

# SOLUTIONS

Name Surname :

ID :

11.01.2017

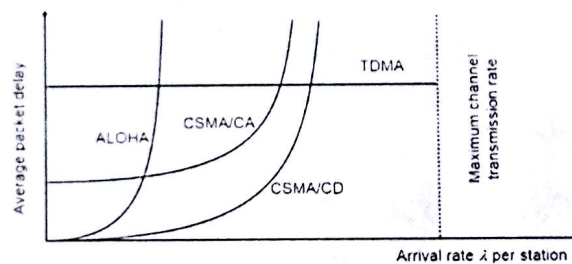
## EE 455 Performance Management of Computer Networks

### FINAL EXAM

Q1) Explain and give some network examples for the Centralised networks, decentralised networks and distributed networks

Q2) Assume that we have system where there are  $10^6$  packets per minute transmission and their acks. Assume only 2 of them get lost on average. What is the expected throughput of the overall network in terms of Mbps.

Q3) Briefly explain which of the listed methods are preferred in which network condition cases



TDMA:

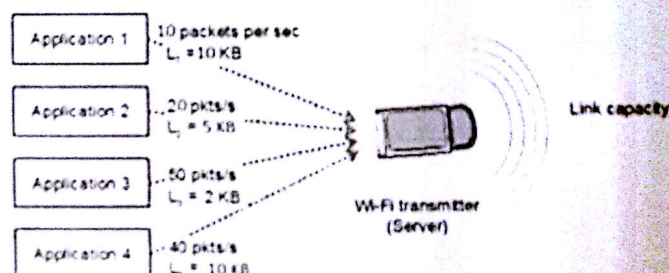
ALOHA :

CSMA / CD :

CSMA /CA :

Q4) 30 p Please fill in the necessary fields of the table according to the figure given below which uses Max-Min Fair Share algorithm. (link Capacity is 5 Mbps)

Sources	Demands [bps]	Balances after 1 <sup>st</sup> round	2 <sup>nd</sup> round					
Application 1	819200	430800	0					
Application 2	819200	430800	0					
Application 3	819200	430800	0					
Application 4	819200	-7026800	-734400					



## SOLUTIONS

- 1) Centralised: LAN with switches or GSM in cell  
Decentralised: GSM with Base stations  
Distributed: multihop networks

2)  $10^6$  packets  $\Rightarrow$  10 000 000 packets per minute  
 $= 1000000$ .

$10000000 - 2 = 999998$  packets / min. not lost

$\text{thr} = \frac{999998}{60 \text{ sec.}} = 16,666$  packets / second

3) TDMA: for large  $\lambda$  values

ALOHA: Never

CSMA/CD: for small  $\lambda$  values

CSMA/CA: for medium  $\lambda$  values and no CA needed

4) on the question...

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Duration : 45 mins

EE 455 Performance Management of Packet Switched Networks

FINAL EXAM

- 1) Why is retransmission timer management important for QoS (Quality of Service) point of view?

Less RTT causes extra transmissions, more RTT causes delay

- 2) If a signal is sampled by 65536 different possible values (as amplitude) and with 2.5 ms sampling period. How much quota will be used for 1 hour of one way signal transfer?

$65536 = 2^{16}$  (16 bits per sample) ,  $1/(2.5 \times 10^{-3}) = 400$  samples per sec. ,  $400 \times 16 \times 3600 = 23.04$  Mbps

- 3) Why is jitter important for QoS (Quality of Service) ?

It reorders the packet sequence

- 4) What is the short name of the message transportation simply by copying the packet at each router and forwarding the copies of original packet to all desired destination points simultaneously?

Multicast

- 5) Why do the Buffer Networks needed to be used for sorting the incoming data at output ports?

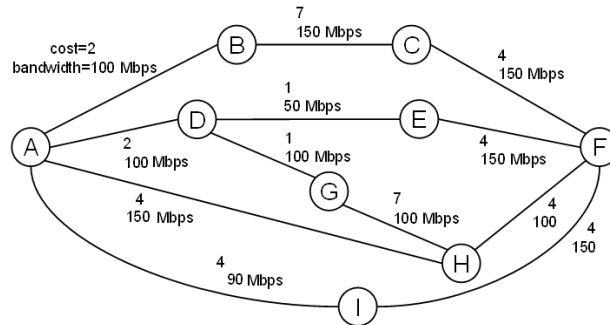
To avoid congestion in switch fabric

- 6) What do LSR and LER mean , and what is the difference between them?

Label switching router (intermediate routers)

Label Edge router (the routers at edges)

- 7) According to diagram below which path is the MOST EFFECTIVELY FASTEST path from A to F when CSPF (Constrained Shortest Path First) routing method is used ?



