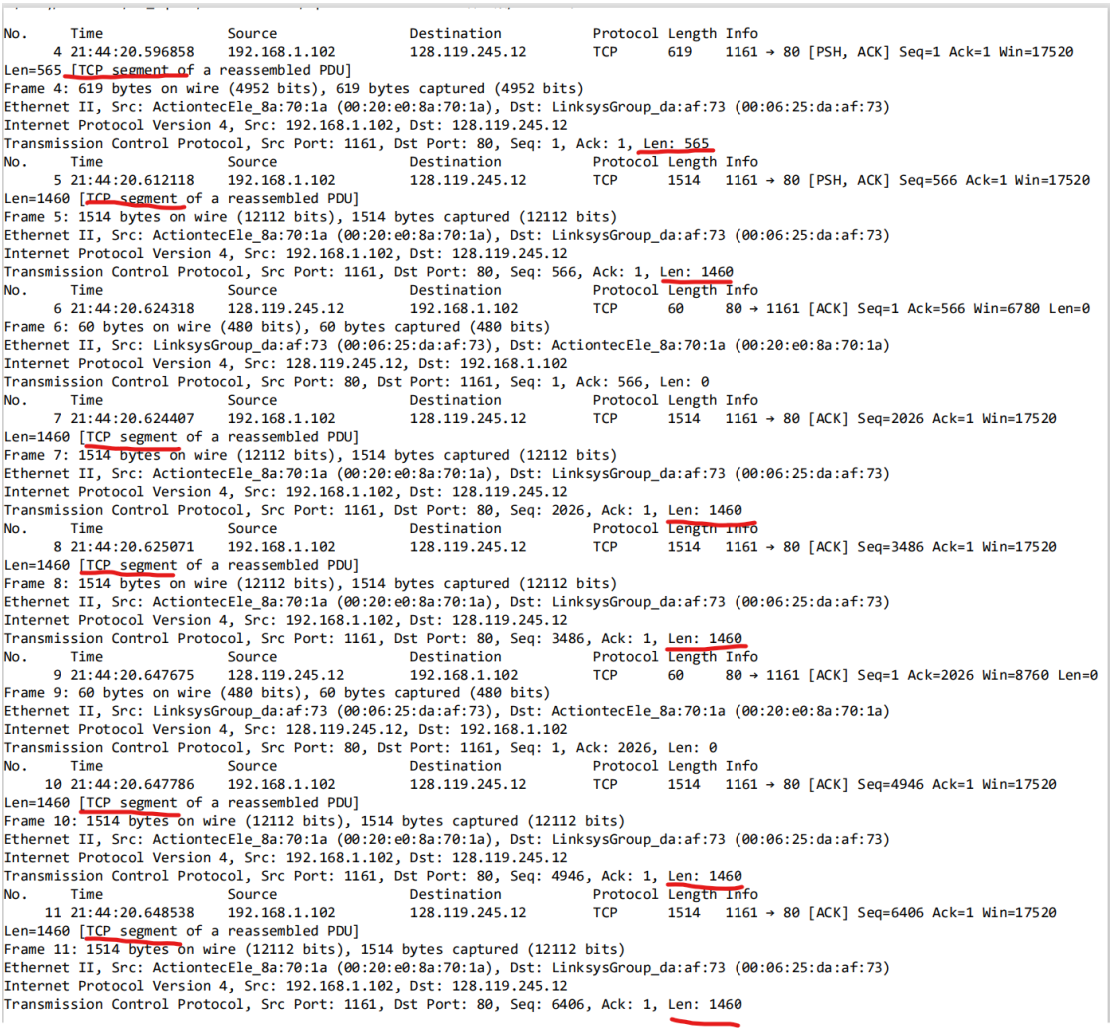
The TCP SYN segment's sequence number is set to 0 in this particular trace, which initiates the TCP connection between the client computer and gaia.cs.umass.edu. When the SYN flag is set to 1 it means this segment is a SYN segment.

```
No.     Time               Source                Destination           Protocol Length Info
      1 21:44:20.570381    192.168.1.102         128.119.245.12        TCP      62     1161 → 80 [SYN] Seq=0 Win=16384 Len=0
MSS=1460 SACK_PERM
Frame 1: 62 bytes on wire (496 bits), 62 bytes captured (496 bits)
Ethernet II, Src: ActiontecEle_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysGroup_da:af:73 (00:06:25:da:af:73)
Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.119.245.12
Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 0, Len: 0
    Source Port: 1161
    Destination Port: 80
    [Stream index: 0]
    [Conversation completeness: Incomplete, DATA (15)]
    [TCP Segment Len: 0]
    Sequence Number: 0    (relative sequence number)
    Sequence Number (raw): 232129012
    [Next Sequence Number: 1    (relative sequence number)]
    Acknowledgment Number: 0
    Acknowledgment number (raw): 0
    0111 .... = Header Length: 28 bytes (7)
    Flags: 0x002 (SYN)
        000. .... .... = Reserved: Not set
        ...0 .... .... = Accurate ECN: Not set
        .... 0... .... = Congestion Window Reduced: Not set
        .... .0.. .... = ECN-Echo: Not set
        .... ..0. .... = Urgent: Not set
        .... ...0 .... = Acknowledgment: Not set
        .... .... 0... = Push: Not set
        .... .... .0.. = Reset: Not set
        .... .... ..1. = Syn: Set
        .... .... ...0 = Fin: Not set
        [TCP Flags: ··········S·]
    Window: 16384
    [Calculated window size: 16384]
    Checksum: 0xf6e9 [unverified]
    [Checksum Status: Unverified]
    Urgent Pointer: 0
    Options: (8 bytes), Maximum segment size, No-Operation (NOP), No-Operation (NOP), SACK permitted
    [Timestamps]
```

