Final Exam

● Graded

Student

Sihat Afnan

Total Points

96 / 100 pts

Question 1

Q1 **4** / 4 pts

✔ **– 0 pts** Correct

– 4 pts wrong

Question 2

Q2 **4** / 4 pts

✔ **– 0 pts** Correct

– 4 pts wrong

Question 3

Q3 **4** / 4 pts

✔ **– 0 pts** Correct

Question 4

Q4 **4** / 4 pts

✔ **– 0 pts** Correct

– 4 pts wrong

Question 5

Q5 **4** / 4 pts

✔ **– 0 pts** Correct

– 4 pts WRONG

Question 6

Q6 **4** / 4 pts

✔ **– 0 pts** Correct

– 4 pts WRONG

Question 7

Q7 **0** / 4 pts

– **0 pts** Correct

✔ – **4 pts** WRONG

Question 8

Q8 **4** / 4 pts

✔ – **0 pts** Correct

– **4 pts** Incorrect

Question 9

Q9 **4** / 4 pts

✔ – **0 pts** Correct

– **4 pts** Incorrect

Question 10

Q10 **4** / 4 pts

✔ – **0 pts** Correct

– **4 pts** Incorrect

Question 11

Q11 **4** / 4 pts

✔ – **0 pts** Correct

– **4 pts** Incorrect

Question 12

Q12 **4** / 4 pts

✔ – **0 pts** Correct

– **4 pts** Incorrect

Question 13

Q13 **4** / 4 pts

✔ – **0 pts** Correct

– **4 pts** Incorrect

Question 14

Q14 **4** / 4 pts

✔ **– 0 pts** Correct

– 4 pts Incorrect

Question 15

Q15 **11** / 11 pts

✔ **– 0 pts** Correct

– 11 pts wrong

– 5 pts adding a delay at the start of the video playtime at the client side

Question 16

Q16 **11** / 11 pts

✔ **– 0 pts** Correct

– 3 pts slow start- incomplete

– 3 pts congestion avoidance - incomplete

– 3 pts time out, w = 1, slow start threshold = w/2

– 11 pts wrong/missing

Question 17

Q17 **11** / 11 pts

✔ **– 0 pts** Correct

– 3 pts Partially Correct

– 5 pts Partially Correct

– 10 pts Incorrect

Question 18

Q18 **11** / 11 pts

✔ **– 0 pts** Correct

– 3 pts Difference between unicast and broadcast

– 3 pts Dangers of broadcast

– 3 pts Mechanisms to avoid dangers

– 11 pts Incorrect

CS232 Final - 2025

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	sihata

- Use of books/notes is forbidden.
- Write the answers using only the predefined space using a black pen
- Put your answer into the box below for Q1-Q14
- **Duration:** 2 hrs.

Q1	Q2	Q3	Q4	Q5	Q6	Q7
a	b	c	c	c	c	c

Q8	Q9	Q10	Q11	Q12	Q13	Q14
a	a	b	c	b	b	b

Q1 Consider a $M/M/1/K$ queueing system with arrival and service rate equal to λ and μ pkt/s, respectively. If we decrease K, the probability that a packet is dropped in going to

☐ a) Increase.
☐ b) Decrease.
☐ c) Stay the same.

Q2 Consider a $M/M/1$ queueing system with arrival and service rate equal to λ and μ pkt/s, respectively. Define $\rho{=}\lambda/\mu$, the expected total time spent by packets in the system ($E[T]$) is equal to

☐ a) $1/\mu$.
☐ b) $\frac{1/\mu}{(1-\rho)}$.
☐ c) $\frac{\rho}{(1-\rho)}$.

Q3 The application layer protocol used by web browsers (such as Chrome and Firefox) is:

☐ a) SMTP
☐ b) FTP
☐ c) HTTP
☐ d) IMAP

Q4 TCP is implemented at:

☐ a) Switches
☐ b) Routers
☐ c) host devices
☐ d) all the above

Q5 Little's Formula (no blocking) is

☐ a) $E[N] = \sum_{n=0}^{N} p^n n$.
☐ b) $P[N(t) = 0] = 1 - \rho$.
☐ c) $E[N] = \lambda E[T]$.

Q6 IMAP (Internet Mail Access Protocol) is an e-mail protocol used between:
☐ a) the sender and the sender's mail server.
☐ b) the sender's mail server and the receiver's mail server.
☐ c) the recipient's mail server and the recipient.