- 8) In a congested network sometimes some packets get lost because of the congestions experienced at the routers in the network. In this case the routers that the losses are experienced notify its neighbours BY SENDING A MESSAGE, then all its neighbours also notify their own neighbours, it goes up to the sender. So that the sender becomes aware of the congested routers and it selects a new path excluding these routers.

What is the name of THIS notification message and where is the notification bit\packet\signal (whatever it is) put to be transferred?

**A D G H F**

- 9) What is the name of the method used for recovering the lost packets even if group losses of the packets occur while FEC (forward error correction) is used ?

**Interleaving**

- 10) What is the general name of the Automatic repeat request methods such as selective repeat, go back N and stop and wait?

**Sliding Window**

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**EE 455 Performance Management of Computer Networks FINAL EXAM**

**NOTE Select only 10 of the given Questions. Exceeding numbers of correct answers will be cancelled  
Write your answers into the boxes given below each of the questions shortly using at max 10 words.**

- 1) Why do we need to use sort (what is the purpose of sorting) the incoming packets of a switching fabric (using Batcher and Banyan networks)?

**To avoid collision in the switch fabric**

- 2) Which layer of the Open system interconnection model, does the Multi Protocol Label Switching protocol correspond to ?

**Layers 2 and 3 (Layer 2.5)**

- 3) Where is the jitter buffer used ?

**At the receiver**

- 4) What problem may occur if Shortest Job First scheduling algorithm is used on a router while forwarding the incoming packets ?

**The very long packets wait forever...**

- 5) Which Scheduling algorithm is proposed/used to solve the problem that occurs "if Shortest Job First scheduling algorithm is used on a router while forwarding the incoming packets" ?

**Round robin algorithm**

- 6) Assume that we want to send the same message to Ahmet, Mehmet, Hasan and Hüseyin, what differs if I create a whatsapp group before sending the message to then or if I not create a group.

**Multicast transmission takes place of unicast transmission and less bandwidth will be used**

- 7) In what kind of network conditions, the arrival times of the acknowledges of the sent packets have less variance values ?

**Idle (less crowded)**

8) In perfect and ideal network conditions where average jitter value is 0 and the average RTT of the packets are 100 ms, write the value of Re-transmission Timer to have maximised throughput with minimized delay.

**100 ms**

9) When a Jam signal is transmitted ?

**In case of collision in a bus topology**

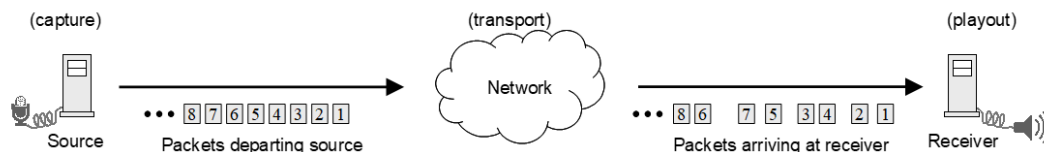
10) What is the advantage of using switches instead of hubs?

**Being able to make simultaneous transmissions in the fabric**

11) In which case UDP is preferred instead of TCP to be used with IP ?

**In case we don't need flow control because of not having enough time (e.g. real time applications)**

12) In the figure below, why can the orders of the packets be changed at the receiver side ?



**Because of Jitter**

13) What does the abbreviated word TOS mean ? and in a Scheduler, why do we use a classifier to separate the packets according to their TOS values ?

**Type of Service. To be able to apply priority to the packets...**

14) What is the potential solution offered to solve the traffic overload on primetimes and having a more uniform traffic distribution over time ?

**Desynchronised TCP senders**

15) What is the exact number of IP numbers that can be assigned to different users for a network with the netmask 255.255.224.0 ( 27 prefix).

**(4 octets x 8 bits each)- 27 = 5 bits remaining**

**$2^5 = 32$  ip addresses are available - (1 for net ID + 1 for broadcast ID) = 30 IP addresses**

2020 – 2021 SPRING

EE 455 Final Exam

QUESTIONS

- 1) Please describe what the jam signal is used for?

It used for notifying other nodes in case of collusion

- 2) Why do we need to know MTU value on the routers (or bottlenecks) on packet switched networks?

To know into how small or how big packet we can divide the segments

- 3) Write the name of the method/protocol used to establish connection by the remote side? Write how it works ...

3 way handshaking. Source (S) send "SYN" message to destination (D), <d replies with "SYN +ACK" then S sends an "ACK" to initiate the connection

- 4) What does flight size stand for?

It is the number of packets that are sent but not acknowledged

- 5) Why do we have to use quantization before transmitting our voice by a packet switched network?

