

COMP 445 – Theoretical Assignment 2 (TA1)

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Instructions

- Please submit your assignment as a pdf file on Moodle. The name of the pdf file must contain your name and student id.
- All questions will receive equal points.
- Each question may have zero, one, or more than one correct choices.
- Wrong answers will be penalized with negative points.
- Partial answers will not receive any point.
- Blank answers (no answer) will not be penalized.

Student ID:

First Name / Last Name:

Signature:

Transport Layer

Q1: Among the following services, which ones are provided by UDP?

- a) ☐ Congestion control
- b) ☐ Flow control
- c) ☐ Reliable data transfer
- d) ☐ Bandwidth reservation

Q2: An application may choose to transmit data using UDP rather than just IP (the network-level protocol) when it needs:

- a) ☐ High throughput
- b) ☐ Multiplexing / de-multiplexing
- c) ☐ Security
- d) ☐ Connection management (establishment, teardown)

Q3: TCP acknowledgments arrive with RTT values of 29, 31 and 32ms. What is the new estimated RTT value after the third acknowledgement was received, taking an initial estimated RTT of 31ms and $\alpha = 0.125$?

- a) ☐ 32ms
- b) ☐ 30.9ms
- c) ☐ 31.8ms
- d) ☐ 31.1ms

Q4: Two non-duplicate ACKs are received while a TCP sender is in Slow Start mode with $cwnd=1KB$, $ssthresh=64KB$ and $MSS=1KB$. What is the state of the TCP sender after the second ACK is received?

- a) ☐ Slow Start
- b) ☐ Congestion Avoidance
- c) ☐ Fast Recovery
- d) ☐ SYN sent

Q5: Assuming the same initial state and sequence of events as in the previous question, what will be the value of the $cwnd$ variable (size of the congestion window) after the second ACK is received?

- a) ☐ 1KB
- b) ☐ 2KB
- c) ☐ 3KB
- d) ☐ 4KB

Q6: The content below was captured using Wireshark:

```

+ Frame 5: 66 bytes on wire (528 bits), 66 bytes captured (528 bits) on interface 0
+ Ethernet II, Src: IntelCor_50:80:98 (f0:d5:bf:50:80:98), Dst: mynetwork (f0:82:61:f7:5e:80)
+ Internet Protocol Version 4, Src: 192.168.2.111 (192.168.2.111), Dst: ec2-107-23-96-9.compute-1.amazonaws.com (107.23.96.9)
- Transmission Control Protocol, Src Port: 45674 (45674), Dst Port: https (443), Seq: 2630206945, Ack: 3725581375, Len: 0
  Source Port: 45674 (45674)
  Destination Port: https (443)
  [Stream index: 0]
  [TCP Segment Len: 0]
  Sequence number: 2630206945
  Acknowledgment number: 3725581375
  1000 .... = Header Length: 32 bytes (8)
  Flags: 0x010 (ACK)
  Window size value: 755
  [Calculated window size: 755]
  [Window size scaling factor: -1 (unknown)]
  Checksum: 0xd13e [unverified]
  [Checksum Status: Unverified]
  Urgent pointer: 0
  Options: (12 bytes), No-Operation (NOP), No-Operation (NOP), Timestamps
  [SEQ/ACK analysis]

0000  f0 82 61 f7 5e 80 f0 d5  bf 50 80 98 08 00 45 00  ..a.^... .P....E.
0010  00 34 8c 2a 40 00 40 06  20 62 c0 a8 02 6f 6b 17  .4.*@.@. b...ok.
0020  60 09 d2 6a 01 bd 9c c5  c5 e1 de 0f dc 3f 80 10  .J].... ....?.
0030  02 13 d1 3e 00 00 01 01  08 0a 40 0f 7e e4 0b 6e  ...>.... ..@.~..h
0040  78 d5                      K.

```

This trace contains:

- a) ☐ A TCP segment that contains an acknowledgment
- b) ☐ A UDP segment that contains an acknowledgment
- c) ☐ A TCP segment that contains an HTTP message
- d) ☐ An HTTP message that contains a TCP segment

Q7: Among the following mechanisms, which one(s) can be used to provide reliable data transfer?

- a) ☐ Checksums
- b) ☐ Timeouts
- c) ☐ Sequence numbers
- d) ☐ Acknowledgments

Q8: In connection-oriented multiplexing, two packets with the same source host, source port, destination host and destination port might be delivered to two different sockets:

a) ☐ Yes

b) ☐ No

Q9: What is the UDP checksum of D=101010101010101010101010101010?

a) ☐ 1010101010101010

b) ☐ 0101010101010101

c) ☐ 1111111111111111

d) ☐ 0000000000000000

Q10: In a pipelined protocol, the sender allows N simultaneous non-acknowledged packets. This is meant to:

a) ☐ Increase network utilization, by a factor of $\frac{N}{2}$.

b) ☐ Increase network utilization, by a factor of N .

c) ☐ Reduce packet queuing time, by a factor of $\frac{N}{2}$.

d) ☐ Reduce packet queuing time, by a factor of N .