Q8.

TCP Segment Number: 1 2 3 4 5 6

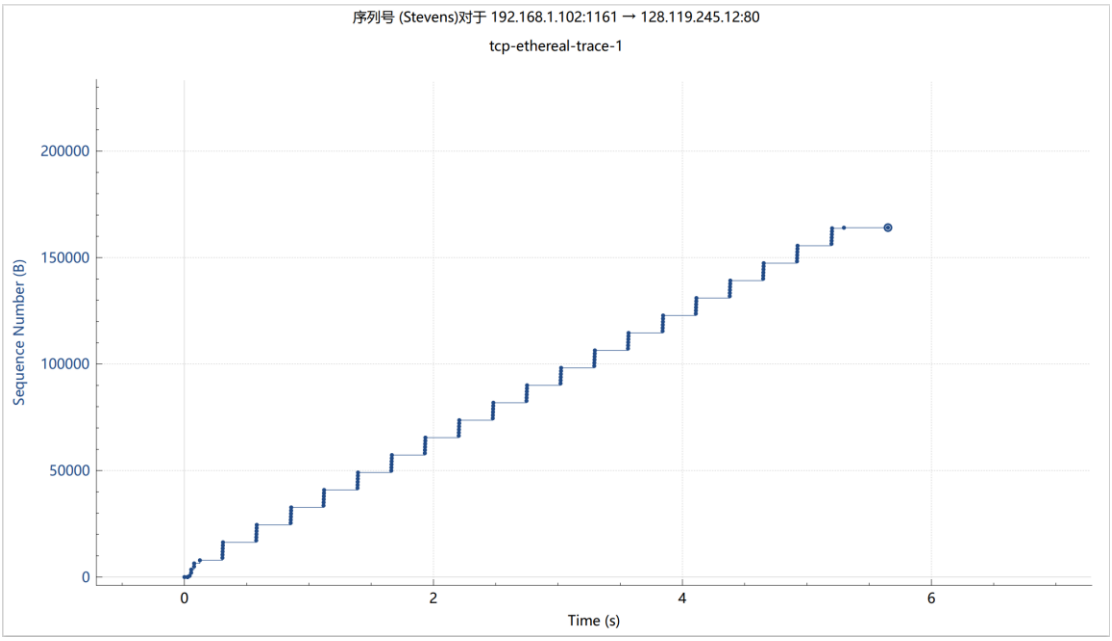
TCP Segment Length: 565 1460 1460 1460 1460 1460



```
No.     Time              Source                Destination           Protocol Length Info
     4 21:44:20.596858    192.168.1.102         128.119.245.12        TCP      619    1161 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520
Len=565 [TCP segment of a reassembled PDU]
Frame 4: 619 bytes on wire (4952 bits), 619 bytes captured (4952 bits)
Ethernet II, Src: ActiontecEle_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysGroup_da:af:73 (00:06:25:da:af:73)
Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.119.245.12
Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 1, Ack: 1, Len: 565
No.     Time              Source                Destination           Protocol Length Info
     5 21:44:20.612118    192.168.1.102         128.119.245.12        TCP      1514   1161 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520
Len=1460 [TCP segment of a reassembled PDU]
Frame 5: 1514 bytes on wire (12112 bits), 1514 bytes captured (12112 bits)
Ethernet II, Src: ActiontecEle_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysGroup_da:af:73 (00:06:25:da:af:73)
Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.119.245.12
Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 566, Ack: 1, Len: 1460
No.     Time              Source                Destination           Protocol Length Info
     6 21:44:20.624318    128.119.245.12        192.168.1.102         TCP      60     80 → 1161 [ACK] Seq=1 Ack=566 Win=6780 Len=0
Frame 6: 60 bytes on wire (480 bits), 60 bytes captured (480 bits)
Ethernet II, Src: LinksysGroup_da:af:73 (00:06:25:da:af:73), Dst: ActiontecEle_8a:70:1a (00:20:e0:8a:70:1a)
Internet Protocol Version 4, Src: 128.119.245.12, Dst: 192.168.1.102
Transmission Control Protocol, Src Port: 80, Dst Port: 1161, Seq: 1, Ack: 566, Len: 0
No.     Time              Source                Destination           Protocol Length Info
     7 21:44:20.624407    192.168.1.102         128.119.245.12        TCP      1514   1161 → 80 [ACK] Seq=2026 Ack=1 Win=17520
Len=1460 [TCP segment of a reassembled PDU]
Frame 7: 1514 bytes on wire (12112 bits), 1514 bytes captured (12112 bits)
Ethernet II, Src: ActiontecEle_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysGroup_da:af:73 (00:06:25:da:af:73)
Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.119.245.12
Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 2026, Ack: 1, Len: 1460
No.     Time              Source                Destination           Protocol Length Info
     8 21:44:20.625071    192.168.1.102         128.119.245.12        TCP      1514   1161 → 80 [ACK] Seq=3486 Ack=1 Win=17520
Len=1460 [TCP segment of a reassembled PDU]
Frame 8: 1514 bytes on wire (12112 bits), 1514 bytes captured (12112 bits)
Ethernet II, Src: ActiontecEle_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysGroup_da:af:73 (00:06:25:da:af:73)
Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.119.245.12
Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 3486, Ack: 1, Len: 1460
No.     Time              Source                Destination           Protocol Length Info
     9 21:44:20.647675    128.119.245.12        192.168.1.102         TCP      60     80 → 1161 [ACK] Seq=1 Ack=2026 Win=8760 Len=0
Frame 9: 60 bytes on wire (480 bits), 60 bytes captured (480 bits)
Ethernet II, Src: LinksysGroup_da:af:73 (00:06:25:da:af:73), Dst: ActiontecEle_8a:70:1a (00:20:e0:8a:70:1a)
Internet Protocol Version 4, Src: 128.119.245.12, Dst: 192.168.1.102
Transmission Control Protocol, Src Port: 80, Dst Port: 1161, Seq: 1, Ack: 2026, Len: 0
No.     Time              Source                Destination           Protocol Length Info
    10 21:44:20.647786    192.168.1.102         128.119.245.12        TCP      1514   1161 → 80 [ACK] Seq=4946 Ack=1 Win=17520
Len=1460 [TCP segment of a reassembled PDU]
Frame 10: 1514 bytes on wire (12112 bits), 1514 bytes captured (12112 bits)
Ethernet II, Src: ActiontecEle_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysGroup_da:af:73 (00:06:25:da:af:73)
Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.119.245.12
Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 4946, Ack: 1, Len: 1460
No.     Time              Source                Destination           Protocol Length Info
    11 21:44:20.648538    192.168.1.102         128.119.245.12        TCP      1514   1161 → 80 [ACK] Seq=6406 Ack=1 Win=17520
Len=1460 [TCP segment of a reassembled PDU]
Frame 11: 1514 bytes on wire (12112 bits), 1514 bytes captured (12112 bits)
Ethernet II, Src: ActiontecEle_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysGroup_da:af:73 (00:06:25:da:af:73)
Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.119.245.12
Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 6406, Ack: 1, Len: 1460
```