To convert the signal from analog to digital

- 6) Where and how the jitter in a network is removed ?

On the receiver. The early packets wait for the late ones to play them together

- 7) What is the tradeoff on positioning the playout schedule line?

Early Playout causes more packets losses, but late ones cause more delay

- 8) Assume a network that, on average 80 packets (16 Kbits each ) arrive to the network per second. If it is known that the link speed of the network is 8 kbps, how many packets can be seen in transmission on the network during a random 0.25 second duration?

$\lambda = 80 \text{ packets /sec}$

$L = 16 \text{ kbits}$

$R = 8 \text{ kbps}$

$L/R = 2 \text{ sec}$

Using little's law the expected number of packets for a random second is  $\lambda L/R = 80 \cdot 2 = 160$  packets/sec = 40 packets /0.25 sec

- 9) What problem the desynchronized TCP senders solves?

Traffic overload is avoided at primetimes

- 10) What is the name of the protocol/method that informs other nodes about a congestion occurred on a/some router(s) in the network?

Explicit congestion notification

EE 455 Performance Management of Computer Networks

2022 – 2023 Fall

Q1) 15p Briefly explain what distinguishes CSMA/CD from CSMA/CA

CSMA/CA has an extra waiting period at the beginning of the transmission even if the line is idle while CSMA/CD does not.

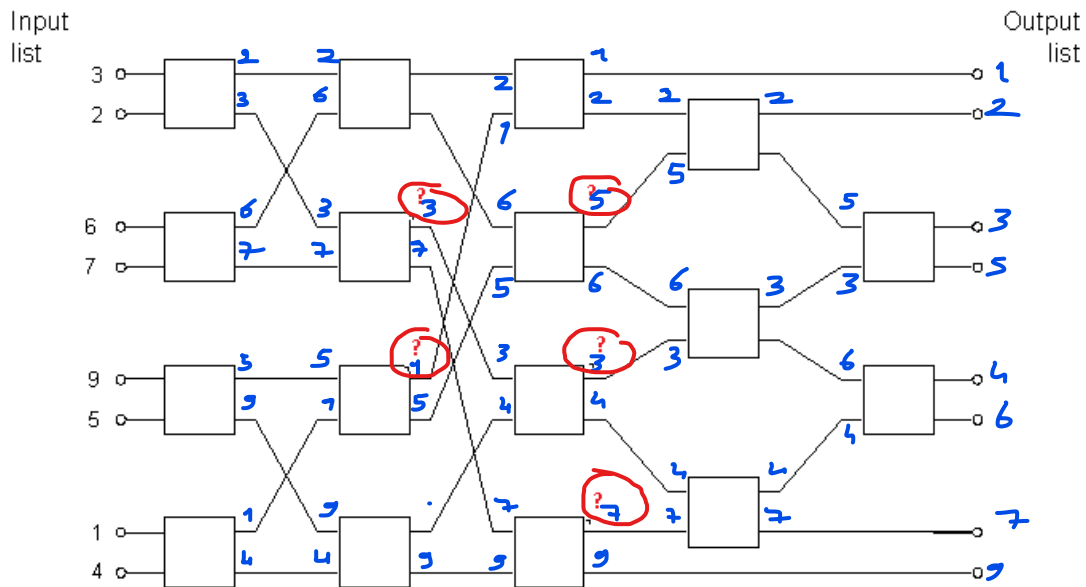
Q2) 15p Briefly explain what the exposed stations state means or when does it occur ?

The state in which recognises a signal and thinks that its receiving end is intransmission but in fact it is not.

Q3) 15p Why Do we need Domain Name Server?

To convert the webpage address names to IP addresses

Q4) 25p For a Bathcer network please fill the figure with the correct values, marked places (?) will get grade



Q5) 30p For Weighted max-min fair share please fill the given table below for the given values

available capacity of the link is  $C = 1$  Mbps = 1,000,000 bits/sec  
 Source weights :  $w_1 = 0.75$  ,  $w_2 = 2$  ,  $w_3 = 0.5$  , and  $w_4 = 1.75$

Sources	Demands [bps]	Allocation #1 [bps]	Balances after 1 <sup>st</sup> round	Allocation #2 [bps]	Balances after 2 <sup>nd</sup> round	Allocation #3 (Final) [bps]	Final balances
Application 1	131,072 bps	150000	+18928	131072	+0	+0	+0
Application 2	409,600 bps	400000	-9600	432998	+23398	+0	+0
Application 3	204,800 bps	100000	-104800	108249	-96551	-73153	-73153
Application 4	327,680 bps	350000	+22320	327680	+0	+0	+0