Q7 Consider a setting where only one node has traffic. Compared to TDMA, polling-based access control achieves
☐ a) a larger data rate.
☐ b) a smaller data rate.
☐ c) the same data rate.

Q8 in M/M/1/∞ the probability of having an empty buffer is
☐ a) $p_0 = 1 - \rho$.
☐ b) $p_0 = \rho$.
☐ c) $p_0 = 1/(1 - \rho)$.

Q9 in M/M/c/c the probability that a connection is rejected is
☐ a) $\frac{\rho^c/c!}{\sum_{k=0}^{c} \rho^k/k!}$
☐ b) $\sum_{k=0}^{c} \rho^k/k!$
☐ c) ρ^c.

Q10 A socket is implemented between:
☐ a) transport layer and network layer.
☐ b) application layer and transport layer.
☐ c) network layer and link layer.

Q11 Mark the (one) correct statement
☐ a) UDP implements packet retransmissions and packet reordering
☐ b) UDP implements packet retransmissions, but does not implement packet reordering
☐ c) UDP does not implement packet retransmissions and packet reordering

Q12 In TCP, if we increase the timeout time with respect to the RTT
☐ a) The number of retransmitted packets will increase
☐ b) The number of retransmitted packets will decrease
☐ c) The number of retransmitted packets will be the same

Q13 In Distance Vector-based routing algorithms
☐ a) the routers send broadcast messages to all the routers in the autonomous system
☐ b) the routers send broadcast messages to all their directly connected routers
☐ c) the routers do not need to exchange messages.

Q14 In broadcast routing based on reverse path forwarding, the router forwards the packet
☐ a) in any case
☐ b) if the packet comes from their shortest path link to the source
☐ c) If the packet comes from a link part of the spanning tree

Q15 Briefly motivate and describe the delayed playout mechanism in multimedia streaming.

The delayed playout mechanism employs a initial delay to each packets before streaming it.

Motivation: This is done so that we can avoid delay or buffering in streaming. The application starts with enough data to be needed in future.

Mechanism: Each packet is marked by its timestamp. A delay time q is chosen. For packet i, ~~if its~~ $t_i + q$ is the delay duration. If the packet arrives before $t_i + q$, it's accepted; otherwise discarded. For fixed mode, the value q is constant. For adaptive mode, the q value is computed based on network status.

Q16 Describe the update rules of the transmission window W in slow start and congestion control states of TCP (Tahoe).

Let cwnd be the congestion window in TCP Tahoe.

Slow Start State:

initially, cwnd = 1

on each Ack, cwnd = cwnd + 1

So, in 1 RTT, cwnd gets doubled

Upon timeout / 3 dup Ack, it makes cwnd = 1 & ssthes = $\frac{\text{cwnd}}{2}$

Congestion Avoidance State:

enters when cwnd $\geq$ ssthreshold

On each ACK, cwnd = cwnd + mss $\left(\frac{\text{mss}}{\text{cwnd}}\right)$

So, in 1 RTT, cwnd increases by 1 segment size (mss = Max. segment size)

Q17 Describe the leaky bucket mechanism and discuss how the bucket parameters influence the characteristics of the output traffic.

The leaky bucket mechanism is a traffic policing algorithm used to regulate the rate at which packets enter a network. It consists of bucket capacity b and leak rate r.

The parameter r controls the long term average transmission rate while b controls the maximum burst size allowed. A larger b allows larger bursts without packet loss and a larger r allows higher sustained bandwith. The output traffic is therefore smoothed and constrained and congestion is reduced.

Q18 Describe the difference between unicast and broadcast. What are the dangers of broadcast and what mechanisms are implemented to avoid them?

Unicast: One to One communication where sender transmits data to a specific receiver. It's bandwith efficient and scalable.

Broadcast: In broadcast, one sender transmits data to all hosts in the network. This is not bandwith efficient neither scalable.

Dangers of Broadcast:

1) Broadcast Storm: When too many broadcast packets generated, there is CPU overload or network shutdown.
2) Bandwith Wastage: Packets delivered to all hosts who don't even need them.
3) Network Congestion: Queue overflow or Packet drops: increased delay.
4) Security Risks: ARP spoofing, MAC flooding Smurf attacks etc.