Q10.

The trace file contains no retransmitted segments, as confirmed by examining the sequence numbers of the TCP segments within it. The Time-Sequence Graph (Stevens) for this trace shows that sequence numbers from the source (192.168.1.102) to the destination (128.119.245.12) consistently increase over time. Should there be a retransmitted segment, its sequence number would be lower than those of adjacent segments.



Q12.

Throughput

= total data transferred / total time cost

= (164091 – 1) bytes / (26.026211 - 20.596858) sec

= 30.222 kBps

```
No.     Time              Source                Destination           Protocol Length Info
      4 21:44:20.596858   192.168.1.102         128.119.245.12        TCP      619    1161 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520
Len=565 [TCP segment of a reassembled PDU]
Frame 4: 619 bytes on wire (4952 bits), 619 bytes captured (4952 bits)
Ethernet II, Src: ActiontecEle_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysGroup_da:af:73 (00:06:25:da:af:73)
Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.119.245.12
Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 1, Ack: 1, Len: 565
```

```
No.     Time              Source                Destination           Protocol Length Info
    202 21:44:26.026211   128.119.245.12        192.168.1.102         TCP      60     80 → 1161 [ACK] Seq=1 Ack=164091 Win=62780
Len=0
Frame 202: 60 bytes on wire (480 bits), 60 bytes captured (480 bits)
Ethernet II, Src: LinksysGroup_da:af:73 (00:06:25:da:af:73), Dst: ActiontecEle_8a:70:1a (00:20:e0:8a:70:1a)
Internet Protocol Version 4, Src: 128.119.245.12, Dst: 192.168.1.102
Transmission Control Protocol, Src Port: 80, Dst Port: 1161, Seq: 1, Ack: 164091, Len: 0
```